Appendix 1A-5: Authors' Responses to Comments on the Final 2007 and Draft 2008 *South Florida Environmental Report – Volume I*

A panel of outside experts provided peer review of the *2008 South Florida Environmental Report* through WebBoard comments during September 2007 and participation in a two-and-one-half day public workshop from October 2-4, 2007. This appendix includes authors' responses to comments on the final 2007 SFER (Appendix 1A-2) and draft 2008 SFER (Appendices 1A-3 and 1A-4), which were posted on the SFER WebBoard (http://www.sfwmd.gov/sfer). With the exception of reformatting some information for better readability, this appendix was not edited by the SFER production staff.

Appendix 1A-5: Authors' Responses to the Final 2007 and Draft *2008 South Florida Environmental Report –Volume I*

A panel of outside experts provided peer review of the *2008 South Florida Environmental Report* through WebBoard comments, participation in a two-and-one-half day public workshop, and a written final report (Appendix 1A-6). Authors revised their chapters and related appendices responsively. This appendix includes authors' responses to major comments and recommendations in the panel's WebBoard comments. With the exception of reformatting some information for better readability, this appendix was not edited by the SFER production staff.

RESPONSES TO GENERAL COMMENTS ON THE FINAL 2007 SFER – VOLUME I

Stacey Ollis and Garth Redfield

Subject: Responses to Panel Comments on the SFER
Document posted as: RTCs_general_092607.doc
Originally Posted: 26 Sep 2007 09:51 AM

RESPONSES TO PEER-REVIEW PANEL COMMENTS

Dr. Jordan

Comment #1: *Whenever new tasks are added to an already huge job, it can seem overwhelming. However, after looking at the responses by authors to the comments from the panel, it is clear to me that extraordinary effort was put into this task. Since panelists rarely looked at the SFER that was produced each spring it was hard to tell if our recommendations were having any impact on the process. The new approach this year allowed us, and authors, to account for the issues that were raised during the fall review.*

Response #1: Comment appreciated. The District hopes that the SFER peer review and workshop process will result in better use of the panel's time on the many challenges facing our agency.

Comment #2 (on Integrating Water Quality): *I know this is a big task, as well as a collaborative one involving both FDEP and SFWMD. I understand the challenges and believe the effort is a sufficient response to the Panel. As is acknowledged, more interaction between the agencies is progress. The formation of the inter-agency working group on water quality is an important step.*

Response #2: To continue to address this important issue, as part of this year's integrative chapter (Chapter 1B), a special report is being included that outlines a new interagency approach to develop a new water quality monitoring strategy across the South Florida region. We expect the reengineering process, a large undertaking, to take several years for all the regional ecosystems.

Comment #3 (on South Florida Water Monitoring Strategy): *The use of the working group should help--sufficient response.*

Response #3: Comment appreciated. The District has found the input from the interagency group to be challenging but very helpful.

Comment #4 (on Documenting Report Authorship): *I still believe there is an important difference between authorship and merely contributors of data or some minor function. The issue is whether readers should believe that all of the people listed are in full agreement with all of the work and conclusions or if their contribution did not include fully reading and approving the material. This issue should still be addressed beyond just leaving it to chapter authors.*

Response #4: The SFER Production Team recognizes this important issue and continues to coordinate with authors to provide consistent guidance on authorship throughout the report, particularly using many proposed recommendations cited in Weltzin et al. (2006)1. Our team is working toward a more uniform approach in SFER reporting, such that the author(s) listed reflect those who have read the entire chapter/appendix, contributed substantially to its content, and agree with its findings, while others are listed as contributors. Authors' responses to the team's

guidance are varied and continuing panel suggestions on this important area during the 2008 SFER workshop are welcome.

Comment #5 (on Reporting on Sulfur): *Adding a chapter on sulfur and its role in causing or contributing to adverse impact in the EPA is a sufficient response. The rest of the responses to the general comments are sufficient. I understand the trade-offs in terms of the executive summary but encourage continued refinements.*

Response #5: Comment appreciated. Also, please note that the title (with associated content on both mercury and sulfur) of Chapter 3B of the 2008 SFER – Volume I has been revised as "Mercury and Sulfur Monitoring, Research and Environmental Assessment in South Florida."

Dr. Meganck

Comment #1: *I believe this exercise of reviewing and verifying the comments from the authors' to the questions posed by the Review Panel is a very effective one. This process will assist the public workshop process as it will be relatively straightforward for panel members (and the general public who follow this exchange on the website) to focus on questions and responses in the ubsequent SFER. Overall, it will make the entire process between the Panel and the authors uch more efficient and over time effective.*

Response #1: Comment appreciated. The District looks forward to a more interactive workshop process this year.

1 Weltzin, J.F., R.T. Belote, L.T. Wliiams, J.K. Kellet and E.C. Engel. 2006. Authorship in Ecology: Attribution, Accountability, and Responsibility. *Frontiers in Ecology and the Environment*, 4(8): 435-441.

Dr. Burger

Comment #1: *Providing the Peer Reviewers the opportunity to see and respond to the responses of the chapter authors is an excellent idea. However, the comments of the Peer Review Panel fall into several categories: a review of the chapter, specific details that can be fixed and amended, and overview comments that require reorganization of the entire effort (or significant parts thereof), re-thinking of issues, and new directions. It is the latter category that were less well addressed in the comments I read. Many of these issues may well require a more in-depth discussion with the Panel. Additionally, in the future we need to organize both the Panel Reviewers comments, and the Authors responses so there is consistency across chapters. This will require a discussion among the Panelists. In the future, it would help the chapter authors, the Peer-review Panel in their response, and the public, if all the comments were labeled. That is, in responding to the authors, the Peer-review Panel needs a way to refer to each comment.*

Response #1: For the 2008 SFER, the District is applying earlier panel recommendations on improving the peer-review process, and has adjusted this process so that panelists have the opportunity to review authors' responses to comments prior to the workshop, to the extent possible, and increase the focus of the workshop on interactive discussions between agency staff and panelists. Further discussion and recommendation by the panel to the District in the 2008 SFER workshop regarding suggestions on continuous improvement of the peer-review process, particularly in ways to further streamline the process, is most valued. The authors would appreciate consistency across chapters in how the panel provides their recommendations, and would hope that recommendations for revision of the report would be separated from long-term recommendations at the programmatic level.

RESPONSES TO PEER-REVIEW PANEL COMMENTS – EXECUTIVE SUMMARY

Dr. Burkholder

Panel Recommendations listed below were not addressed.

Comment #1: *Formatting – Definitions of scientific terms/units should be added to the Glossary. In some cases, brief explanatory legends should be added for figures.*

Response #1: The District greatly appreciates the panel's feedback on the 2007 SFER Executive Summary. Specific suggestions for terms to be included are welcomed but it should be considered that no additional space beyond two pages can be added to the glossary. We attempt to use figure titles and general legends in an explanatory way but unfortunately have limited space for scientific explanatory legends in the Executive Summary layout.

Comment #2: *A section should be added identifying the most important challenges facing the District for the next water year including, as appropriate, what citizens of Florida can do to assist. Such a section could be very useful to the District, for example, on the exotic species issue.*

Response #2: This subject should be discussed during the 2008 SFER workshop as part of the discussion on public outreach. Volume I of the SFER I itself is already challenge-laden and it is not clear how to respond to this request.

Comment #3: *A section should be added about major education outreach activities that the District accomplished during the water year including, importantly, tangible positive outcomes with broad effects beyond completion of the specific activities.*

Response #3: As part of this year's introductory chapter (Chapter 1A), a special report is being included on the District's widespread efforts related to public information, media, and outreach. As part of District-wide updates, an overview of this information will also be presented by the District's Department of Public Information at the 2008 SFER workshop.

RESPONSES TO GENERAL COMMENTS ON THE DRAFT 2008 SFER – VOLUME I

Garth Redfield and Stacey Ollis

Subject: Responses to Panel Comments on the SFER
Document posted as: RTCs_general_092607.doc
Originally Posted: 26 Sep 2007 09:51 AM

RESPONSES TO PEER-REVIEW PANEL COMMENTS

Dr. Burger

Comment #1: *The potential for unusual environmental events (such as the extreme 2007 drought) suggests that there should be an organization or mechanism for Rapid Response that has several different levels. That is, the biologists should be organized in such a way that they can meet early on during any crisis to decide on key questions that will further understanding of Everglades ecology and restoration potential. Some forethought should be given now to what key ecological questions should be addressed should another such drastic drought (or any other ecological stressor) occurs. While the Emergency Operations Center was activated and functioned appropriately, a small group should be forward thinking about potential issues and do emergency planning before such ecological events.*

Response #1: In light of the multi-billion-dollar programs that the District is responsible for implementing, it is unclear how to respond to this suggestion. District scientists are part of the Emergency Operations Center during both droughts and tropical events, but attention is focused on agency responsibilities for public heath and safety and immediate environmental problems that arise following an emergency event.

Comment #2: *Again, there is less consistency both across and within chapters with respect to the initial paragraphs of any project. Such initial paragraph (s) should include objectives, hypotheses, project period, project initiation date and so on. This would make the report far more readable.*

Response #2: It is suggested that this issue is discussed during the upcoming 2008 SFER workshop, and further specific suggestions from the panel are welcome.

Comment #3: *The cross-cutting appendices, such as 3B-2, is a very useful stakeholder tool, and provides an easy and quick look at a particular problem. This type of chapter would be even more useful if there was a table at the end that directed the reader to the appropriate chapter in the entire document that discussed further the aspects highlighted in this chapter. The authors are to be commended on an excellent document.*

Response #3: Clarification of this comment is requested from the panel during the 2008 SFER workshop.

Comment #4: *There is still a need for an examination of the issues and problems adjacent to the Everglades system.*

Response #4: The District recognizes the concern over development in the surrounding areas, as noted in the introductory chapter of this volume (see above-listed general response #1 on Dr. Burkholder's comment).

RESPONSES TO COMMENTS ON THE FINAL 2007 SFER – VOLUME I, CHAPTER 1A

Garth Redfield and Stacey Ollis

Subject: Responses to Panel Comments, Chapter 1A
Document posted as: 2008 SFER RTCs_Ch1A_092607.doc
Originally Posted: 26 Sep 2007 09:46 AM

RESPONSES TO PEER-REVIEW PANEL COMMENTS

Dr. Jordan

General Comment: *All responses to comments in 1A and 1B are sufficient. For comment 2 in 1A, I will look at the 2008 report for the change.*

Response: Comment appreciated. As part of ongoing agency efforts to manage growing demands and embrace reporting efficiencies, where possible, the District is continuing to balance ongoing reporting needs and requirements with efforts to further streamline this documentation. Also, please note that brief narrative on major regional features – including an update on the reclassification of the system into the Northern and Southern Everglades regions – is incorporated into this year's introductory chapter, along with table and figure highlights, to enhance and supplement material presented previous consolidated reports.

Dr. Burkholder

Comment #1: *Panel recommendations below were not addressed (1st, 3rd) or not further addressed (2nd). In general, this was an excellent chapter, and consideration of the recommendations below may make the 2008 SFER's Chapter 1a even stronger. Mention should be made of the potential impact on the S. FL environment of increasing urbanization onto EAA lands…*

Response #1: Please note that the District also recognizes urbanization as a regional challenge, as reflecting in the newly added section in the introductory chapter, *System-wide Challenges and Initiatives*. The challenges of urbanization for water supply, flood control, and environmental management are also recognized in most chapters of the report. An example of this recognition is the recently passed Water Availability Rule.

Comment #2: *A one- or two-page general description of the South Florida environment should be added, to orient the reader to the various parts of the system that are being discussed as well as describe their interconnectedness.*

Response #2: Please refer to response in the above-listed comment from Dr. Jordan.

Comment #3: *A section should be included in Chapter 1a, or perhaps more appropriately, a new chapter, that provides information about the District's many outreach education activities.*

Response #3: Please refer to response in the above-listed comment. As also previously noted, a special report is being included in this year's introductory chapter and 2008 SFER workshop on the District's widespread efforts related to public information, media, and outreach.

Dr. Meganck

Comment #1*: Author's comment noted; will verify during the review period for the 2008 SFER.*

Response #1: Comment appreciated.

Comment #2: *The explanation provided is logical. The section on major features of the South Florida Environment provides sufficient information for the general reader. The reduced size of the chapter is desirable and anyone wishing additional information can access the web as is noted.*

Response #2: Comment appreciated.

Comment #3: *The response provided is fine. With the additional information that will be provided at the 2008 SFER workshop and its final report, the casual or detailed reader should find the information required. The scientist will also have the opportunity to consult references noted and direct contact with the authors. We should review this issue during the October 2007 panel meeting of the 2008 SFER.*

Response #3: Please refer to response in the above-listed comment (#3) by Dr. Burkholder.

RESPONSES TO COMMENTS ON THE DRAFT 2008 SFER – VOLUME I, CHAPTER 1A

Stacey Ollis and Garth Redfield

Subject: Responses to Panel Comments, Chapter 1A
Document posted as: 2008 SFER RTCs_Ch1A_092607.doc
Originally Posted: 26 Sep 2007 09:46 AM

RESPONSES TO PEER-REVIEW PANEL COMMENTS

Dr. Jordan

Comment: *As has been the case in the past, this chapter provides a good introduction to all of the issues behind the SFER. The unification of over 50 reports into one document is an important and difficult tasks, particularly since this chapter is written for a diverse audience. The section on major geographic features is extremely useful and is aided by figure 1A and numerous helpful pictures.*

An important connection is made in this chapter between changes in the hydrology and chemistry of the South Florida ecosystem and widespread development and urbanization. Also this chapter is helpful in noting the 2007 legislation that focuses on the integration of regional projects. In response to past reviews, the new section on public information, media and outreach activities is welcome. One editing comment: For the general audience that will look at only this chapter, I'm not sure the section on pages 18-25 on the peer review panel is necessary. I would suggest putting all of that with the panel comments that become part of an appendix. In general, this is a vital and well-done chapter that forms the basis for the SFER.

Response: Comment appreciated. As suggested, supporting material on the SFER peer review will be adjusted as an appendix in the final report.

Dr. Meganck

Comment: *I have only one question on this introductory chapter. I will however include a general comment about the usefulness of this chapter to the readership of the 2008 SFER in the text to be included in the final report of the panel. Might it be possible to include couple of examples to illustrate the very important points made in lines 137-139 and lines 144-145? I feel this concept should be strengthened with examples to facilitate greater understanding/buy-in from the general public?*

Response: Comment appreciated. As suggested, some examples will be added, as well as cross-references to other relevant chapters, in the final report.

Dr. Burkholder

General Comments *This introductory chapter was a pleasure to read, both from accountability and integrative standpoints. The map of the major features (Figure 1) was helpful. The tables were excellent! The writing was also clear, concise, and nicely descriptive (e.g. Line 106 aptly describing "the liquid heart of the system"). The authors justifiably described the writing as a "sweeping consolidation" and it is a* ***great*** *overview of District activities in WY2007.*

Newly enacted legislation this year emphasizes increased focus and integration of regional projects in the Northern Everglades. It expands the Lake Okeechobee Protection act by adding

the Caloosahatchee and St. Lucie River Watershed programs and the Caloosahatchee River Watershed Pollutant control program. Accordingly, the "South Florida Environment" section of this chapter newly categorizes the region into two primary sub-regions, the Northern (Kissimmee, Lake Okeechobee, Caloosahatchee, St. Lucie watersheds) and Southern Everglades (watersheds from south of Lake Okeechobee to the Florida Keys). Beyond the general comments on increased integrative focus, it would be helpful to add a little more explanation as to how this legislation will alter District operations.

Table 1A-1 provides an excellent comparison of the major areas (surface area, general description). Table 1A-2, describing major District programs, components and objectives, is very helpful. Table 1A-3 provides innovative integration of the information in the 2008 SFER about each of the major areas covered, from the Coastal Watersheds to the Kissimmee. It includes helpful information, as well, about where information about each of the major areas can be found across the various chapters.

Chapter 1A of the 2007 SFER, for the first time, also includes a summary of the District's impressive public education and outreach efforts. It is a welcome, valuable addition, with several outstanding highlights, great description of the website, etc. Clearly, this education/ outreach program is a great credit to the District. The information is contained within a "Special Report" section that follows the report "Peer Review" description, but should precede the "Peer Review" section. It is also strongly recommended that the education/outreach information should appear in every SFER report henceforth.

Response: Comments on this year's introductory chapter are greatly appreciated.

Regarding the effect of the Northern Everglades initiative on District operations, it is difficult to predict because as this is written, projects are in the initial planning phases and will be implemented over the next few years. With this said, the many projects that will be part of this initiative will alter operations inevitably making them more complex.

Regarding the special section on public outreach, the District will respond to panel requests for this kind of information in the future on an as-needed basis. We do not believe that an annual summary would contain enough information to be justified, particularly as outreach materials with relevant content are regularly produced in a series and distributed to the public (e.g., WaterMatters).

Specific Comments

Comment #1: *Figure 1 – the canal designations cannot be discerned; please make labels larger/clearer.*

Response #1: Comment appreciated. This figure will be revised for the final report.

Comment #2: *Lines 218-22 – While the brief descriptions of other chapters seem accurate, this description falls short of describing Chapter 12, which does much more than update the status of freshwater flows. Please alter the writing to more accurately describe the focus of this year's excellent Chapter 12.*

Response #2: Comment appreciated. As suggested, this text will be revised in the final report to reflect the overview content of Chapter 12.

RESPONSES TO COMMENTS ON FINAL 2007 SFER– VOLUME I, CHAPTER 1B

Garth Redfield, Peter Rawlik, and Linda Lindstrom

Subject: Responses_Panel_Comments
Document posted as: Ch1B_07-08(3).doc
Originally Posted: 25 Sep 2007 02:43 PM

Robert Ward

Comment: *Author responses to the Review Panel's comments, in general, further elaborate on issues raised during the review. The detail provided is responsive and helpful in understanding precisely the chapter's purpose and scope. In several responses note is made that the issues raised by the Panel will be considered for further elaboration in the 2008 report, per the Panel's suggestion in several cases. One change is made in the final 2007 SFER – color of basin C-139, in Figures 1B-1a and 1b-1b, is changed to match that of the WCAs. This was done to indicate that the outputs from C-139 and the WCAs are rolled into one number in the figures.*

Response: We can discuss there issues further at the workshop on the 2008 report.

Jeffrey Jordan

Comment: *All responses to comments in 1A and 1B are sufficient. For comment 2 in 1A, I will look at the 2008 report for the change. For comment 4 in 1B, this information is helpful---I hope it will be included in the 2008 report as suggested.*

Response: Thank you and P control efforts for Lake Okeechobee will be discussed extensively in the 2008 report, particularly under the umbrella of the Northern Everglades Initiative.

JoAnn Burkholder

Comment: *Four of seven panel recommendations were addressed; those that were not addressed are: The C-139 basin and data (inputs, outputs) should be added to Figure 4. The District should take the necessary steps to obtain reliable estimates of atmospheric deposition (p.3). It would greatly benefit the District to have a baseline, especially confronting what Chapter 1b describes as dramatic increases in adjacent urbanization. The District should redouble its efforts to control TP loads entering Lake Okeechobee by working with appropriate agencies on development policies that will contribute to reduced TP loads….*

Response: The 2008 Report should provide much additional information on efforts to reduce loads to Lake Okeechobee. Atmospheric deposition is difficult, but we are attempting to build collaboration with FDEP's mercury deposition program to generate new data on phosphorus deposition rates.

Richard Meganck

Comment #1: *Agree that an overall impression from the figure in question is better than trying to force too much hard data onto a map. Perhaps a footnote to the effect that more detailed data on the C-139 basin is found in chapter 4 would be sufficient to deal with this response.*

Comment #2: *The District can only be expected to employ data collection and monitoring methods that are readily available and generally accepted. It won't do much good to collect data that will be questioned in terms of either accuracy or completeness. Therefore, the Panel can only*

expect the District to use new methodologies and equipment as they become available. The explanation provided seems logical. This issue can be reviewed during the October 2007 panel session.

Responses #1 & #2: As mentioned above, atmospheric deposition is important and FDEP is undertaking an intensive new study to support the mercury TMDL. Phosphorus deposition rates will be estimated as part of this study, but there will only be three sites in the South Florida region and two will be close to urban areas.

Comment #3: *Nothing further to add.*

Comment #4: *A logical plan and timetable is in place to increase the density and effectiveness of BMPs based on the experience to date. The response to the question raised provides a clear strategy that the public can grasp and towards which farmers can plan.*

Responses #3 & #4: A large amount of information on the watershed phosphorus control efforts will be included in the 2008 chapters. The Northern Everglades Initiative hits this whole issue from an integrative perspective.

Comment #5: *No specific comment. Rather than present partial data, the Panel agrees with the authors that only if it is discussed and agreed should chapter 1B address Sulfur and mercury. Otherwise there are sufficient topics to address in this chapter.*

Response #5: Sulfur is being dealt with in a separate document appended to chapter 3B and mercury is covered in Chapter 3B.

Comment #6: *The explanation provided is logical and the District should not necessarily alter its implementation plans particularly given that the expected reductions in P loads resulting from installation of BMPs in the Upper Kissimmee Basin are minimal.*

Response #6: See comment #4.

Comment #7: This comment refers to the Panel's Final Report from the 2007 SFER workshop on the relationship between the need to co-manage P and N on a watershed basis. There are undoubtedly an infinite number of new research tracks that can be pursued, although investigating the impact of N on primary production is a fairly obvious one given the surrounding agricultural land use practices. The panelist raising this issue correctly points to the possibility nutrients other than P being a limiting factor to phytoplankton growth and apparently the District is responding to this possibility by conducting a study in the Caloosahatchee estuary. I hope the results of this study, plus the one being undertaken this year in the St. Lucie estuary, will allow the District to draw some conclusions as to the limiting factors for primary production in estuarine environments. It will be interesting to compare the data produced in these two studies with those from the Loxahatchee river and estuary and subsequently with the P data to determine if consistent relationships or trends can be detected. I feel the District is correct to continue to use P as a primary indicator of water quality as well as the principle limiting factor for phytoplankton growth and as possible begin to examine other nutrients which either separately or in combination with P are acting to impact primary production. There is little else that the District can do except to incrementally gain new information on this issue, particularly given budgetary and time constraints overlaying the entire restoration effort, as well as the legal requirements imposed for installing new infrastructure.

RESPONSES TO PANEL COMMENTS ON DRAFT 2008 SFER – VOLUME I, CHAPTER 1B

Garth Redfield, Peter Rawlik and Linda Lindstrom

Subject: Responses_Panel_Comments
Document posted as: Ch1B_07-08(3).doc
Originally Posted: 25 Sep 2007 02:43 PM

Robert Ward

Comment #1: *Chapter 1B describes the initiation of an effort to redesign the monitoring by which information is acquired for the management of water quality in South Florida. Appendix 2-1 presents the current status of the hydrologic monitoring conducted by the South Florida Water Management District (SFWMD). These two portions of the 2008 SFER provide excellent insight into the current water monitoring effort of the District. Such insight has not been provided in the past and is most welcomed by this reviewer.*

Chapter 1B and Appendix 2-1 indicate the SFWMD has begun an evaluation of its water monitoring programs. Given the legal and societal changes facing modern water management organizations, this review is very timely. Water resources management in South Florida, originally established in the 20th century for drainage and flood control, is evolving, in the 21st century, into a program to assure human water needs are met while also sustaining the natural aquatic resources of South Florida. The SFWMD, as do many water organizations around the world today, find themselves heavily involved with environmental, recreation, and exotic species management/control associated with the water resources they manage, whether they want to or not. The SFWMD appears to clearly recognize this fact and is embracing the changes required to assume this new function in society. As a result, the SFWMD finds itself operating at the forefront of establishing modern water and water-related information systems in support of meeting human water needs while maintaining a healthy, sustainable, aquatic ecosystem. A private business analogy can be seen the 'supply chain' software developments enhancing the way modern businesses obtain information in support of business decision making. The monitoring framework, presented in Figure 1B-2 portrays water quality monitoring as a series of highly connected activities (i.e. a chain) that, when designed and operated in an integrated manner, produces information for water quality management decision making.

Response #1: The District recognizes this pattern and finds itself also in a major transition between more than a decade of planning and initial restoration actions to an era of CERP, Acceler8, EFA and Northern Everglades implementation. Our information systems need to be rethought to meet the needs of adaptive management in this era.

Comment #2: *The chapter title refers to 'reengineering' water quality monitoring. Another term, often used in Europe to describe the task discussed in Chapter 1B, is 'rationalizing' monitoring programs. In other words, there is a desire to 'give a rational explanation' of the SFWMD water quality monitoring programs. In the process, monitoring program designs and operations will be carefully examined and revised in a manner that meets legal, scientific, and management needs for an efficient and effective flow of information to decision makers (lines 20-22 on page 1B-2).*

Response #2: We will find information on the 'rationalizing' perspective and add a short narrative on this to 1B.

Comment #3: *The need to rationalize the many individual water quality monitoring programs springs from the wide variety of laws, projects, and initiatives that have been placed on water management organizations during the latter part of the 20th century. Chapter 1B describes this situation with insight and understanding that permits the problem to be well defined. The discussion in Chapter 1B is very well connected to key literature and thinking on the subject of designing water quality information systems in support of 21st century management. The fact that the lead author is a member of the National Water Quality Monitoring Council further connects the SFWMD monitoring evaluation activities to the latest thinking on the subject. Given that water quality monitoring is conducted by many federal, state, and local agencies, Chapter 1B indicates that the SFWMD monitoring evaluation efforts are well connected to the larger state and federal water quality monitoring infrastructure in South Florida.*

Response #3: We appreciate these thoughts. We have also found it challenging to get information from other program that is directly applicable to our situation. We will continue to make the effort to acquire and apply information from other programs throughout the reengineering process.

Comment #4: *The redesign of the SFWMD's water quality monitoring efforts is focused on developing monitoring objectives and designing the monitoring program (lines 125-126), given that there are ongoing efforts to optimize operations of other parts of the monitoring framework, as presented in Figure 1B-2. As the redesign proceeds, there is a need to illustrate and document how all the cogs of the framework, presented in 1B-2, connect in South Florida. The outer ring on the monitoring framework presented in Figure 1B-2 indicates that all the cogs should collaborate and communicate with each other in a coordinated manner – in other words, create an information chain. Chapter 1B is an excellent step to begin the communication and collaboration.*

Response #4: We understand the structure of the framework and appreciate the fact that the 'cogs' are supposed to interact. For the District, this interconnection is helped by the fact that one department, the Environmental Resource Assessment Department, is charged with most water quality monitoring at the agency and sections of that department do interact continuously. Challenges to remain, however, as illustrated in the issues discussed in the last section of Chapter 1B, pages 31 to 35. We will add an explanation of how the 'cog' diagram applies to District monitoring.

Comment #5: *The WCA-2A test case for redesigning the water quality monitoring system is very helpful in understanding the logic and methods employed to date. It is very helpful to explain the reasons why samples are taken, or not taken, for operational purposes (lines 281-293) and present the rationale for change (lines 303-317).*

Questions and comments:

Comment 5a. *The alternative monitoring strategy for grab sampling, presented on page 1B-14, does not discuss the impact of reduced sample numbers on the current method of computing standard compliance (which needs a minimum of 28 samples per year). The statement in lines 383-384 is not clear – how can less samples make standard compliance more robust if the minimum number needed for the selected data analysis procedure, to compute standard compliance, is not available?*

Response 5a: We will discuss this at the workshop and add clarifying text to indicate that we get more data when sampling is triggered to flow conditions; this leads to better estimates of loads and more data to assess compliance.

Comment 5b. *Figure 1B-6 is not clear – are the station visits, by sampling week, for all 11 monitoring stations collectively, under the new policy? Is it possible to illustrate a comparison of the old and new policies on the graph?*

Response 5b: We will clarify the graphic and add language to the legend to make this more understandable.

Comment 5c: *Lines 444-446 discuss how less samples produce an estimated TP mean concentration, but no mention is made of the impact on the confidence interval around this estimate. Have the confidence interval impacts been evaluated with the new policy?*

Response 5c: Not yet, but we will analyze more data on this.

Comment 5d: *Flowing water is the statistical population being sampled for standard compliance at the pumping structures. If the population does not permit acquisition of sufficient samples to support the chosen data analysis procedure (binomial hypothesis test – lines 214-228 in Chapter 3A), there appears to be a disconnect between sample collection policies and data analysis methods. How is this disconnect being addressed?*

Response 5d: The analysis in 3A is based on geographic areas and station types. We do not see a disconnect and suggest discussion during the presentation of 3A.

Comment 5e: *How are the station's identifying letters and numbers determined? Do the identification letters and numbers come from the 'projects' that created the station in the first place? Is there an opportunity to rationalize over larger areas the sampling site identifying scheme to make it easier to locate sites and interpret results presented by station ID?*

Response 5e: Station names are determined either by the structure name or by the project that created the station in the first place. There has been a substantial effort put in to improving and standardizing station titles; however, it may not be possible to retroactively change names without compromising previously published works and substantial documentation would be needed.

Comment 5f: *Are there applicable water quality standards that dictate which water quality constituents to measure at each station (per the discussion on page 1B-30)? No mention is made of applicable standards in this discussion of selecting water quality constituents to measure, that I could find.*

Response 5f: There are applicable standards published in FDEP Class III list. However, parameters can be eliminated when information shows long-term compliance and where there is no background to suggest a potential for impairment.

Comment 5g: *Are there a subset of sampling sites in WCA-2A for which standard compliance is a major reason for sampling? Or is standard compliance evaluated, annually, at all stations? Are stations to be excluded from standard compliance evaluations if there are not enough samples to support the data analysis procedures?*

Response 5g: Yes, TP Rule stations are standard compliance driven and are included in the strawman.

Comment 5h: *In the discussion of 'Other Issues to Resolve' for marsh monitoring, there should be an explanation of the objective of water quality standard compliance in the redesign process. Chapter 3, for some time, has been moving toward identifying a set of sampling sites for routine evaluation of standard compliance. Does the redesign process incorporate the Chapter 3 work?*

Response 5h: As the reengineering proceeds, annual standards assessment will clearly be a major consideration. FDEP has been and will continue to be actively involved in our workshop process.

Comment 5i: *Are the water quality standards not applicable where the water depth is less than 10 cm? This is the implication of the logistical guideline explained in lines 744-751.*

Response 5i: The data screening criteria for the TP Rule expressly precludes sampling at less than 10 cm and using the data for compliance evaluation (see Chapter 3C). FDEP, after extensive discussion early in the rule development process, decided to not use data from samples less than 10 cm because they not representative of local conditions and would require different sampling methods than are used routinely for surface water sampling.

Comment 5j: *A very key point is made in lines 762-764 – viewing monitoring as a whole permits focusing its design on management information goals, especially those associated with long-term management decision making (as opposed to project decision-making).*

Response 5j: We agree while recognizing that this change in viewpoint is a work in progress; project level thinking has a lot of momentum.

Comment 5k: *I am not quite sure I understand the point being made in lines 785-787. What does "…even for compliance with water quality standards" mean in the context of the sentence? Again, the current methods employed to compute standard compliance requires a minimum number of samples of 28. Alternatives are provided for less than 28 samples, but there is a serious loss of confidence in the information when this happens, as stated in Chapter 3A.*

Response 5k: We will remove this compliance statement; it isn't needed.

Comment 5l: *Again, I am not sure I understand the statement in lines 834-835. Water quality is routinely compared upstream to downstream, where the upstream condition is often viewed as a 'reference' site (especially when there is an impact between the two sites to be evaluated).*

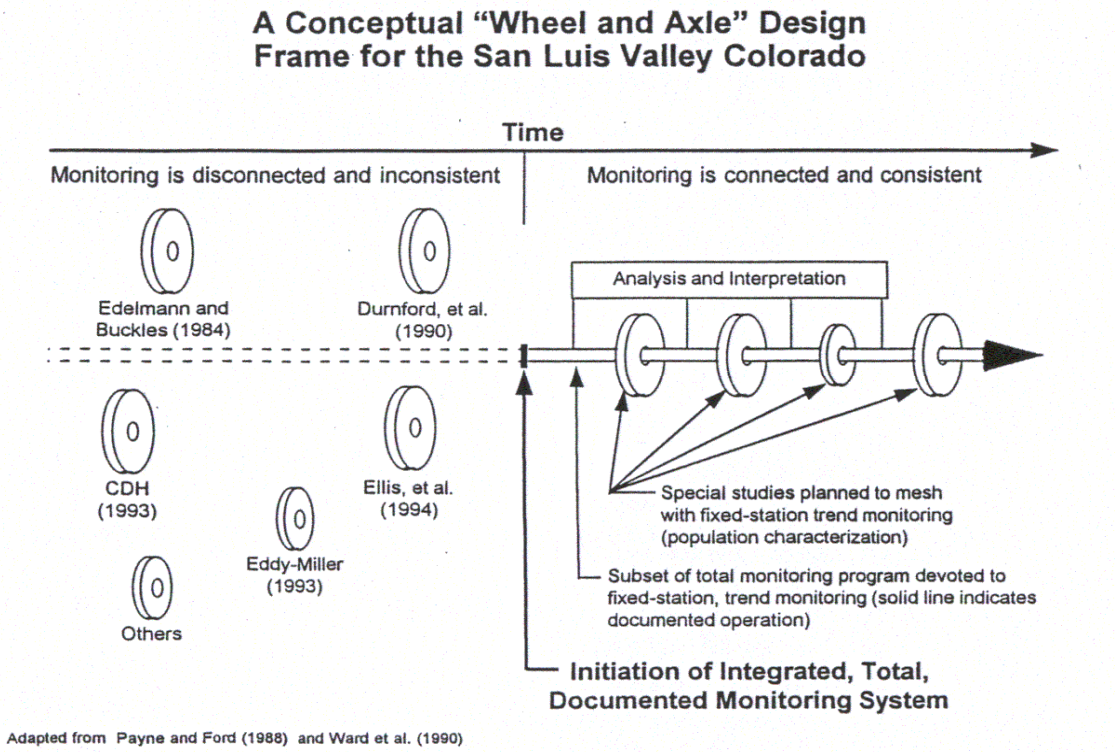
Response 5l: This is a question of semantics. We use the term 'reference' site to mean a site not being affected by a given stress or action. For example, a stream from an unaltered watershed can be compared as a reference to one being altered. We would like to have examples of the upstream – downstream approach.

Comment 5m: *A number of times in Chapter 1B, reference is made to the need to review a situation in the future, after more data/information is available. The redesign should consider developing a 'protocol' for updating the design at regular intervals and the procedures to be employed for such a review (e.g. convening a group of management professionals and research scientists to examine the monitoring network's operations, costs, station locations, sampling policies, data storage systems, data analysis methods, reporting options, etc.). This permits changes to the monitoring program to be considered in an orderly and well documented manner, insuring that future uses of the data are well informed about changes that occurred over time.*

Response 5m: We agree and will add a section describing how we will run the process and record findings in a systematic manner. Our experience from WCA-2A will form the basis of this process.

Comment #6: *A few additional observations. The Chapter clearly notes the different purposes of monitoring, from producing long-term, area-wide, information for management to highly site specific, short-term, research monitoring. Understanding this distinction and incorporating it into the design is very helpful to both managers and researchers. How to evaluate this diverse array of information in order to rationalize the design of a water quality monitoring system is not an easy question to answer. One author, Lacey Goetz proposed one approach. She studied ways to design a ground water quality monitoring network in the San Luis Valley of Colorado where 39 separate laws/regulations addressed ground water quality in the valley. Her MS thesis on the subject can be reviewed at: http://watercenter.colostate.edu/ce545/theses/LGoetz.pdf. (This same reference is provided to the authors of Appendix 2-1 for the same purpose – searching for common information goals among an array of applicable laws and permits.)*

Comment #7: *Also, there is a way to connect research, short study-oriented measurements/ monitoring to routine management-oriented monitoring via concepts presented in the following figure (from Goetz's work).*



(Comment #7 continued) *The axle monitoring consists of a network of sampling sites that are core to management's accountability information needs. The 'wheels' are special studies, projects, research efforts, etc. which have unique, specialized knowledge/technical, information needs. By insuring that each 'wheel' is connected to the 'axle' by common sampling sites, it becomes possible to draw much larger and more complete pictures of water quality conditions in the jurisdiction being managed. Thus, a strong 'axle' monitoring program that is scientifically consistent and comparable over time and space, is designed to provide management's key information needs. The 'wheels' represent all other types of monitoring which are connected, by joint sampling, to address emerging knowledge needs, special project needs, etc.*

Response #7: The utility of this diagram is becoming clearer as we learn more about various monitoring projects and attempt to find a common ground to develop the 'axle'. We intend to use this diagram in the reengineering process and may add it to Chapter 1B. We are going to adapt it to our programs and projects in WCA-2A.

Comment #8: *Colorado State University offered an academic course on the design of water quality monitoring systems for many years. The handouts for this course are still available at: http://www.engr.colostate.edu/CE545/Handouts/Topic_List.htm. There may be some information*

here that would be helpful in the District's efforts to rationalize or redesign water quality monitoring programs in South Florida (e.g. Topic 13: Quantifying Information Goals).

Finally, Chapter 1B (in combination with Appendix 2-1) sets the stage for a new reading of the SFERs – the source of the data (in all its facets) is now being revealed in ways that it has not before. The discussion in Chapter 1B opens much new thinking, such as that offered above, that hopefully, will lead to creating a well documented, rationalized, efficient and effective water quality information system for South Florida.

Response #8: We have reviewed the material from Colorado State University course CE545 on water quality and have found it extremely valuable on many aspects of water quality. We will make use of this information for Chapter 1B and for the reengineering in general. We completely agree that the goal is a new generation of monitoring systems, more efficient and more responsible to ever-changing needs. We appreciate the panel's support on this challenging undertaking.

JoAnn Burkholder

Comment #1: *This chapter considers, as a cross-cutting theme, redesign of monitoring networks to enable data compatibility and rigorous comparison. It is a thoughtfully conceived, innovative analysis, from its honest characterization of the present morass of monitoring networks in South Florida, to its suggestions of new ideas and its acknowledgment of traditional resistance to change (lines 868-879). It suggests a logical progression to "reengineer" a new water quality network based on analysis of sampling station locations, data redundancy vs. the need for additional stations, sampling frequency, and parameters to be considered.*

The problem of focus in this chapter is well described in the introductory writing: A "loose confederation of programs", initiated by various entities for various reasons within various time frames, presently forms the water quality monitoring networks across South Florida. This enormous, albeit "hodgepodge" effort excludes monitoring for TMDLs or NPDES permits, and thus conservatively includes ~1,000 stations and 35,000 sampling events per year, costs ~$18 million per year, and is expected to increase by ~30% during the restoration project. There has been little by way of previous major concerted efforts to infuse coordination or compatibility in sampling frequencies, analytical techniques/detection limits or data management/archiving. Major efforts have been lacking to address overlaps and gaps left by the various programs in water quality data acquisition – in part because no single monitoring approach can satisfy various diverse needs (lines 81-82), and because it would not be feasible for the District to do all of the essential background study needed for a coordinated set of approaches without substantial input from other agencies (lines 199-201).

Nevertheless, water quality is identified as one of four key areas of District responsibility, linked to 10 major programs in its strategic plan; moreover, more than 160 water bodies within the District are degraded (listed in 303(d) lists). The authors acknowledge that an integrated monitoring strategy is needed for the entire South Florida region; previous review panels have repeatedly recommended that regional water quality monitoring should also be standardized and optimized. As a potential approach, they consider the Basinwide consolidation of water quality networks achieved by the Chesapeake Bay Program, which took advantage of parallel efforts across agencies and used a series of technical workshops to rework programs toward an overarching framework of information needs and questions. This strategy was needed despite the fact that the Bay program had repeatedly been reviewed, and efforts had repeatedly been taken to attempt to optimize regional monitoring networks. The authors suggest that the District work collaboratively with an internal group to develop proposals for reengineering that are reviewed, on a regular basis, by an interagency working group with appropriate expertise.

Integrative Review. In a strong integrative approach, the authors state that the District needs to "wipe the slate clean" and rethink its monitoring from entirely new approaches, rather than attempting to "tinker" with existing networks. The two broad goals identified (p.1B-8) are to (1) determine water quality and quantify changes through time, and (2) assess the effectiveness of management actions and programs. The authors suggest a new, flow-based sampling regime (BWRF, biweekly if recorded flow" schedule), to improve efficiency while meeting monitoring standards: Stations would only be visited if flow had been recorded since the last scheduled visit; all non-flowing samples would be eliminated. Through its greater efficiency, this system would emphasize the integrative approach conceptualized by NSTC (1997);it would help to strengthen synergism among information sources and approaches in management efforts, rather than competition and isolation of various approaches to data collection and analysis (p.1B-22). All resulting data in the newly engineered, integrated networks would be set up to follow the requirements for the District's DBYDRO database (including QA/QC).

Technical Review. In WY2007, as a test case the District used the above-mentioned workshop approach to "network reengineer" water quality monitoring in the smallest of the WCAs, WCA-2A. Available datasets from WCA-2A (including water quality, vegetation maps, ground elevation maps, soil TP etc.) have been used to form a set of objectives for the marsh and structure components, need to develop a comprehensive, integrated monitoring plan. Statistical comparisons of stations within five zones of WCA-2A are made from the context of the priority needs to further streamline the network. The generally sound approach (some suggestions/comments to improve, below) also includes an analysis of where stations need to be added. It can accommodate further changes in station recommendations as additional data become available.

Lines 278, 283 – How is a "meaningful frequency" established? This would appear to be a key question for the success of monitoring programs in adequately tracking pollutant inputs and changes over time. This reviewer has major concerns about selection of a monthly frequency for marsh sampling, for example (lines 685-686), because monthly sampling is inadequate to "capture" pollutant loading events. Moving to a bimonthly or seasonal sampling frequency (lines 789-791) is also strongly recommended against – the areas described for this can serve as valuable reference areas (line 819), so the data collected for them is just as important as the data collected for "altered" sites. The authors state that more quantitative study of various sampling frequencies is planned, and this action is strongly recommended, including additional higher-frequency sampling efforts (e.g. weekly, in some important sites – add to lines 806-807).

Response #1: District staff are using available data to look at the ability of networks to detect status and trends at various frequencies. While having more frequent data does account for more natural variability, the question is whether more frequent samples would provide more useful information to support management. Sampling strategies can be discussed at the SFER workshop.

Comment #2: *Lines 704–705—Why is chlorophyll a described as an "esoteric" parameter?*

Response #2: Esoteric in this context means of limited utility, or useful to a very limited group. We will rephrase.

Comment #3: *Lines 709–711—The authors state that a reengineering goal should be to have a standard water quality parameter set agreed upon for all stations regardless of project requirements. This seems counterproductive; it would seem much more constructive to have a standard set of parameters, augmented by additional parameters depending upon project requirements and information needs. For example, the preliminary standard parameter set should include hydrogen sulfide and ammonia/ ammonium (line 721), an important pollutant; and if mercury contamination is a concern for some projects/sites, mercury should be added.*

Response #3: The goal is a standard set that can be widely applied for general utility and to avoid logistic concerns. It is agreed that the standard set should be augmented depending on specific needs. We are working on another conceptual diagram for the reengineering and these ideas will be melded into that scheme.

Comment #4: *Lines 730–732—There is often considerable uncertainty in attempting to use various means to adjust data for diel fluctuations in DO, even when site-specific and based on extensive diel studies. This approach should be abandoned where possible in favor of automated monitoring systems – especially at sites where DO information is critically needed, because this is the only way to obtain scientifically sound data on oxygen sags and other variability. Quarterly deployment of sondes will not provide the information needed to assess DO conditions.*

Response #4: Quarterly deployments were just one suggestion to improve on existing grab sampling. Actually, the SSAC we see as well founded and it substantially improves the interpretability of the DO data. Permanently deployed monitoring systems will be investigated, however they will be subject to routine vandalism and theft as are our autosamplers. Further discussion is needed.

Comment #5 (Editorial changes):

Line 199 - …would not be feasible… be

Line 261 - …plan considers marsh… considers

Line 708 - represent problematic… respresent

Line 715 - should be TP, not $TPO_{4...}$ TP

Line 718 - should be NO_x OK

Response #5: Thanks for the comments.

Comment #6: *Figure 1B-1—is well-conceived, but the color coding for the various features is difficult to discern; please alter for clarity (the authors noted that the figure was being updated).*

Response #6: We'll try.

Comment #7: *Figure 1B-3— a diagrammatic map should also be included with this figure, which is difficult to decipher. In addition, explanation should be given about the sampling station numbers (from what programs?).*

Response #7: We will clean up this figure**.**

Richard Meganck

I have limited my questions to the broader implications of a consolidated water quality monitoring program and not focusing on the detailed methods or specifics of WCA-2A test area.

Comment #1*: While it is apparent that that the reference to "15 federal agencies" in lines 53-55 refers to various water quality programs nationwide, it might not be so clear to the casual reader. A simple clarification should be inserted.*

Response #1: We will clarify.

Comment #2: *Given the reality of the summary comment in lines 88-90, and lines 194-196, is there any precedent (regionally, other state programs) for the District to propose a consolidated, District-wide monitoring program, a single "optimization" model (lines 93-95), to the various regulatory agencies as both a cost-saving and technically feasible manner in which to respond to so many reporting requirements? Would the USEPA, FDEP or the Governor's office support such an effort? The SFER refers to the need to "wipe the slate clean", but is there the political will to do so?*

Response #2: Good thought, we need to clarify. We have received guidance for senior management in both state and federal agencies to conduct the reengineering, and this impetus has been increased by recent and prospective budget constraints. The clean slate is to focus on information needs then reconstruct a monitoring approach to meet those needs. If other agencies do not support the process, it will be up to senior management to decide how strongly to press for changes.

Comment #3: *While the District has "ongoing activities and assigned staff in each element of this framework" (as presented in figure 1B-2), will that initiative provide sufficient technical background for developing an agreed consolidated water quality monitoring program? Are there additional actions contemplated by the District to grease the skids for such an important change in operating procedures? Perhaps the comment in lines 204-213, and in lines 582-588 respond to part of this question.*

Response #3: We have addressed part of this question above, but wish to add that we are relying on internal and external staff to assist us with the reengineering. We are making presentations to various interagency teams associated with CERP or programs under the Everglades Forever Act and these talks are aimed at maintaining multiple agency support for the effort.

RESPONSES TO COMMENTS ON CHAPTER 2

Wossenu Abtew and Chandra Pathak

Subject: Response to Dr. Armstrong Comments
Document posted as: Response_to_Dr_Armstrong_9_27_07.doc
Originally Posted: 27 Sep 2007 03:56 PM

Comment #1: *"Does the draft document present a defensible account of data and findings for the areas being addressed that is complete and appropriate?" The chapter on hydrology is a mainstay of the SFER reports as it is the management of water that is one of the primary missions of the SFWMD, and it is the presence and movement of that water that influences water quality and ecological resources throughout the District's jurisdiction. The chapter does present for WY2007 the sources of water, the storage of water in the various lakes and impoundments, the movement of water throughout the system, the water management process, and in detail the state of the system hydrology in WY2007. The hydrologic system is clearly an immensely complex one, and the chapter is replete with facts about those factors that influence water sources, storage, flows, etc. However, the chapter assigns little meaning to the facts so the reader is left with a staggering amount of information with little sense of its consequence unless the reader is intimately familiar with the system. The chapter could be strengthened by:*

A. *Emphasizing more at a "20,000 ft" level the descriptions of the hydrologic system, how it operates, how it responds to spatial and temporal amounts of rainfall, how the system has been operated to accommodate the availability of water, and particularly the consequences of having too much, just the right amount, or too little water in terms of meeting management objectives (see below).*

B. *Developing on a set of "dashboard" metrics that describes how the hydrologic system has been operated and managed in the past water year and in a historical context so the reader has a quick grasp of the "state of the hydrologic system" in space and time.*

C. *Linking the discussion of the hydrologic system each year to the emerging topics raised over the past several years, i.e., the hydrologic monitoring system (as is done this year), droughts, hurricanes, long-term climatic change, long-term changes in water demands, and so forth. Some of this is being done, and clearly the impacts of droughts and hurricanes that have impacted water resources are being included, but their impacts on the variability of the hydrologic system and particularly how water uses are being met is sometimes lost in the amount of data being presented.*

Response #1:

A. Yes. Expanding the hydrologic system presentation will provide a new reader of the chapter a clear picture of the system. For this report (WY2007), the following paper which is cited in the report will be added as an appendix. For next year (WY2008), we will expand the hydrologic system description following the comment provided.

   "Abtew, W., R.S. Huebner and C. Pathak. 2007. "Hydrology and Hydraulics of South Florida." K.C. Kabbes (ed.). Proceedings of the World Water and Environmental Resources Congress 2007. ASCE, May 15-19, 2007, Tampa, FL"

B. The original design of the Central and Southern Florida Project (C&SF) sought to balance multipurpose objectives that included flood control, water supply, navigation, recreation, and preservation of flora and fauna. To that end, the system is operated based

on criteria defined in regulation schedules for the lakes and water conservation areas and optimal canal elevations for the system interconnecting those water bodies. At any time, a "dashboard" for the water managers and environmental scientists is the water surface elevation relative to those defined criteria.

Refer to Figures 2-24 – 2-30, 2-32, 2-34, 2-37- 2-39 for the lakes and water conservation area water levels through WY2007 relative to the specific regulation schedule. These figures provide the "state of the hydrologic system" temporally. Figures 2-23, 2-33, and 2-36 provide the spatial component by showing the interconnection of each area relative to one another.

Due to the deficit in rainfall, water levels in all but the case of WCA-2A (Figure 2-38) were below the regulation schedule. For WCA-2A water levels above the regulation schedule were utilized for water supply to the Everglades Agricultural Area located north of WCA-2A.

Because project purposes change over time and environmental systems are dynamic, data collected over years are utilized to revise regulation schedules and readjust optimum levels for canal operations.

C. When the current drought is over, expanded analysis of the drought will be included in the WY2008 report.

Comment #2: *"Question to Panel: Is the synthesis of this information presented in a logical manner, consistent with earlier versions of the report?" Yes, the material is presented in a logical manner, and there is continuity with previous versions of the report. The format/outline of the chapter is about right, and this was a point of discussion during the last SFER review. It is the content that needs to be reconsidered (see above) and whether the large amount of detail provided is appropriate for an accountability report.*

Response #2: Please see the above responses.

Comment #3: *"Question to Panel: Are findings linked to management goals and objectives?"A significant enhancement to this chapter would be to tie hydrology more strongly to water management goals and objectives. It is noted in a number of places that the two major purposes of water management at the District are flood control and water supply and that water supply releases are made for various beneficial uses that includes water supply for municipal and industrial use, agriculture irrigation, environmental restoration (especially the Everglades National Park), salinity control, estuarine management, and navigation depths. How water is managed to provide for these uses is described in great detail in this draft and in the hydrology chapter of the 2007 SFER. But what is not noted is how well the management objectives are achieved. This leads to a number of specific questions which are posed as follows:*

What are the management objectives, if any, beyond those listed above and how does one know if all of the objectives are achieved? How does the District measure success in managing flood control and water supply objectives – what are the metrics or indicators, what are the targets, and what are the assessment and evaluation methods? For example, salinity is used as an important indicator in estuaries, and water is released to maintain salinity levels in the estuaries at certain times of the year. Further, pulses of water are released to estuaries as well. How does the District determine it has been successful is maintaining desired conditions in estuaries, how does it measure that success? How well is the District able to respond to adaptive management if eventually meeting salinity requirements is supplemented by meeting nutrient loadings and perhaps other requirements?

Response #3: The question of objectives is addressed in the response to the dashboard suggestion above in item 2. Success in managing for floods and for water supply is measurable, in part, by examining the water level hydrographs for the key canals of the system. Regulation schedule and optimum stage ranges are established for the C&SF system. Departures from these ranges occur at times. The measure of success varies for each part of the system and in some cases, like wading bird nesting success, the results are almost immediate; however, not only tied to how well the system was operated but how rainfall and discharges occurred. Because project purposes change over time and environmental systems are dynamic, data collected over time are utilized to revise regulation schedules and readjust optimum levels for canal operations. For example, salinity ranges for the estuaries are established and measured in near real time. These data are used for planning studies and can indicate not only how the system is operated, but how development and runoff from local basins, those not regulated by structures, may be having an impact on the estuaries. There is a tremendous amount of natural variability that must be taken into account when developing performance measures and the "adaptive management" is an ongoing and developing science that more and more will need to be factored into operations.

Comment #4: *What role has risk management played in developing the decision trees and regulation schedules in terms of managing water to avoid flooding and particularly providing for the various water supply needs under drought conditions? The decision trees focus on water movement but not explicitly on the consequences of that water movement or lack thereof? With the hydrologic system being so sensitive to spatial and temporal variations in rainfall and the ability to store and move water within the system and the economic, environmental, and social consequences of not meeting water needs being so high, it would seem that the risk of meeting or not meeting a management objective should be examined. A corollary would be the reverse impact of the variation in criteria for meeting objectives on the regulation schedules. For example, if a salinity requirement in an estuary is actually some particular level but the uncertainty in that level such that there is a significant error band about that level, how does that uncertainty translate back to the regulatory schedule and what degrees of freedom does that give managers in managing water?*

Response #4: Risk management, like adaptive management, is a high priority to water managers. The Operations and Maintenance Resource area is working to develop a risk management protocol. As this is developed it will be factored into developing decisions trees and future operational criteria.

Comment #5: *How is growth in water use accommodated? As populations grow on the east and west coasts of Florida and within the system and as water use for municipal and industrial water supply and other beneficial uses increases, how will the District accommodate such growth? The District's pumping volumes depicted in Table 2-1 show a doubling in ten years; does this reflect such water use growth?*

Response #5: I suggest that population growth and water supply issues be addressed in Volume II under water supply plans. As shown in Table 2-1, District pumping volume has been increasing. The reason is that the number of pumps has been increasing and the same water is pumped twice. Originally water was pumped out of the Everglades Agricultural Area into the Water Conservation Areas. The addition of the Stormwater Treatment Areas has resulted in more pumping.

Comment #6: *What has been learned about water management through the current drought? It is noted on page 2-13 that the USACE has recently proposed revisions to Lake Okeechobee operational guidance; does this reflect lessons learned from the drought conditions, a management performance gap, or something else? If so, what were they are what are other lessons learned for other parts of the system?*

Response #6: The 2006–2007 drought will likely be addressed in a comprehensive report (separate from SFER). Lessons learned from the 2000-2001 drought were documented in such a report (Abtew, et al, 2002) that was thoroughly detailed. The proposed new Lake Okeechobee regulation schedule was developed before the current drought and will regulate Lake Okeechobee stages lower than the current regulation schedule to reduce risk of failure of the Herbert Hoover Dike. USACE in their draft Supplemental EIS report shows adverse impacts to water supplies and to navigation under proposed regulation schedule.

We will add language to specific sections on how the water shortage was managed for each respective hydrologic area. We will also provide a reference to documentation that may be completed on the water shortage emergency (Drought 2006, 2007 and 2008?) by the time this SFER is finalized.

Comment #7: *What are priorities for water uses and hence water releases? What are the relative priorities among municipal and industrial water supply, agriculture irrigation, environmental restoration, salinity control, estuarine management, and navigation depths? How were these priorities established, and what is the weight given to these priorities for releases from Lake Okeechobee vs. those from the WCAs?*

Response #7: The priorities for water uses are not as explicit as it is implied here. A basic description follows. During droughts when there is competition for limited supplies, the District activates water shortage plans that reduce the supplies for irrigation. Currently, the only major priority issue that is likely to arise is for limited Lake Okeechobee water when both the Lake Okeechobee Service Area (LOSA) and the Lower East Coast Service Areas (LECSAs) have simultaneous need for supplemental water to help prevent saltwater intrusion into coastal well fields. Under such circumstances, the limited Lake Okeechobee water and conveyance capability would likely be shared between the LOSA and the LECSAs. Environmental restoration allocations, or reservations, are not yet explicitly defined for most of the environmental systems. Once the CERP/A8 storage infrastructure is built, a substantial portion of that "new water" is to be reserved for environmental systems.

Comment #8: *What is the Standard Project Flood? Could its definition be added to the Glossary?*

Response #8: The Standard Project Flood (SPF) is the runoff generated from the Standard Project Storm (SPS); i.e., the 1–100 year storm increased by 25 percent. Capacity of canals is given as a percentage of the SPF. The SPF and SPS were developed by the USACE and used for design and operations of water resource facilities.

Comment #9: "Question to Panel: Are large programs presented so that the overall goals are clear and linked systematically to descriptions across the Report?" *As noted above, the chapter could benefit from closer links to management goals and objectives as expressed in other areas of the SFER. Clearly, the hydrologic system has great impact on water quality, stormwater treatment areas, water conservation areas, restoration and management of Lake Okeechobee, the Kissimmee Basin, the Everglades National Park, and coastal estuaries.*

Response #9: We will keep on improving the links between the various chapters.

Comment #10: *"Question to Panel: Is the chapter cross referenced in a thorough and consistent manner?" Again, the chapter could benefit from closer links to water quality, stormwater treatment areas, water conservation areas, restoration and management of Lake Okeechobee, the Kissimmee Basin, the Everglades National Park, and coastal estuaries and the role that water management has on these areas and the role that management of these areas has on water management.*

Response #10: The linkage of chapters was discussed in previous peer reviews. The suggested solution was for the draft of the hydrology chapter to be completed first and the other chapters link hydrology to the discussion of their respective topics.

RESPONSES TO COMMENTS ON CHAPTER 3A & 3C

Kenneth Weaver[1], Grover G. Payne[1]

Subject: Responses to Chapter 3A and 3C comments
Document posted as: Chapters 3A and 3C Responses to Panel Comments(2).doc
Originally Posted: 26 Sep 2007 09:34 AM

PANEL COMMENTS ON FINAL 2007 SFER– VOLUME I, CHAPTERS 3A AND 3C

Robert Ward

Comment #1: *Regarding streamlining Chapter 3, the Panel notes that other chapters in the SFER are expanding their scope to address all of South Florida, but Chapter 3 remains limited to water quality violations in the EPA. Are there plans to develop Chapter 3 into a truly South Florida assessment of water quality or leave its purpose as:"the primary purpose of this chapter is to provide an overview of the status of water quality, relative to Class III criteria, in the EPA during WY2006"?*

Response #1: There are not currently any plans to develop Chapter 3 into a truly South Florida assessment of water quality. In the near future, the focus of the chapter will remain on the more narrowly defined mandates of the Everglades Forever Act. However, the recent adoption of the Northern Everglades and Estuaries Protection Program by the Florida legislature may afford a future opportunity to take a more consolidated and regional approach.

Comment #2: *The author response to how data are queried each year from DBHYDRO, mentioned on page 1A-4-17, note that the stations used for all periods in the 2007 report were updated to the 'standard network' to assure consistency between periods. Is this the new network that will consistently be used to evaluate standard violations in the future?*

Response #2: The authors have sought, wherever possible, to use a standard network consistently between reports. Yes, it is our intention to continue the network described in the 2007 report. However, we are aware of and are engaged in the efforts to optimize the monitoring network, which may lead to changes in the network. A major goal of that effort will be to develop a 'standard' and long-standing network to assure consistency.

Comment #3: *Also on page 1A-4-17, in reference to added stations in the Arthur R. Marshall Loxahatchee National Wildlife Refuge, it is noted that a revised network, with the added stations, provides a more accurate representation of water quality conditions. How are terms such as 'more accurate' and 'improved spatial coverage' used as criteria to bring new sampling site into the network? Hopefully there will be more elaboration on this point in the 2008 SFER? Or will the need to annually update the monitoring network be greatly reduced once there is a standard network for long-term water quality criteria violation assessment? It is recognized that there will always be shorter term water quality assessments related to emerging concerns and responses.*

Response #3: The references to more accuracy and improved spatial coverage were meant to convey the idea that the "new" network included stations in areas of the marsh which had not

[1] Florida Department of Environmental Protection, Tallahassee, FL

been previously monitored on a routine a basis; that is, an attempt had been made to fill in "holes" within the spatial coverage. As described above, a major goal of the effort to optimize the monitoring network is to develop a 'standard' and long-standing network to assure consistency in the future. While shorter term water quality assessments will continue to be conducted for a variety of purposes, the data from these short-term efforts have not and will not be included in the water quality criteria assessments presented in Chapters 3A and 3C. Although shorter-term datasets may be used to better understand the biogeochemical or spatial processes cause or contributing to excursions.

Comment #4: *The Panel's comment on Table 3A-3 regarding the disparity between sample sizes, is acknowledged in the authors' response, but there is no change in the substance of the table. An asterisk is used to indicate insufficient sample size to confidently characterize the excursion frequency in both the draft and final 2007 SFER reports.*

Response #4: Additional cautionary text was added to the 2008 report to address this issue. "No conclusions regarding differences (trends) in DO excursion rates between individual water years and the previous periods can or should be made, given the large disparity in sample sizes among time periods." Furthermore, given the revised analysis periods presented in the 2008 SFER it will be possible in future reports, after the phase I period has expanded sufficiently, to make valid comparisons between the phase II and the baseline and phase I periods.

Comment #5: *The errors (incorrect order of columns) in Table 3A-4 are corrected in the final 2007 SFER report.*

Response #5: There is no need to respond.

Comment #6: *The time period for pesticide detection and exceedance categories, in Table 3A-5, was changed in the final 2007 SFER to reflect an annual assessment (February 2005 through February 2006) rather than the December 2004 through February 2006 stated in the draft 2007 SFER.*

Response #6: There is no need to respond.

Comment #7: *On page 1A-4-19, it is noted that the annual queries of DBHYDRO do not result in different records from year to year and that if there are differences, it is due to refinements in the monitoring network. Regardless of how differences are created, is there not a potential for inconsistencies in the findings/conclusions from year to year due to changes in the monitoring network? The Panel notes that once a consistent network of sampling stations, with consistent sampling frequencies, is devoted to standard violation detection, such issues should be greatly diminished, or even eliminated.*

Response #7: Great care is taken every year to avoid inconsistencies in findings and conclusions from year to year. However, as the Panel has noted the monitoring design including sampling frequencies and stations is not completely under the control of authors, therefore inconsistencies are possible. It should be noted that the District conducts monitoring under close consultation with the Department. The authors would be made aware of any major changes in the monitoring network well in advance of any changes and would be afforded the opportunity to comment on the proposed changes on how these might affect standards compliance assessments. Minor inconsistencies due to differences in sample sizes, related to hydrologic conditions (water depth) or other sampling difficulties, between years are more likely. It is highly unlikely that the minor inconsistencies in sample sizes would alter the chapter findings/conclusions.

The authors agree that a consistent network of sampling stations will greatly diminish inconsistencies. We support the efforts to optimize the South Florida monitoring network summarized in Chapter 1B of the Draft 2008 SFER

Comment #8: *On page 1A-4-27, the Panel asked if it was possible to place a confidence interval around the estimate of atmospheric deposition of TP. The authors' response to this question is not clear. If a number is reported and there are 'many data issues', would it not be more scientifically sound to report the estimate's uncertainty than just a firm number? It seems it should be possible to place a confidence interval around an estimate from weekly sampling at five stations.*

Response #8: The estimate of atmospheric TP deposition was developed based on a presentation the Everglades Technical Oversight Committee. The 95% confidence interval of the mean annual atmospheric TP deposition is ±56 metric tons.

RESPONSES TO PANEL COMMENTS ON DRAFT 2008 SFER – VOLUME I, CHAPTERS 3A AND 3C

Robert Ward

General Comments

Comment #1: *If the sampling was designed to support the protocol, there would be a minimum of 28 samples collected at each sampling site used in the excursion analysis. To overcome this data limitation, the authors of Chapter 3 developed a excursion analysis protocol that utilizes several assessment procedures, based on the number of samples available (or 'found' in DBHYDRO). Chapter 1B in this SFER, addresses this past concern and defines a context in which the water quality data limitations, as applied to excursion analysis protocols, can be discussed and addressed.*

To further elaborate, a minimum of 28 samples is needed to support the binominal hypothesis test chosen for use in the excursion analysis protocol. If there are not 28 samples available during the year, alternative data analysis methods are employed. The question arises as to why a data analysis method was chosen to conduct excursion analysis if the minimum number of samples required for its use will not be collected at all stations each year, by definition in the sampling protocol?

Response #1: The primary focus of the current excursion analysis protocol is on regional evaluations with a minimum of 28 samples within a given analysis region (e.g., WCA-2 interior, WCA-3 inflows). The proposal in Chapter 1B is expected to provide the minimum required number of samples, except under extreme hydrologic years.

In addition to the regional analyses, Chapter 3A does present analyses of individual monitoring station excursions to provide additional information on sub-regional patterns. The existing monitoring protocol does not support analysis of individual site exceedances on annual basis, using the existing protocol, nor will the proposal in Chapter 1B. Individual site exceedances are therefore evaluated on a five year basis. It is unlikely that it would be economically or logistically feasible for the District to support a sampling regime requiring at least 28 samples per station per year without substantially reducing the spatial coverage. Requiring 28 samples at each site would necessitate sampling every 10-12 days, which would raise questions regarding the independence of samples, especially in the marsh. The authors believe that it is vital to maintain (or expand) the existing spatial coverage, given the substantial spatial heterogeneity across the EPA. The spatial variability across the EPA and within WCAs is greater than the annual or inter-annual variability at a site. We believe that an effective monitoring program must focus on the sources of variability in an attempt to minimize the overall variance in the resulting dataset. Further, we agree with the general thesis of the review comments; that is, any revised sampling protocol should support the analysis methodology and visa versa.

Comment #2: *As the new Everglades Protection Area Phosphorus Criterion Achievement Assessment comes online, compliance methods are well defined in the criterion itself. There is a*

separately designed network to supply the data; however it is not clear if the data needs for the assessment influence the sampling strategy at the 58 stations in the network (or if the project requirements, alone, associated with the various stations, guide the sampling strategy). The fact that only 30 stations of the 58 had sufficient data to support the compliance protocol in the TP criterion (page 3C-4, line 124), suggests that the sampling strategies employed at the 58 stations do not account for the data needs of the TP criterion. Or are there reasons, such as dry conditions, that greatly limited sampling in WY 2007?

Response #2: A monitoring network consisting of 58 stations was established specifically to be used in the evaluation of compliance with the TP criterion. The monitoring network was established in accordance with the requirements of the phosphorus criterion rule. Existing sites that were being monitored for other purposes were incorporated into the network where ever possible to maintain the period of record. However, to obtain the required spatial coverage, several new monitoring stations were added to the existing sites to complete the 58 station network. The minimum sampling frequency for all marsh sampling stations is monthly which would normally provide 12 samples annually (i.e., twice the minimum of 6 required for the data to be included in the assessment).

As stated in the chapter, there were two reasons for a large number of sites not having the minimum of 6 samples required for inclusion in the TP criterion assessment. First, monitoring at the full network was not initiated until January 2007. Since the water year ended April 30, 2007, none of the new (i.e., previously non-existing) sites had sufficient samples collected during the monthly monitoring. In addition, during the January–April 2007 monitoring period it was impossible for the new sites to satisfy the requirement for samples to be collected in both the wet (May–September) and Dry (October–April) seasons for the data to be included in the assessment. In addition, during the second half of water year 2007, dry conditions resulting from an extended drought precluded sample collection at a number of sites for several months.

Unless extremely dry conditions or other unforeseen circumstances that preclude monitoring persist for extended periods, the monthly sampling strategy is expected to provide an ample number of samples for all future evaluations.

Comment #3: *The definition of compliance contained in the TP criterion (Chapter 3C) is rather specific and, due to critical ecosystem health issues, does not integrate well with the 'excursion analysis protocol' employed for the other water quality constituents assessed in Chapter 3A (thus the need to break the compliance assessments in Chapter 3 into parts A and C). At what point does the monitoring and compliance assessment of TP move from warranting a special section of Chapter 3 into the routine standard assessment compliance descriptions presented in Chapter 3A, even if different excursion analysis methods are employed? This question is asked in the context of providing more integration of water quality assessments across South Florida and across water quality constituents – to better connect with development of a more integrated water quality monitoring design for South Florida, as well as a more integrated view of water quality in South Florida that can be presented in future SFER reports. Chapter 1B in the 2007 SFER hinted at how this might be accomplished.*

Response #3: We are continuously investigating ways of streamlining the chapters including combining Chapters 3A and 3C. In many ways combining the two chapters makes sense but, several factors make the two chapters unique, especially when expanding the scope of the chapters outside the Everglades Protection Area (EPA). First, Chapter 3A evaluates compliance of monitoring results with Class III surface water criteria that are applicable throughout the state so it would be relatively straight forward to expand the assessment to other areas across South Florida. In contrast, the numeric phosphorus criterion is only applicable within the EPA. Outside the EPA, phosphorus as well as nitrogen are regulated by a narrative criterion designed to prevent imbalances in the natural biological communities. Assessing compliance with the narrative

criteria is much more complex and requires large amount of biological data that is generally unavailable outside the EPA. Efforts are currently

Comment #4: *Are the water quality standards, whose compliance is being evaluated in Chapter 3, applicable to only flowing water or any water in the water column at any time of sampling, whether flowing or not? Or is the sampling strategy, described in Chapter 1B, relevant to only the permit requirements associated with the pumping?*

Response #4: Florida's water quality standards apply to all waters of the state. The standards are applicable whether the water is flowing or not and throughout the water column.

The sampling strategy described in Chapter 1B is relevant to both ambient monitoring [e.g. Chapter 3, 303(d) listing] and permitting requirements. However, the proposed conditional monitoring based on flow conditions would apply only to monitoring at structures where the primary objective is generally to characterize the water quality and loads flowing through the structure and the characterization of stagnant water behind the structure is not of great value. Additionally, to assure that the revised monitoring continues to satisfy permit objectives, any changes to permit required monitoring will require the approval of the permitting agency (typically DEP) and formal modification of the permit.

Comment #5: *Can the sampling strategy, described in Chapter 1B, be connected to the excursion analysis protocol, described in Chapter 3A, to insure the minimum number of samples are available to support evaluation of standard compliance? If it is not possible to insure the minimum number of samples will be collected each year at each sampling site (e.g. due to economic constraints), is it possible to revisit the excursion analysis protocol to better match available samples with chosen methods to evaluate standard compliance? Currently, there are several excursion data analysis methods employed in order to handle a range of sample sizes available at the sampling sites.*

Response #5: The sampling strategy, described in Chapter 1B, can and should be connected to an excursion analysis protocol to insure that the monitoring program supports one of its major objectives; that is, determine the quality of waters in the region. It is possible to insure that the revised monitoring plan will provide the minimum number of samples to support the excursion protocol. Although it is possible to revisit the excursion analysis protocol the authors believe this will be neither necessary nor advisable. The monitoring network described in Chapter 1B would provide sufficient data to support the excursion analysis protocol, with the exception of annual DO at the flow structures (inflows and outflows) since the population of stations is less than 28. There is also a potential for insufficient sample sizes during extremely dry years. Furthermore, the protocol was developed to be consistent with states 303(d) listing protocol. The authors advise that this be maintained into to insure a maximum level of consistency between evaluations.

The current excursion analysis is being conducted on a regional basis and the minimal sample size is applied to a group of stations within a given region. There is no requirement for 28 samples at a single station. However, the samples collected within a region need to be reasonably evenly distributed both spatially and temporally in order to prevent biased results/conclusions.

Comment #6: *Can there be a reminder in the text of the sampling strategy for pesticides. Use of the term 'pesticide monitoring events' suggests that there is a separate sampling strategy used for pesticides. Are the pesticide data stored in DBHYDRO?*

Response #6: Pesticide monitoring is conducted on a quarterly basis as a separate program from the other monitoring. The pesticide data are stored in DBHYDRO. The requested additional text will be added to the final report.

Comment #7: *In the specific conductance discussion on page 3A-21, lines 403-404, it is noted that all but one of the WY2007 exceedances occurred during periods of no recorded flow. Will the*

new sampling strategy, described in Chapter 1B, miss many of these exceedences in the future since only flowing water will be sampled? Consistency of excursion analysis results, across any sampling strategy change, is of concern. Sampling strategy changes have many ramifications, which if understood, often can be accommodated in a scientifically sound manner (e.g. using both sampling strategies for a year to provide correlation among the old and new strategies).

Response #7: The specific conductance exceedances discussed in lines 403-404 referenced conditions within the interior marsh. Under the sampling strategy described in Chapter 1B these samples would still have been collected. The flowing water requirements would only apply to inflow and outflow structures. This proposed flowing water requirement is still being considered by the larger interagency working group. While the biweekly when flow is recorded recommendation would provide a representative picture of EPA inflows and outflows, it remains to be determined whether this should be the only objective of the structure monitoring. Several non-SFWMD team members have expressed an interest in the continued monitoring during non-flowing periods at selected structures to provide a characterization of boundary or canal conditions.

The authors agree that the network optimization effort needs to consider consistency of results among time periods.

Comment #8: *On page 3A-33, it is noted that the non-ECP permit was amended on July 13, 2006. This legally driven change to the monitoring program (or more broadly, water quality information system) has implications to the consistency of information provided over both time and space. Can protocols be established to incorporate such modifications into the monitoring program in a well documented and transparent manner? This would help all those who use DBHYDRO data understand the changes taking place in the sampling regime employed.*

Response #8: The changes to the non-ECP Permit were approved by DEP as a modification to the permit. DEP technical staff, including the authors of Chapter 3, were consulted prior to approval of the modification. Modifications to DEP issued permits are conducted in a public process, which include public noticing requirements. Furthermore, the SFER provides additional documentation and transparency.

Comment #9: *On page 3A-30, lines 546-548, the following quote is noted: "To document the accuracy of the collected data….the District has compared WY2007 water quality data from non-ECP structures to state water quality standards." How does comparing data to standards insure its accuracy? The QA/QC procedures, followed in the collection of the data, insure its accuracy for use in standard compliance work.*

Response #9: Agreed, comparison of water quality data to standards does not insure the accuracy of the data. Proper QA/QC, collection, and analysis procedures provide confidence in the data's accuracy. The text will be revised in the final chapter.

RESPONSES TO COMMENTS ON CHAPTER 3B

Donald M. Axelrad[2]

Subject: FDEP Responses to Panel Comments, Chapter 3B
Document posted as: 2008 SFER_RTCs_Ch3B_da.doc
Originally Posted: 19 Oct 2007 12:49 PM

PANEL COMMENTS ON FINAL 2007 SFER– VOLUME I, CHAPTER 3B

Panel comments on Axelrad's responses to Peer Reviewer comments on the 2007 SFER

Comment #1: *The exceedingly high levels of mercury in largemouth bass in some locations require further understanding, particularly the levels in Everglades National Park.*

Response #1: Saltwater intrusion appears to be influencing the near-coast Everglades National Park (ENP) mercury in fish sampling stations, namely North Prong Creek and Lostmans Creek. This could be providing the sulfate (seawater has ca. 2700 ppm sulfate) to drive mercury methylation by sulfate-reducing bacteria (SRB). Otherwise, ENP surface water remote from canal discharges and the coast is generally very low in sulfate (< 1 ppm). As regards the sampling station in the north of the ENP, L67F1 at the terminus of the L67 canal where mercury in largemouth bass is also very high, the sulfate necessary to drive mercury methylation at this site is possibly derived from canal discharge (USEPA R-EMAP and USGS/Smithsonian ACME data). A new three-year USGS project will seek to extend our knowledge of the factors controlling methylmercury production in the ENP. "….USGS will direct… efforts towards Everglades areas where less research has been conducted, in particular, federally managed lands… including the ENP …" (2008 SFER, Chapter 3B).

RESPONSES TO PANEL COMMENTS ON DRAFT 2008 SFER – VOLUME I, CHAPTER 3B

General Comments

Comment #2: *The experiments with fish-eating birds are extremely useful, although the initial page needs to have more details of actual effects. Further, these experiments were quite intriguing, but the write-up needs more actual results data presented, and accompanying statistics to allow the reader to judge. Where is the experiment going, and for how long?*

Response #2: The final Chapter will include additional details of the UF white ibis mercury toxicology research.

Comment #3: *The relative contribution of small urban sources of mercury to the Everglades needs further study to ascertain both its importance and the potential for reducing mercury loads. Thus, an updated emissions inventory might shed some light on whether the initial large reduction in local atmospheric sources is still true.*

Response #3: The Florida statewide mercury TMDL as being developed by FDEP and due in 2011 will elucidate sources of atmospheric mercury to the Everglades (which contributes 95-98%

[2] Florida Department of Environmental Protection, Tallahassee, FL

of total mercury input). An emissions inventory is planned, and novel techniques are being discussed for quantifying small urban sources.

Comment #4: *…the issues associated with alkalinization are more complex that stated here.*

Response #4: The final chapter will elaborate on sulfate causing alkalinization which may accelerate phosphate release from Everglades sediments.

Comment #5: *…focus on better delineating threshold concentrations of mercury and sulfur inputs to minimize Hg (mercury) methylation, subsequent concentration through the food chain, the interactions between sulfate and sulfide and the influence of sulfate and sulfide on nutrient release and plant toxicity.*

Response #5: The further publication of Everglades sulfate-addition mesocosm research (Gilmour, Orem, Krabbenhoft, Aiken et al. - Smithsonian, USGS) next year will assist in elucidating methylmercury and sulfur relationships. Modeling approaches to defining areas of the Everglades where methylmercury concentrations are most sensitive to altered sulfate inputs will also be considered. Research is being considered on the influence of sulfate and sulfide on nutrient release from Everglades sediments.

Comment #6: *Two questions remain: What is the contribution of current to legacy sulfur, and What are the other sources? Both warrant considerable study.*

Response #6: Research to determine an Everglades sulfur mass balance is being discussed. Such research would answer these questions.

Comment #6: *…what is the degree of backpumping (of EAA water) into the lake (Okeechobee), how often and what quantities, and what time of the year?*

Response #7: Backpumping has comprised ~ 2% of Lake Okeechobee inflows on average per year over the past 10 years. Thus the Lake is a significant source of sulfur to the Everglades, and the final Chapter will elaborate on this point.

Comment #8: *..add a graph that shows the relationship between rainfall, runoff and sulfate increases to the EAA (Everglades Agricultural Area) canals.*

Response #8: The final Chapter will include R-EMAP and/or ACME figures on the relationship between rainfall and sulfate levels in EAA canals.

Comment #9: *Is there any way to estimate how much of the Everglades is under conditions where increased sulfate would enhance (or decreased sulfate would reduce) MeHg (methylmercury) production? Would a map help?*

Response #9: Modeling approaches to estimate areas of the Everglades where methylmercury concentrations are most sensitive to altered sulfate inputs will be considered. Elucidation of porewater sulfide concentrations as an indicator of methylmercury production sensitivity to altered sulfate loading is also being considered.

The following "Specific Comments" will be addressed in the final Chapter.

Comment(s) #10:

Line 12: I wonder if it should read that it is a threat to the fish themselves, to fish-eating wildlife...

Line 26: should say something here about potential causes of the high mercury levels.

Line 48 and on: The new findings section is extremely useful, and the inclusion of information from both the chapters and appendices is very important.

Line 56: Please include the SE or SD for the mean.

Line 59: Please include the wildlife criterion for clarity.

Lines 51-72. Somewhere here you might need to mention why sunfish and bass are used as bioindicators.

Line 71: give SE and ranges.

Line 73: give SE and ranges.

Line 76: Were these differences significant for both endpoints?

Line 126: Should give the wildlife adverse affects levels.

Line 267: The need for a sulfur mass balance for the Everglades is critical, and should be a high priority.

Mercury in Everglades Fish and Wildlife

Line 302: I thought that inorganic mercury was toxic to some invertebrates?

Line 305: Need to give the reference for Florida's criterion

Line 393-428: These increases in mercury levels are a problem, and some explanation of potential sources might be useful (the north to south explanation needs more work).

Figure 3B-1: It would be useful to put some measure of variance on the table for the current year values.

Figure 3B-2: This is very useful; 2003 seemed to have slightly higher levels in both areas - was there some atmospheric event that caused the increase?

Figure 3B-4: Also very useful, but there seems a clear increase in 2006 and 2007 over 2005. Causes?

Figure 3B-7. Holeyland WMA is clearly experiencing great increases, and the program is correct in following this disturbing trend.

Figure 3b-10. ENP NP had lower levels of mercury in the late 1990s, and I wonder why this was so then, and why the increase now. Holey is difficult to read on this graph because it is too light a color.

Lines 437-457: The increase in mercury in feathers is disquieting, especially since there is no clear cause.

Lines 472: Isn't the average for mercury in feathers in colonies?

Figure 3B-11: Again, some of the graphs are hard to read because of color choices. It is hard to determine which colony has the large increase in mercury in feathers from the graph.

Atmospheric Deposition of Mercury to the Everglades

Line 511: state when the system began.

Figure 3b-15 is very useful

Figure 3B-17 and 18: The inclusion of the residuals is important to evaluating the data.

Lines 531-547: The removal of wet deposition data for so many months makes the model problematic, and some explanation of the possible effect needs to be included.

Lines 559-566: These data clearly indicate the importance of long- term data to examine trends, and the use of statistics to truly examine whether there are trends.

Lines 572-: Are there any regional data to support this?

Lines 581-588: This seems the most logical solution: that there was some regional event which relates to both wet deposition and levels in fish and wildlife in 2003-2004.

Lines 614-616: It is not clear that the models are sufficient to distinguish and examine wet deposition/VWM concentrations in different parts of the Everglades that can be related to the levels of mercury in fish and birds at some sites.

Sulfur Levels, Sources and Effects on the Everglades

Line 658: Please add some indication of variance

Also what is the degree of backpumping into the lake, how often and what quantities, and what time of the year?

Line 668: what is the source of the dry deposition

Line 672: What is significant mean? Can some measures be given

Lines 679-685: Has the use of agricultural sulfur decreased in the last few years - from what to what? And are the soils tested to make sure this sulfur is actually needed?

Lines 695: Is it possible to add a graph that shows the relationship between rainfall, runoff and sulfate increases to the EAA canals.

Lines 750: Are there data on amounts of fertilizer used - has it increased in the last 50 years, in the last 10 years?

Lines 775: Is there any way to estimate how much of the Everglades is under conditions where increased sulfate would enhance (or decrease sulfate would reduce) MeHg production? Would a map help?

Lines 781: Since no references are given to the potential toxic or stimulatory effects of sulfide on plants, does this mean the experiments have not been done? Some limited experiments are mentioned, and these should be references.

Lines 829: any indication of what these local sources might be, and whether they could be managed or reduced?

Lines 844: Are these research needs identified in all past reports, recently, and by Everglades scientists?

Lines 848: Perhaps a statement should be added here that one of the problems is species-specific effects may well differ greatly (as well as time of exposure effects).

Line 850: The study should be identified (I assume this is Frederick's work).

Line 860: Were they given mercury-laced food throughout their development?

Research Progress

Line 864: What age were the ibis chicks?

Lines 867-872. This effect is unclear: did the dosed birds actually forage more or eat more?

Line 872-873: were all these deficits? (that is, in the predicted direction?)

Line 878: give reference for this effect

Lines 888-889: Are the young birds being followed to ascertain whether the hormonal effect will appear in older birds?

Lines 900-910: I assume this section relates to adult bird fecal samples? (but this needs to be stated).

Line 913: should give data and significance levels so the reader can judge if it is biologically meaningful.

Lines 919-926: What is the sample size for each comparison?

Lines 930-936: Did the females simply not pair, or were there any female-female pairings or attempts?

Lines 955: How long will the experiment continue?

Line 958-980. Should reiterate the main questions these four stations will address, and why each placement is necessary.

Line 989: need references for some of the statements here.

Lines 1000-1039. It is not entirely clear how the model fitting occurred, and what the results were.

Lines 1041-1046: The objectives and plans are not clear, and a further statement should be added here.

Lines 1060-1064: Will the plans for a mass balance be explained in the final version? How far are the discussions?

Future Activities

Lines 1073: what specific areas?

Line 1081: Why not also include those areas with especially high MeHg?

RESPONSES TO COMMENTS ON CHAPTER 4

Stuart Van Horn with Chapter Co-Authors

Subject: Responses to Panel Comments for Draft Chapter 4
Document posted as: 2008 SFER Draft Chapter 4 Responses to Panel Comments.doc
Originally Posted: 28 Sep 2007 07:42 PM

Comment #1: *At the public workshop next month, as part of the presentation on Chapter 4, please give us an explanation, analysis, and evaluation of the effectiveness, of the BMP point system as well as a discussion of the different levels of BMP activity.*

Response #1: Explanation of the BMP Point System. The rationale for assigning points to Best Management Practices in Everglades Works of the District (EWOD) permits arises primarily from the District responsibility of ensuring that an "equivalent" level of implementation effort is achieved from the different permittees ("levels the playing field"). The equivalent point system serves to set minimum requirements, and allow flexibility in selecting the practices that better fit the specific conditions related to a crop, a farm or an urban area. It also considers that the contribution load from flow and concentration will vary depending on various factors such as weather, operation, and soils. This plan development method considers that both flow and concentration must be targeted through a balanced plan. The plan implementation also had to be verifiable for compliances purposes at the parcel level. With these objectives in mind, the number of points assigned to each BMP was developed as a negotiated solution in a regulatory context. As indicated in Chapter 3 of the 2006 South Florida Environmental Report under the EAA Best Management Practice Plans, the BMP equivalent points system was based on the review of available technical publications, on the best professional judgment of District engineers and scientists, and on extensive cooperative workshops with landowners, consultants, and the general public. The BMP equivalent points system was not developed through strict scientific or engineering analysis; however, it follows common sense guidelines. Considering the objectives, the method has worked well to determine whether individual permittees are in compliance with their permitted implementation requirements.

Analysis of the BMP Point System. Nutrient Application Practices. Nutrient application practices refer to optimizing application rates and minimizing nutrient losses. The table below indicates the equivalent points assigned to typical BMPs in this category. Some BMPs may be more applicable than other based on the characteristics of each farm, or urban area. The table below presents typical nutrient BMPs. They are presented side by side to facilitate comparison.

Table 1. BMP equivalents point table for nutrient control practices.

Nutrient BMPs					
Description	Points	Description	Points	Description	Points
Soil Testing	5	Vegetables: Successive Planting	2.5	Slow Release Fertilizer	5
Nutrient Application Control	2.5	Citrus (typical): Plant Tissue Analysis	2.5	Reduced Fertilization	5
Nutrient Spill Prevention	2.5	Sod (typical): Split Application	5	Pastures: No Nutrients Land applied	15
		Pastures: No nutrients in feed	15		

Soil testing requires that prior to applying nutrients growers obtain soil tests and develop recommendations that are crop and farm specific. Growers shall follow those recommendations or explain the reasons for any deviations. Soil testing is essential in that it prevents over fertilization by determining nutrient plant requirements in addition to those provided by the soil. Application rates require technical justification and documentation to verify implementation. Yield response curves can be developed to justify application rates. In contrast, Nutrient Application Control is based on the application method and guidelines followed during application (e.g., no overlapping application, canal setbacks). Nutrient spill prevention does not require the same burden of developing technical documentation as soil testing.

There are BMPs that are applicable to specific crops, such as split application in sod farms, or plant tissue analysis—which may occur in lieu of soil testing for citrus groves. Split application requires that nutrient application be split in different applications to maximize intake by the plant. Documentation similar to that collected for soil testing is required. There are multiple applications and cost associated with those activities. Slow release fertilizers, which prevents losses by delivering the nutrients required as different stages of crop growth serve the function of split application, and are of greater cost than traditional fertilizers. Finally, BMPs which prevent import of phosphorus such as “no nutrients land applied” receive a high level as they are the ultimate control.

Water Management. Water management BMPs refer to optimizing drainage and irrigation practices to minimize off site discharges. Water management is generally provided in accordance with approved surface water or environmental resource permits (ERP). The equivalent point system is based on the level of attenuation that is anticipated and the water management system that has been developed (operational and infrastructure) that is in place to ensure that water quality and quantity is provided. The table below describes the points assigned to typical BMPs in this category. They are presented side by side to facilitate comparison:

Table 2. BMP equivalents point table for water management practices.

Water Management BMP Sub-Categories					
Canals and Soils	Points	Infrastructure improvements	Points	ERP Design Criteria	Points
½-inch detained	5	Infrastructure improvements for recirculation	5	ERP approved and operational impoundment	35
1-inch detained	10	Reduced flow through water table management (irrigation)	5		
Sheet flow	15	Holding Pond	15		

For systems where runoff storage is provided in canals and soils, such as those with canals and no reservoir, discharging through a pump structure, providing 1-inch of detention is assumed to require closer attention to pump operation than 0.5-inch (i.e. because of high ground water elevations and less water tolerant crops). To avoid over drainage, permittees must provide start and stop pump elevations, conduct calculations to demonstrate the storage is available, and implement internal water table management to ensure the storage is provided for day to day operation. Half-inch of storage is generally provided with less effort because of the characteristics of the EAA.

Equivalent points are provided to agricultural operations that have invested in infrastructure to enhance detention levels or reduce discharge (e.g., surface water impoundments, recirculation systems, or means to optimize drainage and irrigation schedules.)

Water systems designed, built, and operated in accordance with the most recent ERP design criteria (surface water impoundments) which discharge via gravity structures with set control elevations and that provide longer detention times, are assigned the highest level of equivalent points based on providing the greatest attenuation. However, high phosphorus concentration levels from the C-139 Basin and increasing rainfall-runoff trends from the Basin suggest that the equivalent points assigned need re-examination. As indicated above, the BMP plan development serves to set minimum requirements for improving water quality on individual farms so that achieving compliance with water quality requirements, at the basin level, is realized. Technical evaluation of existing water management systems is being considered.

Particulate Matter and Sediment Controls. The purpose of sediment control BMPs is to prevent or minimize the transport of phosphorus off site with sediments and particulate matter. The points assigned to sediment controls increase proportionally to the number of sediment controls being selected. It is difficult to pinpoint the level of effort for the different sediment controls, as it generally varies from grower to grower based on farm needs (e.g., frequency and extent of canals cleaned). An example of sediment controls are indicated below.

Table 3. BMP equivalents point table for particulate matter and sediment controls.

Sediment Controls	Points	Examples
Any 2	2.5	• Leveling fields
Any 4	5	• Canal cleaning
Any 6	10	• Vegetated berms
Any 8	15	• Aquatic weed control
		• Cover crops

For the EAA Basin and for customized BMPs in the C-139 Basin, staff can evaluate the BMP equivalent points assigned to a specific BMP on a case by case basis and with adequate technical justification (e.g., level of effort and effectiveness) provide incentives for implementation. To this date, however, there have not been any requests for such evaluation. For instance, it appears that sediment controls to prevent particulate phosphorus transport due to biological material may require an additional level of effort compared to other sediment controls. They are not as routinely implemented as those more related to sediment particles. Based on research conducted by the University of Florida IFAS, particulate P transport can be reduced by maintaining low canal velocities, longer pump periods, ensuring water level control (to prevent over drainage) and aquatic weed control. Increased equivalent points for a biological sediment control "package" including these individual practices could provide an opportunity for optimization of this BMP.

Evaluation of the Different Levels of BMP Activity. In an effort to respond to your questions, following is a "preliminary look" at farm level data. The majority of EAA farms have selected one of two types of BMP Plans as summarized below:

Table 4. Type of BMP plan breakdown for EAA.

EAA Farms 2007	Plan 1: Sediment Control	Plan 2: Detention
% Farms[1]	48	48
% EAA Acreage	49	50
BMPs	Water Management (½-inch) Soil Testing Nutrient Application Control Nutrient Spill Prevention 6 Sediment Controls	Water Management (1-inch) Soil Testing Nutrient Application Control Nutrient Spill Prevention 4 Sediment Controls

[1]Other BMP Plans account for 4% of the farm-basins and for less than 1% of the acreage.

Similar BMP plans can be associated with very different concentrations and loads because of site-specific conditions (e.g., crops, soils), and incidental factors. Out of 200 farm basins in the EAA, the table below lists the farms that since 1994 have consistently ranked above the 75th percentile based on concentration and unit loading:

Table 5. Type of BMP Plan for farms ranked above 75th percentile based on TP concentration and unit loading.

Basin Id	BMP Plan	Acreage	Sub-basin
50-003-03	Plan 1	118	S-2
50-007-02	Plan 2	5717	S-5A
50-011-03	Plan 1	14,338	S-6
50-020-01	Plan 1	320	S-2
50-023-01	Plan 2	278	S-2
50-031-02	Plan 2	1387	S-2
50-031-03	Plan 2	602	S-2
50-033-02	Plan 2	6101	S-5A
50-035-01	Plan 1	478	S-2
50-035-02	Plan 1	1634	S-5A
50-059-03	Plan 2	720	S-5A
50-059-04	Plan 2	306	S-5A
50-061-17	Plan 1	1598	S-5A

As can be seen from the table, the consistently higher phosphorus farms can implement either of the two types of BMP Plans (higher sediment or higher detention controls). The data suggests that other factors such as crop, area, or location may be more influential than the plan itself. The majority of the farm-basins were in more intensive uses (five were in vegetable farming; there was one sod farm, and one urban area.) The rest were sugarcane farms. The farms varied in size, although were generally smaller than the lower phosphorus farms described below. Higher phosphorus farms were exclusively located in the S-2 or S-5A Basins. Farm location within the EAA Basin is associated with specific soils, irrigation water quality, and District canal influences (e.g, seepage). In addition, out of the fifty farms that were identified each year above the 75th percentile, only the thirteen farms were identified to place consistently in the higher phosphorus bracket, thus, the majority of farms experienced changes from year to year.

While the average load and concentration for the farms above the 75th percentile were 270 ppb and 2.5 lbs/acre during the 1994 to 2007 period. Farms below the 25th percentile had average concentrations and loads of 68 ppb and 0.3 lbs/acre.

In contrast, as the same type of BMP Plan did not appear to be a common characteristic for the higher phosphorus farms, it was more characteristic among the farms which had consistently ranked in the lowest 25th percentile of all farms in the EAA:

Table 6. Type of BMP Plan for farms ranked below 25th percentile based on TP concentration and unit loading.

Basin Id	BMP Plan	Acreage	Sub-basin
26-003-01	Plan 2	599	S-8
50-060-01	Plan 2	8,166	S-6
50-061-10	Plan 1	25,062	S-8
50-062-01	Plan 1	4626	S-7
50-062-02	Plan 1	10,754	S-7
50-062-03	Plan 1	1,188	S-2
50-062-10	Plan 1	8,772	S-6
50-062-11	Plan 1	1,276	S-2
50-067-01	Plan 1	1,144	S-3
50-067-05	Plan 1	7,223	S-8

The lower phosphorus farms could be typified as being larger farms dedicated to sugarcane with BMP Plans providing for a lower detention levels and more sediment controls. None of the farms are in the S5A Basin. Seven of the 10 farms are managed under the same permit. Same as for the higher phosphorus farms, except for the ten farms listed here, the majority could drop in or out of the lower range category from year to year.

Evaluation of Effectiveness of the BMP Point System. Effectiveness under this program consists of achieving compliance with Everglades and Rule 40E-63, F.A.C., phosphorus requirements. The BMP point system has been effective in establishing the grounds for an equivalent level of effort when implementing BMPs and achieving the phosphorus loading reductions for the EAA. Through rule development and the supplementary projects described in the Update on Source Control Activities for the C-139 Basin, District staff are conducting analyses and data collection necessary to improve the program, so that phosphorus loading requirements for the C-139 Basin are also achieved. It should be emphasized, however, there are many challenges associated with pinpointing the effectiveness of individual BMPs, and external factors (such as those referred to in Comment #8) that have resulted in the source control program initiating a comprehensive approach to optimizing implementation of BMPs at the farm level.

This preliminary evaluation gives a sense of how the data can guide the process and was performed quickly based on the questions from the SFER panel however, more in depth evaluations are necessary and planned for more meaningful results. Specific BMP implementation (methods, frequency, rationale) and available farm water quality and quantity data are reviewed with permittees at the time of inspection, as an indicator of BMP *Plan* effectiveness. This evaluation is on a case by case basis. Specific BMP implementation in comparison to BMP technical datasheets as produced by the University of Florida IFAS and other technical sources is discussed with permittees.

Comment #2: *line 391–398: Will any preliminary findings be available for this years report? Any speculation or reasons for the 18% reduction, rather than 25%?*

Response #2: A preliminary evaluation on potential effects from Lake Okeechobee, weather conditions, water management BMP implementation, and farm discharge levels was conducted to initiate investigation of potential causes behind the 18% reduction.

Lake Okeechobee Impacts. There is some speculation that the increase seen in Lake Okeechobee TP concentrations is having an influence on EAA BMP performance since the lake is the primary source of irrigation water for the farms. A trend of increasing inflow TP concentrations to the EAA from the lake is apparent and can be seen in the following three graphs for each of the major inflow points. Each graph depicts the annual flow-weighted mean TP concentration of lake inflow versus total EAA outflow. Since WY1980 lake inflow concentrations have been steadily on the rise and EAA outflow concentrations have been steadily decreasing. Both trends took sharp upturns starting in WY2004 and have been generally going in the same direction since. The fourth graph depicts the trend of monthly flow-weighted mean TP concentration attributed to EAA runoff (basin wide calculation). The downward trend until WY2004 is evident, along with the sharp upturn afterwards. The impacts have not yet been fully studied or quantified, and an evaluation is planned to be completed during WY2008 that will hopefully shed more light on the relatedness of the lake inflow increases on the EAA.

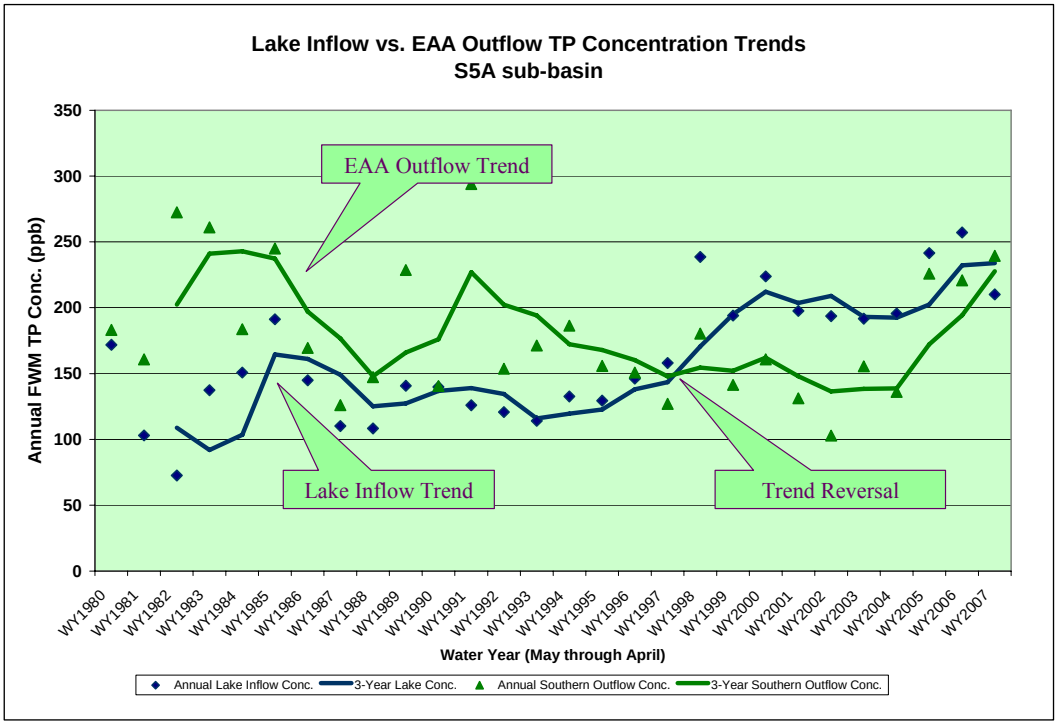


Figure 1.

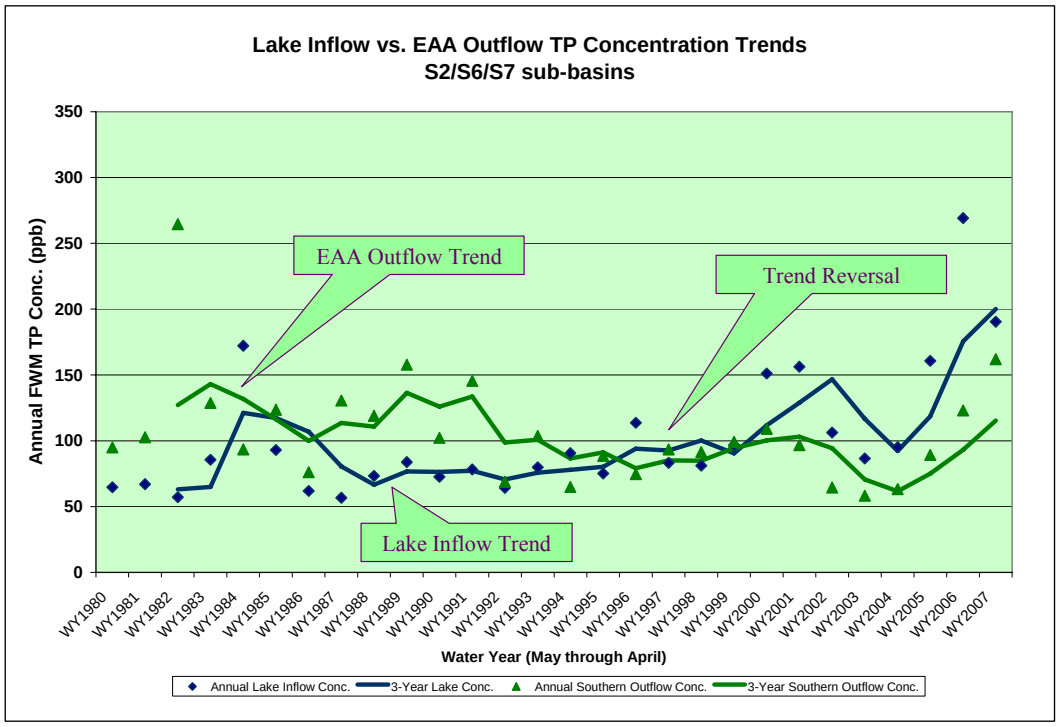


Figure 2.

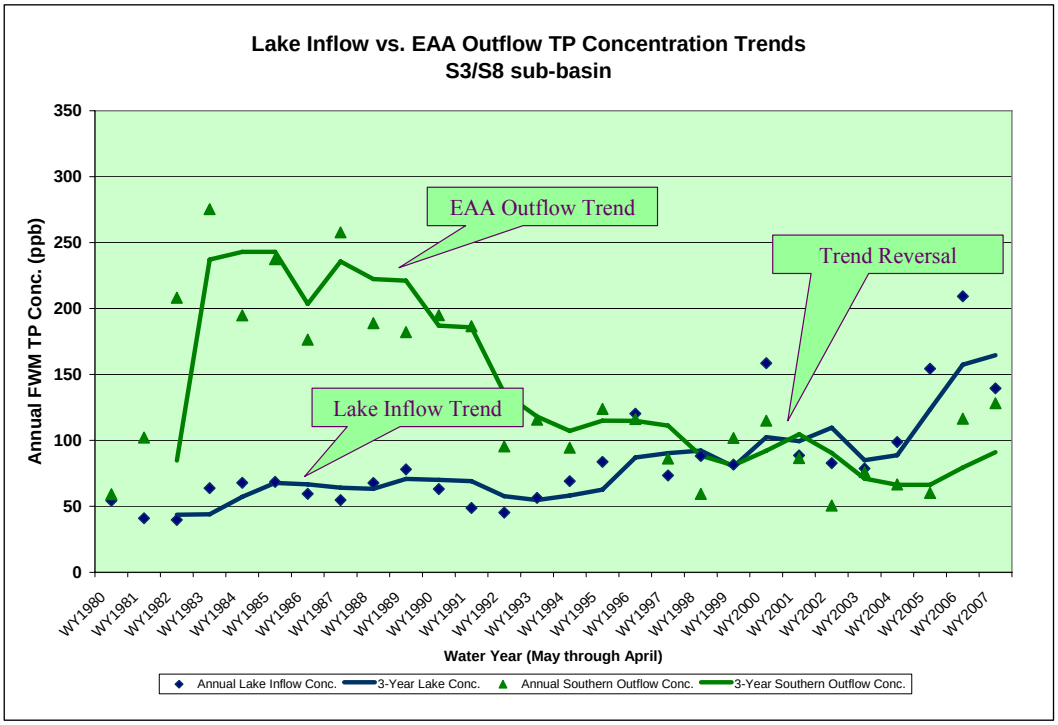


Figure 3.

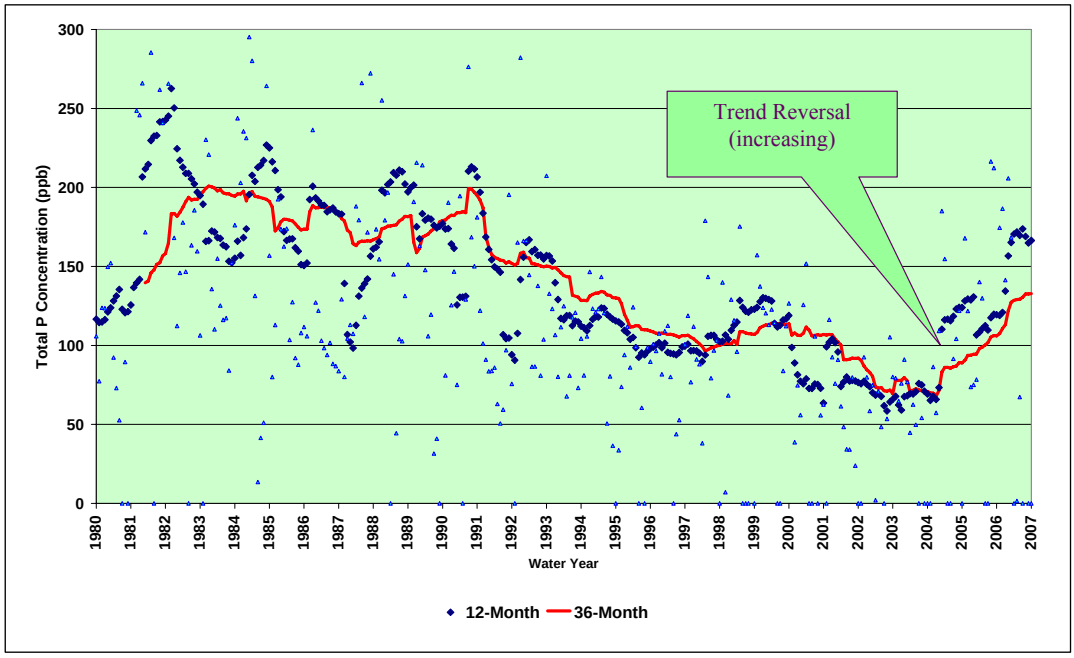


Figure 4.

Weather Conditions. EAA Basin rainfall and discharge characteristics during Water Year (WY) 2007 were reviewed in comparison to WY2001. WY2001 was a drought year where phosphorus reduction achieved 73%. EAA Basin annual rainfall and monthly discharge distribution were similar in both drought years. Although, Tropical Storm Ernesto in August 2006 contributed to higher rainfall amounts and thus slightly higher runoff through September when compared to same period in WY2001.

The Adjusted Basin Rainfall values serve as indicators of the approximate similarity in annual rainfall amount and monthly distribution between WY's 2007 and 2001. The EAA prediction of TP Load is based on the statistical properties of monthly rainfall distribution, and therefore nearly the same 25% reduction target goal was calculated in both years (136.9 vs. 146.3 mtons), with WY2007 slightly less by 6.9%.

EAA Basin runoff volumes were slightly higher in WY2007 by 14.6% mainly due to TS Ernesto and runoff observed through September 2006.

However, EAA Basin runoff TP Loads were markedly different than WY2001, with WY2007 being 65% higher at 149.5 mtons.

As shown in the TP concentration graphs, some causative factors of higher TP loads in EAA Basin runoff during the WY2007 drought year could include the increasing TP concentrations observed since the mid to late 1990's in the Lake inflows, and the impacts from the active hurricane seasons during Fall 2004 and 2005.

While visually there appears to be cause and effect relationships between the increasing Lake inflow concentrations and EAA runoff concentrations, the statistical evaluation and validation of observed trends, and other possible causative factors, is the subject of a Long Term Plan study currently under way.

Water Management BMP Implementation. A preliminary review of water management detention levels for the farms of higher unit loading (above the 75th percentile) in WY2007 was conducted. The objective was to verify that compliance with water management practices during WY2007 was generally consistent with years of better performance based on the sample. It should be clarified that a complete analysis of compliance with water management detention levels would have required pump logs to establish water table elevations at start and stop pumping, and explanation of critical agricultural operations requiring pumping regardless of rainfall detention requirements. Only rainfall runoff records were available, however, these were sufficient for a relative comparison.

Performance during WY2006 was used as a reference (44% TP reduction). The results indicate that the average detention slightly improved from 80% in WY2006 to 83% in WY07. That is that in eight of 10 rainfall events, discharge pumps were started farm rain gage readings reached the permitted 0.5-inch or 1-inch detention level. The slight improvement in performance appears to have been caused by the less pumping during the drought.

Detention at the farm level does not appear to have diminished in comparison to previous years, thus have become a factor behind the reduced performance during WY2007. However, nutrient management BMPs and sediment control BMPs can also have a significant influence on phosphorus loading, for instance, causing elevated concentration levels. Detailed documentation to verify implementation needs to be obtained through site inspections. In general, there has been less attention to EAA basin farms in recent years due to staff being more dedicated to C-139 Basin compliance, which may have affected BMP performance. EAA BMP verification inspections will be emphasized in WY2008.

Farm Discharge Levels. Since basin wide performance decreased in WY2007 in comparison to WY2006, farm level unit loadings were reviewed to determine any significant deviations from previous years. The histogram below shows the number of farms within specific rainfall adjusted unit load ranges. The purple bar shows the number of farms in each unit load range during the "pre-BMP period" and how they were distributed in WY2006 and WY2007. As indicated in the histogram below, unit loading at the farm level in WY2007 was not very different from 2006.

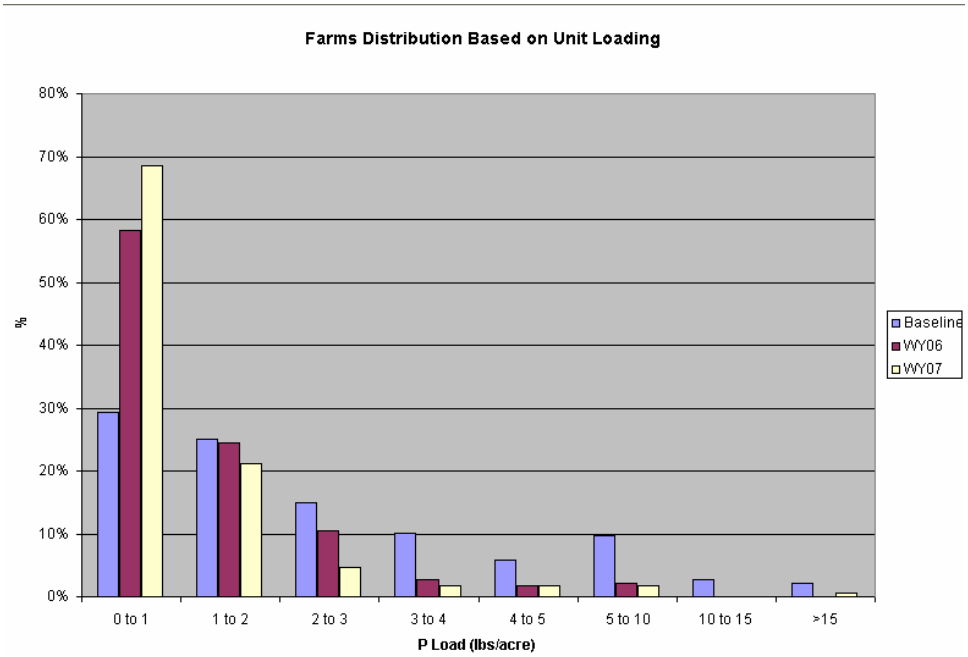


Figure 5.

Considering that unit loadings of up to 2 lbs/acre are currently the average, one can see that only 55% of the farms had baselines at or below 2 lbs/acre before BMP implementation. In WY2006 83% of the farms were at these levels and this increased to 90% in WY2007. There have not been significantly higher unit loadings at the farm level except for a single farm.

Since as a total farms did not appear to have significantly worsened, the potential effect of individual farms was reviewed. Based on unit loading and size some farms may have a greater potential to influence water quality at the basin discharge structures. Evaluating whether and how a farm or group of farms has the ability to impact basin wide performance is complex. In EAA canals, runoff from one farm can be recycled into another for irrigation purposes. Only a fraction of runoff from farms leaves the EAA basin and is accounted for basin wide compliance.

Nevertheless one can assume that larger farms with higher unit loadings may have more probability to influence unit loading. Timing and implementation of BMPs at these farms may be essential for basin wide performance. The table below presents EAA farms that had the larger individual runoff contribution to EAA canals. The 17 farms listed represent 50% of the farm runoff discharged during WY2007. There are 200 farms in the EAA Basin. As indicated in the highlighted areas, some farms had high unit load, high concentration, or were ranked among the top because of their large size. District staff prioritizes high unit loading farms for inspection.

Table 7. EAA Farms representing 50% of the farm runoff discharged during WY2007.

Basin ID	WY07 lb/acre	WY07 TP	% P EAA	% Accumulated	Ranking Contribution	Ranking Unit Loading
50-018-12	22.24	1751	8%	8%	1	1
50-011-03	2.14	447	6%	14%	2	17
50-059-01	1.59	451	4%	18%	3	29
50-007-02	3.15	341	4%	21%	4	10
50-054-01	1.77	332	4%	25%	5	26
50-010-06	0.53	111	2%	27%	6	120
50-061-10	0.53	83	3%	29%	7	119
50-021-01	4.42	429	2%	32%	8	6
50-002-02	1.14	272	2%	34%	9	49
50-033-02	1.97	368	6%	40%	10	19
50-061-17	5.86	518	2%	41%	11	3
50-018-10	1.02	147	2%	43%	12	63
50-011-04	1.83	234	2%	45%	13	25
50-080-01	0.91	186	2%	46%	14	77
26-010-02	0.66	122	1%	48%	15	100
50-018-03	0.69	123	1%	49%	16	97
50-044-01	2.85	382	1%	50%	17	11

The relative contribution of different farms to EAA canals can be visualized in the curve presented below.

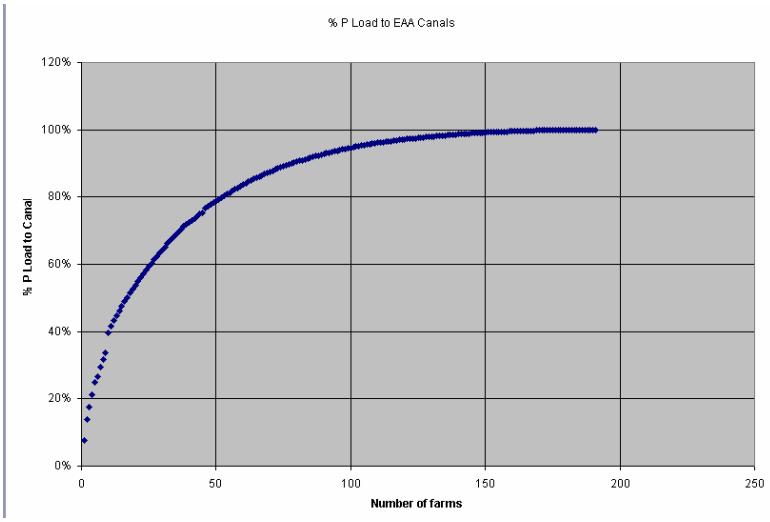


Figure 6. Percent TP Loads to EAA Canals vs. Number of Farms

The map below depicts the EAA Basin and the farms that account for 60% of the P in runoff to EAA canals. As discussed before, there are many complex interactions occurring to establish a direct relationship between farm discharge and phosphorus levels from the basin as a whole. As can be seen from the map, some large farms or higher loading farms are located nearby basin wide compliance monitoring points. Timing of their discharges and irrigation, and BMP implementation are factors that need to be explored in more detail. As previously discussed, only a fraction of farm runoff into EAA canals leaves the Basin at the compliance points. A large portion of the runoff is recycled within the Basin.

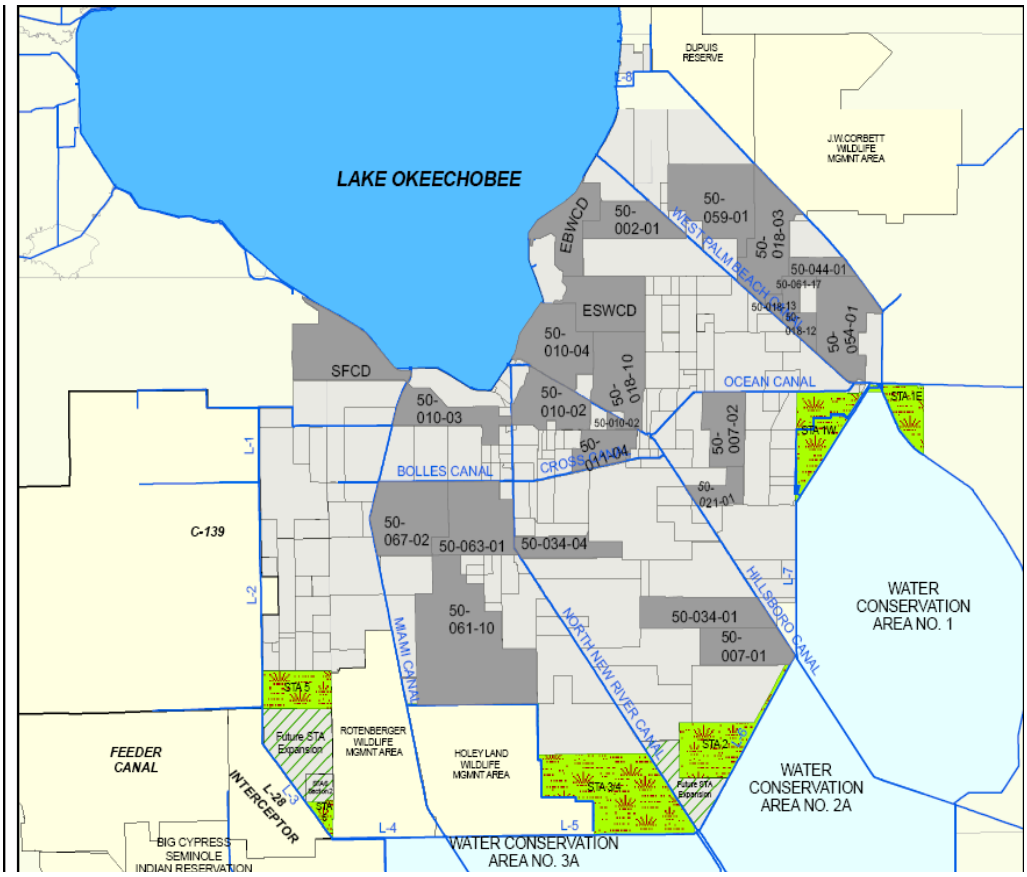


Figure 8. Location of Farms accounting for 60 Percent Loading to EAA Canals.

Farm Concentration Levels. Farm level concentration data for WY07 was compared with historic data to identify whether these could have been the factor beyond the lower performance due to the drought conditions. For instance, first flush conditions or pumping under lower canal water table levels, could have caused scouring of historically deposited particulates. Histograms were developed for:

- WY1994, as it served as the baseline year for the majority of EAA farms
- WY2001, as it was a drought year
- WY2006, as it reflects current farming practices and
- WY2007

The graph below depicts the distribution of farms among various concentration ranges, with the years presented in historic order from WY1994 to WY2007. As can be seen from the graph, farms with concentrations in the lower level brackets (below 150 ppb) have increased in recent years in comparison to the program starting years and the most recent drought. Accordingly, farms in the higher concentration brackets (> 150 ppb) have decreased or have been maintained.

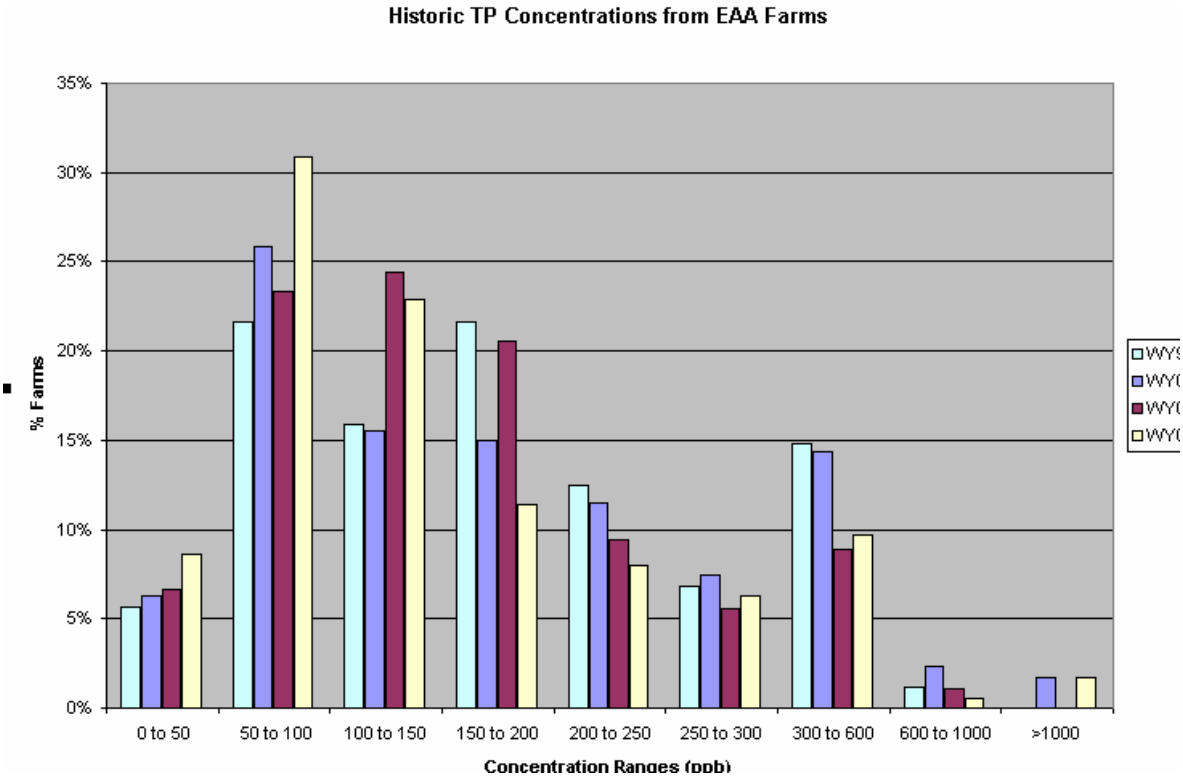


Figure 9.

Conclusion. Based on this preliminary evaluation covering EAA Basin data, Lake Okeechobee contributions, and farm BMP performance, it would appear as though this year's 18% reduction is a statistically-predicted (not unexpected) result. However, farm and basin level evaluations will continue to improve understanding on the conditions associated with these results, and toward prevention through increased with farm BMP verification efforts.

Comment #3: *It would be helpful to note what is the real difference between 18 and 25% in terms of the impact on the system. What is the impact of the difference between 150mt observed in WY07 TP load and the 137mt predicted 25% reduction? There was still an 32mt reduction that should be discussed.*

Response #3: From a BMP program performance perspective, any level of load reduction achieved signifies a positive outcome. While only an 18% reduction was achieved, 33 mtons of phosphorus was removed from the system by the BMP program that otherwise would have required removal through STA treatment. In contrast, if the 25% reduction mark had been realized, an additional 13 mtons in phosphorus would have been removed through the BMP program. Arguably, based on the relative magnitude of the TP load reduction, there is no

significant impact of achieving only 18% versus achieving 25% during WY2007. Additionally, compared to WY2006, which had a 44% reduction, there were 153 mtons of phosphorus exported from the basin compared to 150 metric tons in WY2007. However, having said this, it is not the intent of Chapter 4 to assess the relative impact on the system of one load reduction versus another, or of the magnitude of those load reductions. The main intent, as driven by statutory requirements, is to furnish information that explains and tracks the success of the EAA BMP program in meeting the mandated 25% reduction goal.

Further elaboration in this regard could be included in Chapter 4. Either of the following two graphs may be useful for gaining a better understanding of the relative magnitudes of load reductions and the associated percent reduction. However, the Chapter 4 authors feel that conclusions or inferences as to impacts on the system would not be appropriate as a Chapter 4 topic.

The first graph depicts the minimum 25% load reduction value, the actual load reduction achieved and the associated percent reduction. For comparison, in both WY2000 and WY2002, a 55% load reduction was achieved. However, an additional 126 mtons of TP load was removed beyond the minimum 25% requirement in WY2000 compared to an additional 69 mtons removed for WY2002. Therefore, for the same percent reduction, the magnitude of the load reduction in WY2000 was two times greater than WY2002. For WY2007, the 18% reduction achieved (33 mtons) was approximately 13 mtons less than the 25% goal. From a magnitude perspective, the difference between an 18% and 25% load reduction was relatively small and the overall impact on BMP program performance was negligible.

The second graph presents basically the same information by contrasting the percent reduction and the total load reduction achieved. Something to note would be a comparison between WY2007 and WY2003 where actual load reductions of 33 mtons (18%) and 44 mtons (35%) were observed, respectively. If WY2007 had achieved a 25% reduction of 46 mtons, the overall magnitude of the load reduction would have been nearly identical to the 35% reduction of WY2003.

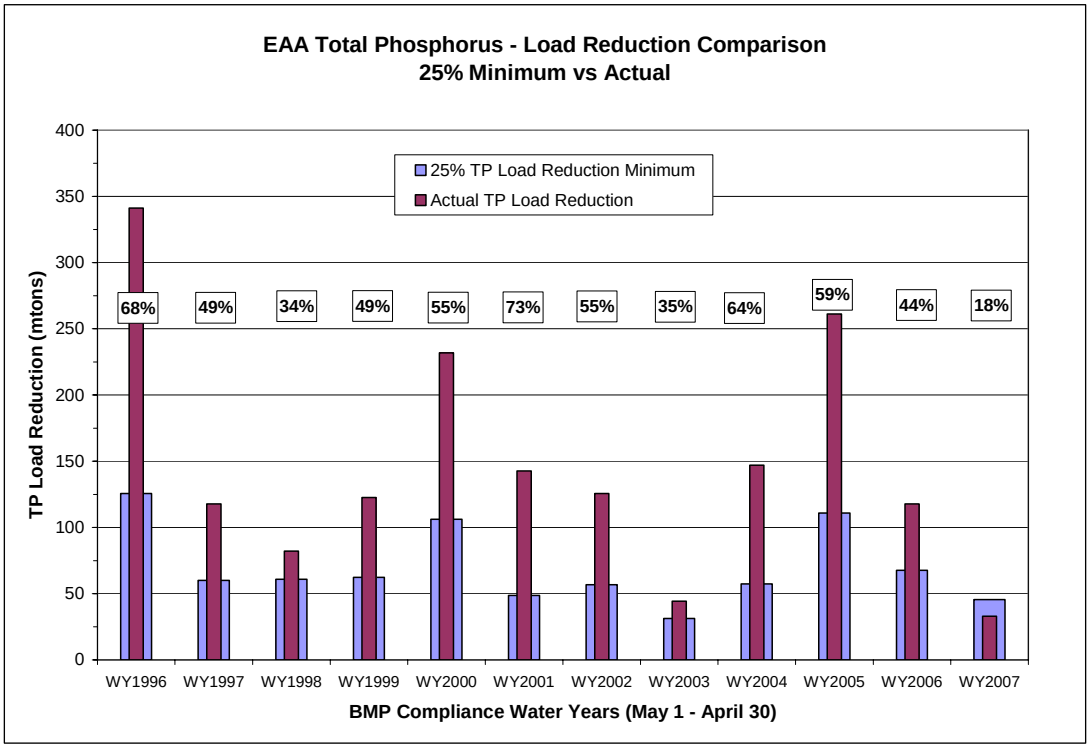


Figure 10.

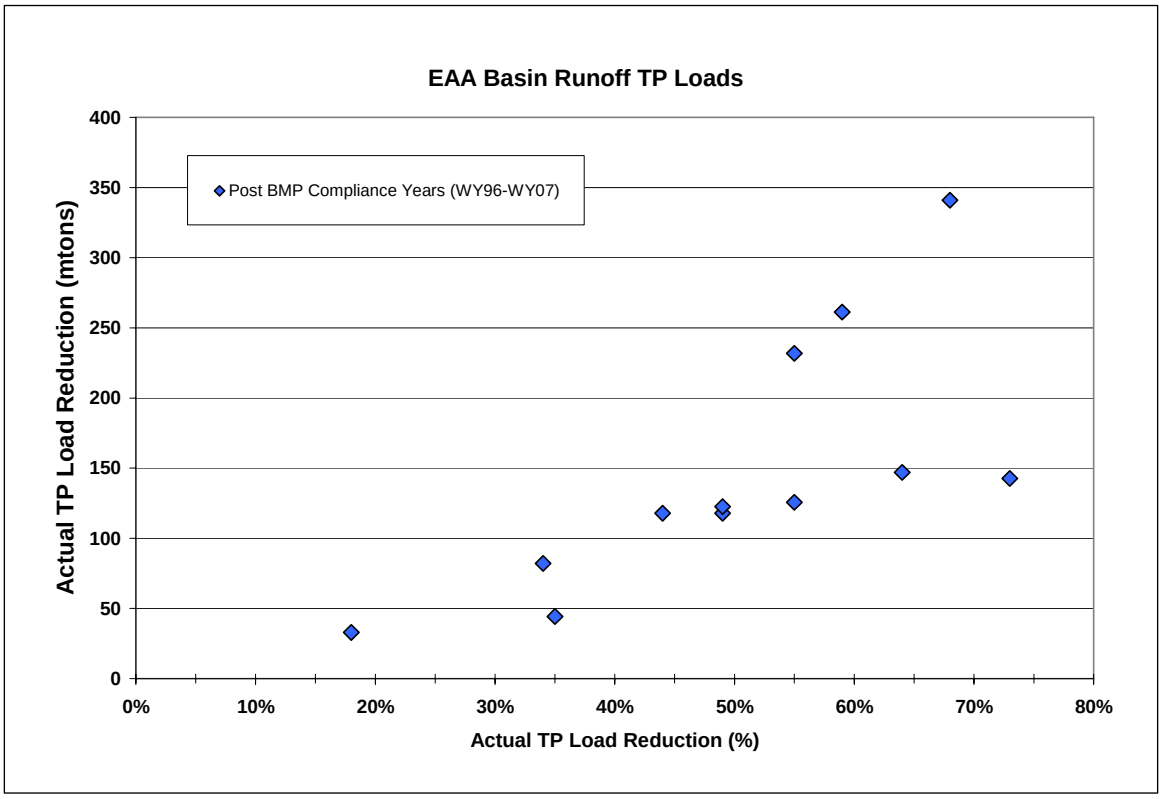


Figure 11.

Comment #4: *line 563-564: What is the status and dates for any information? "An evaluation of this relationship has been initiated to ascertain the relationships between the lake inflows and EAA basin phosphorus levels."*

Response #4: The evaluation is being conducted through a consultant and the final deliverable is expected to be completed by February 2008. Progress is being reported on the District's Long Term Plan web site. However, results will also be reported in the 2009 SFER. This is Item #6 described on line 838–843, which has a link to get to the LTP web site.

Comment #5: line 573–580: While referring to Chapters 3C and 5—could you provide a bit more information here on the Lake, particularly in inflows from North of the Lake?

Response #5: Yes, this could be addressed by including the three lake inflow concentration graphs shown under the response to question # 2, heading "Lake Okeechobee Impacts". Is there anything else of particular interest to show or explain from either a WY2007 or historic perspective?

Comment #6: *Line 741: 481,415 acres under permit—out of how many acres?*

Response #6: All acres that are required to be under permit are permitted in the EAA. The changes in permitted acreage from year to year is the result of land being taken out of agricultural production for construction of stormwater treatment areas or reservoirs for CERP and Acceler8 projects. For example in WY2007, 5,500 acres were removed from EWOD permits to be used in construction of the EAA Reservoir. The District requires that any dewatering discharges from lands converted to regional projects be monitored for total phosphorus loading during construction.

Comment #7: *line 795–96: How many attended?"Seven BMP training workshops were conducted between September 2006 and April 2007 for growers in the EAA."*

Response #7: There were six workshops that were for specific companies, and one that was open to the general public. There were a total of 117 attendees. There are 30 EWOD permits issued in the EAA.

Table 8. Attendees at IFAS Workshops in EAA.

Training Group	Date of Training	Number or Attendees
Open General BMP Training	10/12/2006	43
USSC	09/20/2006	13
	09/28/2006	7
Star Farms – Star Ranch	11/08/2006	8
East Beach WCD East Shore WCD South Florida Conservancy District South Shore WCD Pelican Lake WCD	12/08/2006	9
Hundley Farms	12/18/2006	4
TKM - Bengard	01/10/2007	33

Comment #8: *line 958–970: Seems to be describing an intractable situation---is there a solution? "A preliminary review of rainfall, runoff volumes, and water quality data was conducted to identify causes for this year's results. It was concluded from the evaluation that an influential factor is the temporal distribution of rainfall impact on the ability to retain runoff. The three major canals serving the basin (Deer Fence Canal, S&M, and L1-L2-L-3) have limited capacity to detain and re-circulate runoff. Reported land use intensification since the baseline period is assumed to have increased flood control in upstream areas of higher phosphorus use. Because surface water for irrigation is not available to most landowners in the basin and there is limited allocation from the groundwater sources, a common landowner practice is to maximize storage during the growing season (August to May). Runoff at the time of an intense rainfall during this period is likely compounded with previously stored runoff. As land uses intensify and historical drainage levels are more controlled, if discharges from multiple sources are timed concurrently during these events the limitations of the existing drainage system may be accentuated (e.g., more use of overflow structure G-406)."*

Response #8: District staff is seeking a solution through the mandatory source control program and supplementary projects as described in the Update on Source Control Activities for the C-139 Basin. It is apparent that, although some phosphorus reductions can be achieved through the source control program, a comprehensive approach that handles water management, economy of the water supply, and regional projects may be necessary for achieving compliance with the Everglades Forever Act TP loading requirements. Hence, demonstrates the need for BMP *Program* effectiveness (all of the components that make up how the program as a whole is carried out), and a holistic approach for achieving compliance.

Comment #9: *line 1149–50: Is this happening? "Developing basin-specific BMP plans that better address site conditions such as water management, soils, water conservation, and phosphorus usage seems necessary."*

Response #9: Yes. District staff is revisiting BMP Plan requirement in the C-139 Basin as part of the rule development process. Currently, all of the equivalent point required for the BMP Plan can come from one BMP category (e.g., water management). Staff recommendation at this point is to require BMP Plans to address phosphorus using different BMP categories to provide a "balanced" plan (similar to the EAA approach) or a customized plan with technical justification. The BMP categories are nutrient control practices, water management practices, particulate matter and sediment controls, and pasture management (if applicable). Monitoring data that has been collected in the basin will be used to help choose more specialized BMP plans and to optimize BMPs. Data collected in the C-139 Basin indicates that, in contrast with EAA Basin where particulate phosphorus is a significant contributor, total reactive phosphorus is the main concern in the C-139 Basin, except for isolated events when particulate peaks were observed. In addition, increased trend in the rainfall-runoff ration from the basin suggests that water management strategies need to be refined. Final staff recommendation in how the BMP Plan section of the rule will be revised should be complete in six months.

Web link: C-139 Rule Development Workshop # 2

Comment #10: *line 1152–1162: Notes what is needed—is it being done? If not, why not? "There is a need for research on how BMPs can be more effective and practical to implement. Regretfully, in contrast with the rule for the EAA which requires farm-level monitoring plans that provide useful data to verify BMP implementation, operation, and effectiveness, this requirement does not exist for the C-139 basin. Landowners have elected not to conduct farm-level monitoring, and there is not adequate information on the effect of the individual BMP plans on the farms. In some cases, individual farm monitoring may not be feasible because of joint*

drainage configurations or sheet runoff. There is also need for conducting research and demonstration projects to verify and quantify the water quality benefits of BMPs that are only presumed to be beneficial, but that cannot be validated. Finally, it is necessary to provide for a learning curve and period for realization of benefits when new BMPs or optimized BMPs are implemented."

Response #10: Yes. A demonstration project to optimize phosphorus application rates on vegetable farms is ongoing. Vegetable farming is associated with the highest nutrient application rates. In addition, the District has cost-shared, a tail water recycling project to prevent runoff losses and groundwater irrigation in the last portion of the S&M Canal. Water quality monitoring within the Basin is conducted to compensate for the lack of farm-specific data.

In addition, the District is developing a scope of work to cost-share BMP demonstration projects. There will be funding available for landowners participating in demonstration projects for water quality and quantity monitoring, thus, to measure the effectiveness of the BMPs. The BMPs that are validated as having a quantifiable water quality benefit will be disseminated to the rest of the C-139 Basin. Alternatively, the District will work in partnership with other agencies to develop BMP technical guidance and optimization paths on a case by case basis, as necessary to bring the basin into compliance. As part of the rule development process, District staff anticipates that BMP Plan optimization will be required from permittees if found out of compliance with Rule requirements, unless permittees participate in BMP demonstration projects.

Comment #11: *line 867-68: refers to "Source Control Strategy" section on reasons why limits are being exceeded. Line 955-56 again refers to this section for reasons for ineffectiveness. Line 1004-05 again refers to the section for future evaluations. First it would help to note where that section is (page, line numbers). More importantly, when we actually get to the section (line 1178) there is not much there (only 6 paragraphs). Seems a lot is left to that section with little delivery. Mostly what is noted is a lack of requirements in permits—is that it? Is ti the next section that you are really looking to? I would also like to see more attention paid to the point system for BMPs—I suspect some of the problem is in a system that I have been unclear about for some time.*

Response #11: The "Source Control Strategy" section refers to lines 1123–1349. Lines 1123–1177 provides reasons why the phosphorus loads may be being exceeded, and provides some discussion of how the Source Control Program can be improved to meet the phosphorus load requirements. See response to Comment 1 for an explanation of the BMP point system.

Comment #12: *line 1289-92: Are these efforts in line with the problem that is noted in lines 1152-62? "BMP Regulatory Program: Level IV BMP verifications and outreach efforts will continue to ensure improved BMP implementation and effectiveness. Rule development for the C-139 rule will continue in order to improve the BMP program. The focus will be on optimizing current BMPs, requiring more comprehensive BMP plans, and refining the current compliance methodologies. Six rule development workshops have been scheduled to allow stakeholders to provide ideas and input. The input and ideas provided at these workshops, along with the information gained from five years of implementing the BMP program and the supplementary source control projects will be used so that modifications to the rule will be effective in the long term. The last workshop is scheduled for December 2007, and it is anticipated that the revised rule will become effective in the early part of WY2009."*

Response #12: Yes, these efforts are in line with the problem that is noted in lines 1152-62. Please see the response to comments 9 and 10.

Comment #13: *line 1355: Timetable? "Evaluations are under way to explain whether this is an incidental exceedance or the beginning of a trend."*

Response #13: Because of the timing when water quality and quantity data for the EAA and C-139 basins are available to conduct the annual compliance evaluation, and the timeline for

producing the SFER; it is not possible to conduct en exhaustive analysis on the causes behind the year's performance. The preliminary evaluations presented in the response to question 2 discuss the complexity of the system and the difficulty to identify specific causes. The District will expand on these evaluations during WY08 with the objective of presenting them in the 2009 SFER. The evaluations referred to in Anticipated Activities for Water Year 2008 items #4 (Line 827–833) and #6 (Line 838–843) will also serve to supplement and evaluate means for preventing lower performance years in the future. A Draft Statistical Report was submitted by IFAS to the SFMWD under for Item #4 on August 27, 2007, and it is currently in the review process. The evaluation under Item #6 is planned to be completed in February 2008. Additionally, the scope of items 1, 3, and 5 of the Anticipated Activities for Water Year 2008 (Lines 815–818, 822–826, and 834–837) will be reviewed to include a focus on preventing lower performance years and develop tools to track Basin's performance before the year ends.

RESPONSES TO COMMENTS ON CHAPTER 5

Kathy Pietro with Chapter Co-Authors

Subject: Responses to Panel Comments (Ward), Chapter 5
Document posted as: SFER2008_VolI_Ch5_Response_Ward_Comments_final.doc
Originally Posted: 28 Sep 2007 03:00 PM

Robert C. Ward ('A' Review)

General Comment: *Chapter 5 highlights efforts of the SFWMD to understand and manage natural processes for the enhancement of water quality, specifically, and ecosystem health, in general. Stormwater Treatment Areas (STA), at the scale being operated in South Florida, are not well understood. The research updates provide insight into efforts to better manage the STAs for phosphorous removal while enhancing wildlife habitat and public recreation.*

The stormwater treatment efforts of the SFWMD have come a long way in a short period of time, especially when the scale of the operation is considered.

Comment #1: *Chapter 5 describes a number of efforts to rehabilitate STA cells. What is the longest period of consistent operation of an STA or a cell in a STA? Is the need for rehabilitation caused mainly by natural conditions, poor TP removal rates, or are they part of ongoing research?*

Response #1: STA-1W has the longest period of continuous operation as an STA. The Everglades Nutrient Removal Project consisting of Cells 1-4 began operations in 1994. Cell 5 was completed in 1999 and Cells 1-4 were then incorporated with Cell 5 into STA-1W. Cells 1 and 3 have the longest period of continuous operation (approximately 11? years) until they were taken off-line in October 2006 for Long-Term Plan Enhancements construction.

The need for rehabilitation can be caused by both natural conditions and high nutrient and/ hydraulic loading rates. Natural conditions such as hurricanes and drought have significantly impacted the status of STAs in recent years. Although we do not specifically rehabilitate STAs cells in order to conduct research, we are opportunistic in initiating research or monitoring activities that assist us in understanding the response of the system to our rehabilitation activities, and to help guide future efforts.

Comment #2: *STA-1W was operational in 1994, but 10 years of operational data is missing from Figure 5-13. Why is the 10 years of data not included in the figure?*

Response #2: The Appendix contains period of record time series graphs for inflow and outflow volume, TP load, FWM TP, hydraulic loading rate, and phosphorus loading rate.

Comment #3: *Given the large number of current research projects and new initiatives mentioned in Chapter 5, is there a long-term research strategy for the STAs that indicates what the overall research plan hopes to accomplish? I assume part of the goal is total compliance with permit conditions, but there are so many other aspects to the STAs that I wonder how there total picture is viewed as part of a long-term research plan.*

Response #3: The overall goal of our applied research is to provide operational guidance in support of our long-term goal of sustainable and optimized STAs. The STA Management Division is currently developing a research plan taking into account STA performance and

observations thus far, which will address start-up, recovery, optimization, and sustainability issues.

Comment #4: *Page 5-23 lines 685–686—This water year, flow that moves in the opposite way than intended (termed negative flow) is included in the STA TP load estimates. Why was this change made?*

Response #4: This was done to more accurately calculate TP load estimates. In the past, negative flows were excluded from the calculations with the result that the amount of phosphorus entering the STAs was being overestimated. Future TP load estimates will be calculated in the same manner and previous TP load estimates were also adjusted accordingly. It should be noted that negative flows are minimal, and our operators make every attempt to try to prevent them from happening. It should also be noted that the impact of this change in the method of calculating TP load estimates was relatively minor compared to the overall load calculations.

Comment #5: *Page 5-25 lines 751–754 - For the purpose of this report, DO levels measured at outflow stations from the five STAs (STA-1E, STA-1W, STA-2, STA-3/4 and STA-5) will be assessed using the developed SSAC rather than diel DO evaluation as performed in previous reports.This change in the report was agreed to by the FDEP and the District. Why was this change made? Because the SSAC is being added to the permits?*

Response #5: The new STA permits that were recently issued for STA-2, STA-5 and STA-6 (and the remaining STA permits that are forthcoming) have the Site Specific Alternative Criterion (SSAC) requirement instead of the diel oxygen comparisons. The diel oxygen information collected in previous years was used to develop the SSAC

Comment #6: *A streamlined STA Performance Synopsis could be a highlight of Chapter 5, in my opinion. I would suggest streamlining the Synopsis that begins on page 5-109 and moving it to the front of the chapter. The detailed information in the Synopsis, that is not streamlined, could be moved to an appendix with references to it in the shortened Performance Synopsis. Table 5-31, a summary of all STAs, would be a key figure in a streamlined synopsis. Is it possible to prepare a time series plot of the collective performance of all STAs for a streamlined synopsis? In particular, it would be of interest to observe the collective STA's performance time series relative to the hydrologic and climatic variation routinely experienced in South Florida.*

Response #6: The collective STA performance time series graph will be created. Changing the placement of this evaluation in the report is still under consideration.

Comment #7: *At a number of places in the text of Chapter 5, changes in the way data are analyzed are noted (two are cited above but there are others, e.g. page 5-29 line 828; page 5-56 lines 1501–1502; and page 5-107 lines 2771–2773). Are there plans to standardize data analysis methods in the future so there is consistency in performance results for the STAs from year-to-year? This question is particularly relevant when the performance data is presented over time.*

Response #7: The performance data calculations will be standardized (see comment 4 above). Although these calculations apply only to WY2007, the previous years will also be calculated in the same manner.

Comment #8: *Tables 10, 13, 17 and 20, as examples, present the results of a statistical test. Exactly what hypothesis was tested? What 'n' was used in the computations? Is a statistical difference water quality relevant in this case, if the n changes greatly across inflow and outflow measurements?*

Response #8: Monthly flow and TP was compared over the water year to determine if the inflows were different from the outflows. N = 12.

Comment #9: *Why are the 'other' water quality constituent lists different in Tables 11 and 14? Are not all STAs subject to the same permit conditions regarding 'other' water quality constituents?*

Response #9: The following text will be added to the Water Quality Permit Requirements section: "The permitting reporting requirements for the other WQ parameters is different for each STA".

Subject: **Responses to Panel Comments (Stein)**
Document posted as: **Response_Stein_2008 SFER_draft_ Chapter 5_final.doc**
Originally Posted: 29 Sep 2007 01:45 PM

Otto R. Stein

Comment #1: *In general the authors have done a commendable to integrate and report what is clearly an almost overwhelming volume of information in a concise and readable format.*

Comment #2: *The one exception is the section on the RWMA which displays a lack of proof-reading.*

Responses #1 & #2: This section will be revised so that it reads better in the final version.

Comment #3: *The overall structure is well laid out and the section-internal format adequate.*

Response #3: Thank you. The chapter layout and format was modified as per the Peer Review comments received last year. The changes to the chapter include: the general permit information was consolidated into tables or placed in centralized Summary Section or Appendix, a chapter layout description was added, the bulleted highlights were retained, and general vegetation management and research activities were put in centralized Summary Section.

Comment #4: *That said, as a first-time reviewer I found it very difficult to read through the document; there is too much "boiler-plate" prose and a basic description of results in a very general sense, almost meaningless sense. There is very little synthesis and integration of the results, even in the sections dedicated to "the big picture".*

Response #4: Some of the language in the chapter is written specifically for the permit compliance reporting; we understand it may have been considered to be "boiler-plate" prose. Also, each STA section is laid out in the same way to aid the reader in locating similar information for each STA.

We agree that increased data interpretation is needed but due to limited resources we must prioritize areas of focus. The recent focus has been on STA-1W and the next area of focus will be on STA-5. Funding has been budgeted in FY08 for more detailed analysis of water quality, vegetation, soil, and performance data for all 6 STAs.

It should be noted however that this year, there was an increased amount of data synthesis and integration of results compared to previous years as seen in the sections describing the results of the rehabilitation efforts in STA-1W Cell 5, the inclusion of the research conducted for the Hydropattern Restoration projects in WCA-2A and Rotenberger Wildlife Management Area, the inclusion of the STA hindcast evaluation and increased interpretation of STA cell by cell performance. Additional graphics and tables, such as the period of record time-series plots of annual hydraulic and phosphorus loading rates, the multiple year performance tables containing basic statistics (min, max, standard deviation, Student's t test), and plots showing combined monthly inflow and outflow loads with flows for 3 years of data rather than just the last water year were also part of this year's chapter.

Comment #5: *As a firm believer in the adage "a picture is worth a thousand words" I think it would be well worth the effort try to enhance the quality of figures especially the captions to fully explain what is contained within. It should then be possible to reduce the text somewhat as it would not need to contain a description of what is contained in the figures and tables. I have made many suggestions for improvement, cited by page and line number, but many of the comments could be applied to figures, tables and sections other than where first mentioned. For the most important changes I have tried to repeat the comment again where appropriate.*

Response #5: Text will be added to the figure captions to make them more descriptive. Additionally, the graphs will be annotated to show when the hurricanes, drought, or other major events occurred at the STAs.

Comment #6: *5-3,63. variable loading of both flow and P? Was the variation greater than in previous years? Is this important to this year's performance compared to previous years?*

Response #6: The ambiguity was intentional because these sentences were intended to be summary statements. In this sentence, flow was intended, although TP load is directly related to the amount of flow. The sentences following this general statement indicate that flows were high in late August and early September partially in response to Tropical Storm Ernesto then low due to the regional drought. This pattern of inflow volume is rather atypical and although southern Florida does experience wet and dry season variability, drought conditions are not usually experienced annually. The drought conditions decreased the amount of water flowing through and out of the STAs which did impact performance. The variability of inflows was not statistically measured.

Comment #7: *5-6 Table 5-2 In looking at Table 2, it is quite obvious that the loading trends within the various STA's are different when compared to the long term average. For example HLR was up in STA-1E and STA1-W even though this was a drought year (though the others are down) and this would seem counter-intuitive. I can find no explanation for this in the detailed sections of these STA's. However, more interesting is the inconsistent patterns between the HLR and PLR amongst the STAs. One would expect both to go up or down in a similar ratio, but STA2 and STA6 show HLR down and PLR up. Clearly the influent P concentration this year was greater than the long term mean (data not given) at these two STAs. Three questions are therefore: why?, is this a long term trend?, and is this important to the performance in this and future years?*

Response #7: The hydraulic and phosphorus loading rates do vary among the STAs because each one receives discharges from different tributary basins. The following clarifying text will be added to the final chapter: "The hydraulic and phosphorus loading rates are calculated by dividing the inflow by the effective treatment area. These rates are affected when areas of the STAs are temporarily taken off-line for construction or rehabilitation". In the STA-1E and STA-1W sections, the following text will be added: for STA-1E: "Although drought conditions existed in the last part of the water year, STA-1E experienced high inflow volumes in July, August, September, resulting in an increase in the annual HLR. For STA-1W: "Although drought conditions existed in the last part of the water year, STA-1W experienced high inflow volumes in August, September and October, resulting in an increase in the annual HLR."

Over time, other major factors can impact the annual HLR and PLR values for each of the STAs. Examples include expansion of the existing treatment areas, addition of upstream reservoirs, or decreases in tributary basin discharges. Because annual variability in loading is impacted by a variety of factors, it is difficult to predict if the loadings this year show a long-term trend.

Yes, it is known that hydraulic and phosphorus loadings are critical factors in treatment performance.

Comment #8: *The HRT is reported as zero, which obviously is not true and probably different for each flow-way. These data should be included.*

Response #8: The following mean hydraulic residence times (HRT) values will be included in the final chapter: STA-1E: 23 days, STA-1W: 14 days, STA-2: 13 days, STA-3/4: 21 days, STA-5: 12 days, STA-6: 5 days.

Comment #9a: *5-7 Table 5-3 The significance of this table is completely lost to me and not explained anywhere I can find in the document. I can guess that diversion water was water that was intended to go into the STAs but for some reason was not, but inflows from Lake Okeechobee were somehow put into the STAs directly? How do these relate to the information presented in Table 5-5 (pg 5-15) These look like the data but the numerical values are different.*

Comment #9b: *5-8,181 15,000 ac-ft matches the data in Table 5-5 but not Table 5-3.*

Response #9: Clarifying text will be added to explain what a "diversion" is and, in Table 5-3 text will be added to indicate that the table shows only the amount of inflows from Lake Okeechobee received by the STAs as regulatory inflows (a permitting term) and that the amount of supplemental water that was received in response to the drought conditions. You are correct that the values do not match because Table 5-3 shows the amount of regulatory releases (as required by the permit) and Table 5-5 shows only the amount of supplemental water that was received by the STAs.

Comment #10: *5-11m table 5-4 Floc soil biogeochemistry,last column and also of what?*

Response #10: The words "and also" should not have appeared in that section of the table and will be deleted in the final version.

Comment #11: *Scirpus should be Schoenoplectus*

Response #11: "Scirpus" will be changed to the new genus name "Schoenoplectus".

Comment #12: *5-12,316–322.Why are only two factors considered in this mesocosm study? Seems that the jury is still out on which plant communities are best, SAV and PSTA's seem to have the recent favor but why not initiate a much more comprehensive study before huge and costly changes are made to the full-scale STA's such as the conversions to SAV, as is currently occurring?*

Response #12: This section contains an update of the research conducted in WY2007. Prior research was also conducted by the EAA-EPD as well as the District; this research was focused on evaluating the effectiveness of SAV and PSTA. Currently, a PSTA (periphyton- based STA) Implementation Project is being conducted in STA-3/4 which will evaluate the sustainability of PSTA on a large scale (100 acres).

Comment #13: *5-13,332 Grammatical error.*

Response #13: The grammar will be corrected.

Comment #14: *5-13, 343. It would nice to include adjectives such desired or undesired when mentioning species changes (especially in the summary pages) to help the less initiated reader better understand the meaning.*

Response #15: Clarification will be added to indicate that the survey was conducted to evaluate the amount of SAV re-establishment and that Chara is considered to be a desired type of SAV.

Comment #15: *5-13 348 vegetation sampling campaigns?*

Response #15: The word "sampling" will be changed to "surveys".

Comment #16: *5-14,369–371. If mass removal is higher but concentration is unchanged when adding Ca, then something else must changing too. Is the Ca enriched water also P enriched? If so then we don't know if it is higher Ca or higher P causing the increased removal rate.*

Response #16: We are still developing a response to this comment; it will be addressed in the final chapter

Comment #17: *5-16 456–470. The results indicate raising water level after killing undesirable emergent plants might be a way to enhance periphyton growth, at least in the short run. Has this been explored at other locations?*

Response #17: SAV-dominated treatment cells typically also contain periphyton (attached to the SAV, so yes, when converting emergent cells to SAV/periphyton dominated cells, raising the water depth has ben the operational method used to encourage the SAV/periphyton growth and discourage the emergent plant regrowth.

Comment #18*: 5-17 493–495. In this case periphyton is not desired?? If standing biomass is an issue why not burn, mow or cultivate the site before introducing water?*

Response #18: Again, SAV-dominated treatment cells typically contain periphyton (attached to the SAV), so SAV (and the associated periphyton) is desired. In this cell, the SAV establishment appears to be hindered by the amount of dead biomass. This research study is exploring whether operational activities to eradicate the biomass are necessary because there are high costs and operational constraints placed on the system in order to burn or mow. To mow, the treatment cells would have to be dewatered which is costly or may not be possible due to seepage issues from adjacent water bodies. We are considering burning as an operational tool to remove undesired vegetation but there are also constraints with this method. To burn a cell, the cell would have to be dewatered and there would have to be a water source available to control the fire and rehydrate the cells after burning to prevent regrowth of the undesirable vegetation. In some cells, burning may not be an option due to proximity to urban areas or powerlines, or if the biomass is too wet to burn. Another tool that has been used to eliminate the terrestrial vegetation, or to achieve large-scale conversions to SAV in treatment cells that have dried out, is to plow the unwanted biomass into the soil before flooding. In some STAs (STA-3/4, STA-1W), large-scale aerial inoculation has been done to assist the SAV in establishing.

Comment #19: *5-27 782 preceded not proceeded*

Response #19: The word will be changed.

Comment #20: *5-27 Fig 5-8 (and all similar figures in each STA section) It is often quite difficult to find in the figure the various important canals, inflow and outflow structures, pumps etc. mentioned in the text (and in some cases at other STA figures I could not find them at all), as there are many gates, canals and structures labeled, but not mentioned. Please be sure all mentioned structures are identified on the figure (in this case they are). Is there a way to highlight the main inflow and outflow structures in the figure? (Note: due to travel, this year I am forced to read the report as a hard copy without color. Perhaps if the PDF were available I could see things better!)*

Response #20: The major structures will be highlighted in the maps presented in the final chapter to assist the reader in locating them. Please elaborate on the features that were missing from the figures so that they can be added.

Comment #21: *5-29 Table 5-9 (and all similar tables in each STA section) I suggest a second bar across the table immediately below the year bar to indicate water year which is shifted by almost 6 months. Since WY is used for almost all reporting it is arguable that it is more important than calendar year and would help interpret the overall details shown in these tables.*

Response #21: Agree. The water year will be shown on these tables.

Comment #22: *5-29,825 Table 5-9 should be Table 5-10.*

Response #22: This change will be made in the final chapter.

Comment #23: *5-30 Figure 5-9 (and all similar figures in each STA section) It would be helpful if the scales of the y-axis and secondary y-axis were offset so that TP load and flow data were offset sufficiently to not plot on top of each other. It is good they are plotted together to make a visual comparison but is somewhat hard to read with so much data plotted so close to each other. Also, it would be illustrative if the specific water years could be shaded in the background to highlight differences in water years.*

Response #23: Agree that adding shading to the plots would be helpful and the shading will be added to the plots. Unsure if the suggested off-setting can be done due to the software constraints and also because the data may be misrepresented by doing so.

Comment #24: *5-30 Figure 5-10 (and all similar figures in each STA section) I cannot follow how the 12 month moving average is being calculated. The line is consistently higher that the individual monthly measurements for a period greater than 12 months. This cannot be as it is an average of 12 months. A moving average is usually calculated from as the previous and following 6 months, but is sometimes the preceding 12 months are used so that calculations up to the current month can be made. In either case, the calculated values would be different than reported. Also, as with figure 5-10, it would be illustrative if the specific water years could be shaded in the background to highlight differences in water years.*

Response #24: Agree that adding shading to the plots would be helpful and the shading will be added to the plots. The 12-month moving FWM average was calculated using the preceding 12 months up to the current month (which, in this case is the last month in the water year).

Comment #25: *5-31 Table 5-10 (and all similar tables in each STA section) The column headings for Load (mt) should be P Load (mt) for clarity. What is monthly standard deviation for flow and load? I assume it is based on an "average" monthly value determined by dividing the annual value by 12 and compared to the 12 measured values, but this is not clear. The details should be added as a footnote. Why is the geometric mean used for reporting P concentration values? Are there very large variation in the values? I assume it is calculated as the antilog of the log of the individual values, and can't figure why that is better than the arithmetic mean.*

Response #25: The column heading will be modified to show TP Load (mt). Also, the standard deviation shown is the annual standard deviation, not monthly and the tables will be adjusted to indicate this. The geometric mean is shown for permit compliance purposes and was calculated in Excel using the geomean function for the 12 months of FWM TP estimates.

Comment #26: *5-32 Table 5-11 (and all similar tables in each STA section),What is the difference between number of samples and number of samples with flow? Since flow is measured continuously, wouldn't (shouldn't?) all samples be "with flow" if that means used in the flow-weighted mean calculations?*

Response #26: The water quality parameters are collected using grab samples, not flow-proportional samples. The summary table for the water quality parameters other than TP shows both the arithmetic means of the all the samples collected during the water year as well as estimates of the FWM concentrations calculated when there was flow on the sample collection dates.

Comment #27*: 5-33 Figure 5-11 (and all similar figures in each STA section) I really don't see the need for the lower panel as it is simply the difference between the bar heights shown above.*

However, it would be advantageous to add the numerical values to just above the bars and the numerical value of the difference in a text box within the figure.

Response #27: Correct, the second graph is the difference between the bar heights, but the graph serves to indicate if the station was above or below the SSAC limit.

Comment #28: *5-35,977 clean out of the G-253.*

Response #28: This grammatical change will be made in the final chapter.

Comment #29: *5-42, 1143–1147. I can't think of an obvious relationship been flow rate and DO levels for velocities as low as they obviously are in these flow-ways. At any rate, all offered reasons for the differences in DO levels between gates in purely speculative. The real reason must be related to differences processes in different regions within this STA that contribute more flow to one or the other outflow structure. No information is given (at least in this chapter) as to the contributing areas to each structure. Is this data available from tracer studies?*

Response #29: The G-310 and G-251 structures at STA-1W where the DO was measured are large outflow pump stations where velocities can be very high during pumping events. The following statement will be added to the final chapter: "The District and the Department of Environmental Protection will continue to evaluate the reasons for DO depression at the G-251 pump station." Also, a brief description of the areas contributing to the flow at each of the structures will also be added.

Comment #30: *5-46, 1222 old ditches were… regrading rather than degrading.*

Response #30: The suggested revision will be made to the final chapter.

Comment #31: *5-48 Figure 5-16, I believe the lowest legend should Cell 5B not STA1W.*

Response #31: Cell 5B is a cell within the overall STA-1W facility, therefore the legend is appropriate and will not be changed.,

Comment #32: *5-48 Figure 5-17 is missing.*

Response #32: Figure 5-17 was inadvertently deleted during the editing process. The figure below will be included in the final document.

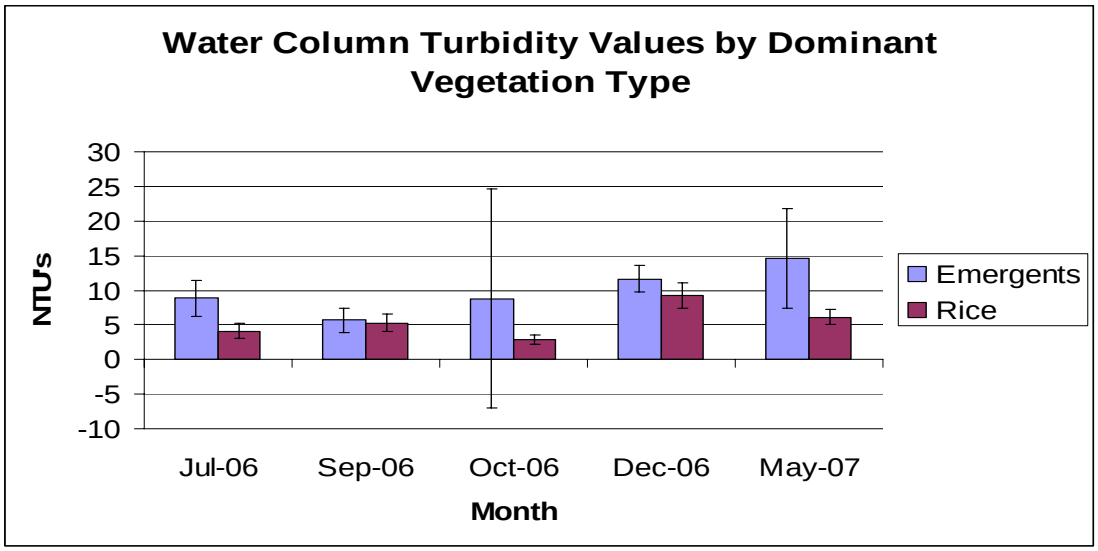


Figure 5-17. Water column turbidity in Cell 5B by dominant vegetation type expressed in NTUs.

Comment #33: *5-48, 1304–1311 High turbidity is often mentioned as a reason for poor SAV colonization and survival throughout this chapter. How does the data from cell 5 compare to the other areas within the entire STA complex as far as the link between low turbidity and good SAV survival or visa versa?*

Response #33: Increases in turbidity were observed in the SAV areas that experienced damage during the hurricanes (STA-1W Cell 5, STA-2 Cell 3) or in areas that were dried down for construction but no SAV recolonization was observed following rehydration (STA-1W Cell 4) even with water depths maintained at low stages. It is speculated that the turbidity interfered with the light penetration and that the soils were too unconsolidated to allow for rooting.

Comment #34: *5-48, 1308–1309 Hard to say if planting rice helped, after about Nov 2006 influent TP is also very low.*

Response #34: The decrease in water column turbidity, the recolonization of SAV, and the decrease in outflow TP grab sample concentrations are indications that the rice played a beneficial role in the reestablishment of the plant communities. Although the inflow concentrations measured from grab samples were about the same from November 2005–September 2006, improvements in the outflow concentrations were not observed until May 2006 following the rice planting and associated SAV grow-in. It is true that the influent TP was low after November 2006, where inflow volumes were also greatly decreased due to the drought conditions.

Comment #35: *5-49 Figure 5-18 An arrow to indicate the beginning/end of restoration efforts would be beneficial.*

Response #35: Agree. An arrow will be added to the figure.

Comment #36: *5-49, 1336–1350, These paragraphs seem contradictory. On the one hand, SAV was sparse in areas planted with rice, but on the other hand, rehabilitation efforts (apparently mainly planting rice at least as a final step) enhanced SAV growth. Perhaps the problem is one of which time period is considered and the first paragraph needs some editing. It does seem to be in conflict with the data in Figure 5-21, at least after July 2006.*

Response #36: Agree. Clarifying text will be added.

Comment #37: *5-53, 1409 not as much of.*

Response #37: The word "much" will be added to the sentence.

Comment #38: *5-54, 1430 2015-acre expansion (cell 4) of the STA*

Response #38: The suggested words" Cell 4" will be added to the sentence.

Comment #39: *5-54, Figure 5-23 I suggest labeling the L-6 Borrow Canal and adding and arrow and to the S-7 Pump station as appropriate*

Response #39: The recommended labels will be added to the STA-2 schematic.

Comment #40: *5-55, 1460 delete: were complete*

Response #40: The recommended deletion will be made.

Comment #41: *5-56, 1500 irrigation of cell 3?*

Response #41: Clarifying text will be added to indicate that the irrigation water was used in the adjacent upstream farm, not in the STA.

Comment #42: *5-56, 1501 I have no clue what is trying to be conveyed by this inflow calculation. This needs a little better explanation and perhaps some checking for typos.*

Response #42: The equation lists the stations as they appear in the database and an accompanying explanation will be provided.

Comment #43: *5-61, 1623-–1624 How are vegetation strips established by aerial spraying (and of what)?*

Response #43: Vegetation strips can be established by selectively spraying emergents that have naturally recruited in a cell targeted to be SAV dominant. Cell 4 is an SAV dominated cell, so herbicide was applied to eradicate the emergent vegetation, except in those areas where the vegetation strips were intended to be located. Text will be added to clarify how the vegetation strips were established. Information about the types of herbicides used is found in the appendix.

Comment #44: *5-62 Figure 5-27. The delineation of SAV and emergent cells does not match the text on the following pages. All 3 "B" cells are now planted with SAV?*

Response #44: Yes, all of the "B" cells are targeted to be SAV dominated cells, although establishment in Cell 1B is proceeding more slowly than in the other two "B" cells. The schematic will be adjusted to indicate that Cell 1B is an SAV cell.

Comment #45: *5-63, 1667–1668. Double check these dates.*

Response #45: The dates are correct: the Western Flow-way was off-line from January–May 2006, while the Eastern and Central Flow-ways were operational during the entire period.

Comment #46: *5-67, 1763 change Figure 5-60 to Figure 5-31*

Response #46: The figure number was inadvertently changed during the editing process. The correct figure number 5-30 (not 5-31) will be added to the final text.

Comment #47: *5-68, 1808 Aerial applications of what?*

Response #47: The 2007 SFER contains information about the herbicide aerially applied during this particular event.

Comment #48: *5-68, 1810 What is planted in the vegetation strips?*

Response #48: These vegetation strips were not planted, but instead consist of vegetation (cattail) that naturally recruited in the area. Notation that the vegetation strips consist of cattail will be added to the final text.

Comment #49*: 5-69 1838–1840 Operations were not suspended for the entire STA-3-4, just the PSTA Implementation Study, correct?*

Response #49: No, water shortages at the end of WY2007 forced the District to suspend operation of all of STA-3/4, including the PSTA project. This sentence has been reworded to make this clear.

Comment #50: *5-69, 1856–1865 This entire paragraph seems out of place, pre and post-ceding paragraphs relate to vegetation, this to water quality.*

Response #50: The two paragraphs at lines 1850–1855 and 1856–1865 (the paragraph in question) describe vegetation and water quality sampling methods. The following paragraphs at lines 1866–1875 and 1876–1887 describe vegetation and water quality results. The vegetation methods paragraph is placed correctly.

Comment #51: *569, 1866–1875 Please identify desired and undesired species.*

Response #51: SAV species in the SAV cells of the STA-3/4 PSTA Implementation Project are not classified as "desirable" or "undesirable". We have no plans at this time to manage for a particular suite of SAV species in these cells. Emergents are not desired in the SAV cells, with the exception of vegetation strips which are being maintained in these cells.

Comment #53: *5-71 Figure 5-32 This figure needs to be put into context of Figure 5-27 and/or Figure 5-31.*

Response #52: The plot and legend for Fig. 5-32 have been modified accordingly.

Comment #53: *5-75, 1983–1986 When did these operations occur?*

Response #53: The use of the G-507 pump started in April 2006 and G-345 culvert was closed in early 2007.

Comment #54*: 5-76, 2009. Again, there is confusion as to what is meant by Lake Okeechobee water.*

Response #54: Clarifying text to indicate"Lake Okeechobee regulatory releases" will be added to the text. The phrase "Lake Okeechobee regulatory releases" refers to water released from the Lake when the Lake's operating schedule requires the lowering of Lake stages. These "regulatory releases" can be sent to tide or south to the Everglades; those sent south to the Everglades are treated in STA-3/4 when treatment capacity exists in the STA.

Comment #55: *5-76, 2016. Why is this STA still considered in the stabilization phase?*

Response #55: One of the permit conditions for STA-5 states that it will remain in the stabilization phase of operation until STA-6 Section 2 begins full flow-through operations. This was added to the permit in recognition that STA-6 Section 2 would treat a portion of the water from the C-139 Basin (the tributary basin for STA-5) and that until STA-6 Section 2 was done, STA-5 would be receiving inflows in excess of the intended long-term design capacity. Details about the permit status of the STAs are found in the Permit Status Section of the chapter.

Comment #56: *5-76, 2018, What is the C-139 basin?*

Response #56: Text will be added to say that C-139 is the contributing basin to STA-5 and a reference to Figure 5-1 will be included.

Comment #57: *5-80 Figure 5-36, It would be nice to identify the flow-ways associated with each gate.*

Response #57: Reference to Figure 5-33 will be included in the legend.

Comment #58: *5-81, 2133, What is compartment C Build-out and it relation to other STA's?*

Response #58: Reference to Figure 5-1 will be included in the text.

Comment #59: *5-82 to 5-87, This section seems to be far less complete than the previous STA sections.*

Response #59: We are not clear about the meaning of this statement because the same elements (i.e. STA schematic map, highlights section, operations table, hydrology and TP loading text, graphics and table, water quality table, DO section, vegetation management, and expansion and enhancements sections) are presented for this STA as found in the other STA sections.

Comment #60: 5-82, 2150–2151 Section 2 became/will become flow capable in 2006 or 2007?

Response #60: STA-6 Section 2 became flow-capable in December 2006 and the tense of the rest of the text will be changed from future to present tense. Flow-capable means that the facility was constructed to the point that all structures, levees, etc., were complete and the facility could accept water to begin the start-up phase. Unfortunately, due to the drought, there were no inflows to this STA until 2007.

Comment #61: *5-82, 2154 How does water get to the G396 gates?*

Response #61: Water gets to the G-396 structures from the L-3 canal and G-600 pump station by means of an inflow canal.

Comment #62: *5-82, 2155 Delete is after section 1*

Response #62: The word "is" will be deleted.

Comment #63: *5-82, 2156–2165, Many on these structures are not identified on Figure 5-37.*

Response #63: The schematic will be annotated to show the L4 canal and the G-88 and G-407 structures.

Comment #64: *5-83, 2183, Change Figure 5-26 to Table 5-26.*

Response #64: This change will be made in the final chapter.

Comment #65: *5-83, 2202 delete one of the simulated words*

Response #65: This change will be made in the final chapter.

Comment #66: *5-87, 2271. Where is the dissolved oxygen data?*

Response #66: The reference to Table 5-28 will be added to the text along with the sentence that appears in the Dissolved Oxygen section located at the beginning of the chapter "Since the STA-6 existing permit did not have diel requirements, no SSAC comparison was performed for this STA for WY2007."

Comment #76: *5-88-101 This entire section on the Rotenberger Wildlife Management Area (RWMA) is poorly written. It is hard to follow (has no "flow") and contains numerous typographical mistakes. In fact, it looks like it was cut and pasted from another document and poorly proofed. I will highlight only a few major concerns below.*

Response #67: The RWMA section will be improved in the final chapter, including improving the figures and flow of information. Assessment of fire burn intensity was limited to the few transect sampling locations; area-wide survey was not performed to be able to reliably map the burn intensity.

Comment #68: *5-94, 2480–2481 Is this a separate section or a subsection of the previous one on the RWMA?*

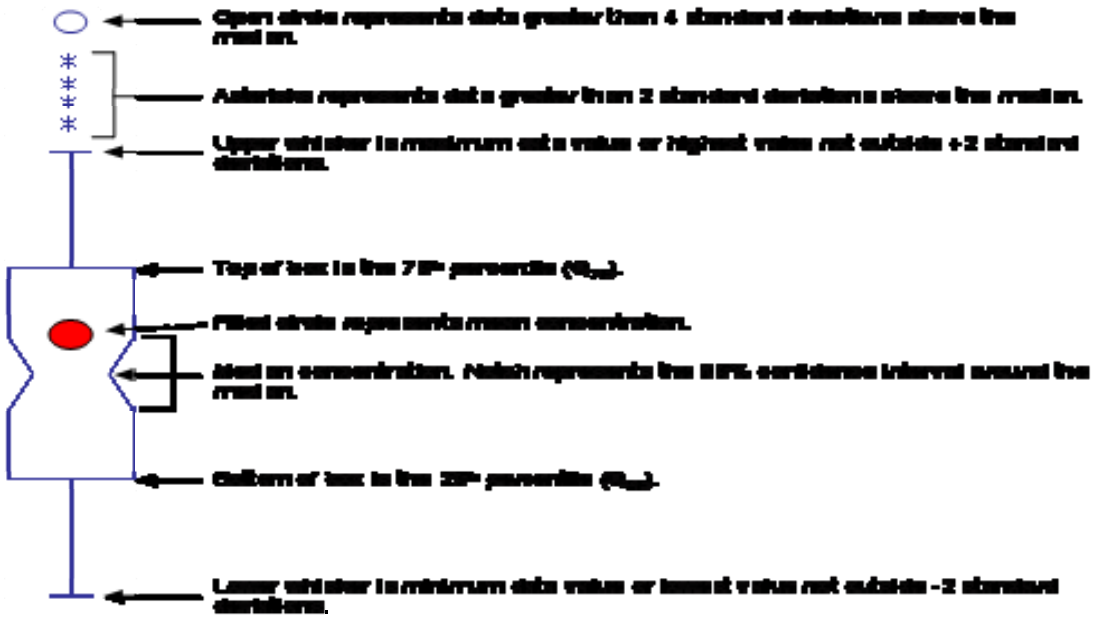
Response #68: This is a separate section and is not part of RWMA; the section heading will be formatted appropriately with the revised title: Hydropattern Restoration within the Northwestern Conservation Area 2A.

Comment #69: *5-88, 2319–2320. Wow, only 4650 ac-ft discharged but 16195 ac-ft put in?? Something doesn't seem right.*

Response #69: The values are accurate as reported. The explanation for the difference between inflow and outflow volumes is attributed to high receiving capacity within the RWMA because of low water stages and water loss from a combination of high ET rates and seepage. During the drought period, the area had constantly increasing dense vegetation coverage, mostly Eupatorium capillifolium (dog fennel) and temperatures regularly exceeding 100°F within these vegetation stands.

Comment #70: *5-97-98 What do the box, whiskers and points represent on these figures. They are never described.*

Response #70: The box, whiskers and points represent:



Comment #71: *5-102, 2668, TKN is mentioned as a calculation component of TN but is not included as a measured parameter a few lines above. Was it measured, and if not how was TN calculated?*

Response #71: TKN will be added to the sentence listing the water quality parameters that were monitored.

Comment #72: *5-105, 2671 available for*

Response #72: The suggest change will be made to the text in the final chapter.

Comment #73: *5-102, 2681, How often, and in what locations, was groundwater outflow available? (Partially addressed a few paragraphs later)*

Response #73: Groundwater outflow is not directly measured in the STAs. This component of water budgets was estimated as seepage through the perimeter levees and is based on head differences between the STA and outside water levels, levee length and a first-order seepage coefficient (cfs/mi/ft) optimized for each STA. Groundwater outflow was estimated on a daily basis and aggregated over longer periods.

Comment #74: *5-104, 2743 One of the key issues is whether or not the gradual conversions of the second cells in a specific flow-way is improving the overall quality of the STA effluent. Considering this, it seems this should be a focus of the ensuing figures 5-53, 5-54 and 5-55 discussed below.*

Response #74: These issues (comparison of treatment efficiency of emergent vs. SAV cells and improvement of flow-way treatment performance after conversion of cells to SAV) will be addressed in the STA Management Division's Strategic Plan to be developed in FY2008. We will defer making these comparisons until the Plan has been finalized.

Comment #75: *5-106 Figure 5-53 In looking at this figure, I wonder if it might not be more instructive to look at separating the symbols by cell type i.e. emergent vs SAV, PSTA etc. first, then by STA. As presented what jumps out is some STAs are more heavily loaded than others, not which treatment type is working best.*

Response #75: See response to the comment above relative to addressing treatment efficiency among different vegetation communities. The intent of this figure was to (1) illustrate that inflow loads have varied widely among the treatment cells and (2) treatment performance as measured by outflow loads and flow-weighed concentrations is correlated with inflow loads. The close relationship between inflow load and treatment performance is often misunderstood.

Comment #76: *5-107,108 Figure 5-54 and 5-55 Again it would instructive to separate individual cell time trends (at least by symbol type) when operation changed from emergent to SAV. Also it not clear why time-series data from only some of the STAs and cells would be presented.*

Response #76: See responses to the two comments above relative to addressing treatment efficiency among different vegetation communities. Time-series for STA-1E and STA-3/4 were not presented because there were only one and two years of data, respectively, for the treatment cells in theses STAs. This has been noted in the chapter.

Comment #77: *5-109, 2791–2792 phosphorous outflow loads??*

Response #77: Yes, clarification that outflow loads were compared to inflow loads will be included in the final text.

Comment #78: *5-109, 2796–2802 Is there any reason for the seemingly random pattern of co-dependence between influent hydraulic and P loadings? If a rational meteorological or management issue could be found it might help to better manage the STAs in the future.*

Response #78: The amount of hydraulic and phosphorus loading to the STAs is variable and dependent upon conditions within the contributing basins, which are influenced by rainfall, land use, etc. The largest contributor to the STAs is the Everglades Agricultural Area (EAA), and the main source of irrigation water for the EAA is Lake Okeechobee. For this reason, an evaluation of the impact of the concentrations of the phosphorus from Lake Okeechobee on the Everglades Agricultural Area and the consequences to the receiving downstream areas is currently underway.

Comment #79: *5-109, 2803–2811 Talking about the change in performance from this WY to last is very misleading, and could easily be due to the drought and/or other random variables. Except for the young STAs which are just coming on line, the overall decreasing performance with time of STA1-W and STA 5 shown in Figure 5-58 is unmistakable. The real question is why STA 2 and STA 6 have not shown this decreasing performance. Identifying this is the key to improving performance of these two longer-record, worse-performing STAs.*

Response #79: Agree that identification of the reasons for the good performance as well as reasons for poor performance is important to improving the performance of the STAs. Evaluation and integration of the various data collected at STA-5 is currently underway in order to improve the performance of that STA. Funding has been budgeted in FY2008 for a more detailed analysis of water quality, vegetation, soil, and performance data for all 6 STAs.

Comment #80: *5-110, 2812–2819 There seems to be confusion between the usage of mass removal of Eq 5.1 (presented on pg 5-102) and "settling rate" Eq. 2. These are the same equations except that Eq.1 assumes C*= 0.0 and is calculated on a monthly basis. Therefore the calculated k value should be virtually identical (assuming both are using TP as stated). The good news is that this appears to be true, but as these data are presented, indicates that the application of these models is not properly understood.*

Response #80: We are not clear as to why the reviewer states that "the application of these models is not properly understood" and the authors request further clarification. The term settling rate will be changed to "TP Removal Coefficient" and the equations are the same, except for the differences with the C* values. In both sections, the k values are calculated on an annual basis. The difference is that in the Data Performance Synopsis section, the performance of the entire STA is presented instead of by treatment cell as found in the Analysis and Interpretation section.

Comment #81: *5-111 Figure 5-58 What is the difference between the data in this figure and Figure 5-54 other than the 5-54 separates the data by cell? Is there some difference between "retained" and "removed"? Compressing the y-axis on the earlier graph masks the unmistakable downward trend in performance.*

Response #81: There is no difference between "retained" and "removed" and the figures will be modified to show the same labeling. Figure 5-54 shows the TP mass retained by each individual cell within the STA while Figure 5-58 shows the TP mass retained by the entire STA. The axis on Figure 5-54 will be uncompressed to match the axis shown in Figure 5-58.

Comment #82: *5-112 to 5-113, Figures 5-60 to 5-62 What do the various symbols represent; water years or cells or both? Hard to see any trend in any of this data other than the obvious between inflow and outflow TP. The slope of a regression line of these data would represent an overall average removal rate over the data set, which could be a good simple summary of the effectiveness of these systems.*

Response #82: The symbols represent water year annual values and the legend will be annotated to indicate this. The graphs show the variability in the TP removal rates and inflow/outflow concentration both within and among the STAs, making the trend difficult to see. The slope of a regression line for each STA could be added to the summary to indicate the overall trend and will be added to next year's chapter.

Comment #83: *5-114 to 5-115 This is perhaps the most encouraging part of the report: The system is performing at least as well as designed! However, the devil (if there is one) is in the details. This model does not have a residual concentration C* so "hindcasting" depends on the accuracy of the calculations, especially the difficult-to-quantify k value. Considering some potential confusion as to the calibration of that parameter discussed above, it would behoove the agency to double check these calculations. Also, it is clear that, in general, STA 5 is not meeting the design target discharge and efforts should be made find out why. Note there is no Figure 5-64 and a labeling of symbols as for Figures 5-60 to 5-62 is recommended.*

Response #83: The original STA design model used a "k" of 10.2 m/yr. This value was used in the hindcast analysis and will be mentioned in the text. The symbols were changed in Fig. 5-63 to match those in used Figs. 5-60 to 5-62. Figure 5-64 was inadvertently omitted during the editing process. Additional analysis has been added to this section relative to the underperformance of STA-5:

"The reason for this discrepancy is not entirely clear at this time, although it does not appear to be directly related to excessive loading nor differences in sediment characteristics. STA-5 was not loaded more heavily than the other STAs based on a comparison of observed annual versus design water and TP loading rates (Figure 5-64) and examination of the period-of-record loading rates among the STAs (Table 2 in Appendix 5-19); all the STAs were overloaded in some if not all years and STA-5 was loaded at levels that were either equal to or less then design assumptions in two of the years when it failed to meet model predictions (Figure 5-64). Also, sediment characteristics (e.g. bulk density and TP, total carbon and iron content) in STA-5 were comparable to the range of values in the other STAs (see Figure 4B-12 in the 2002 Everglades Consolidated Report and Figure 4-51 in the 2006 South Florida Environmental Report). At this time, we suspect that the underperformance of STA-5 may be related to hydraulic inefficiencies. Plans are being developed to address some of the obvious hydraulic problems in STA-5. Finally, STA-5's underperformance will be the subject of future research."

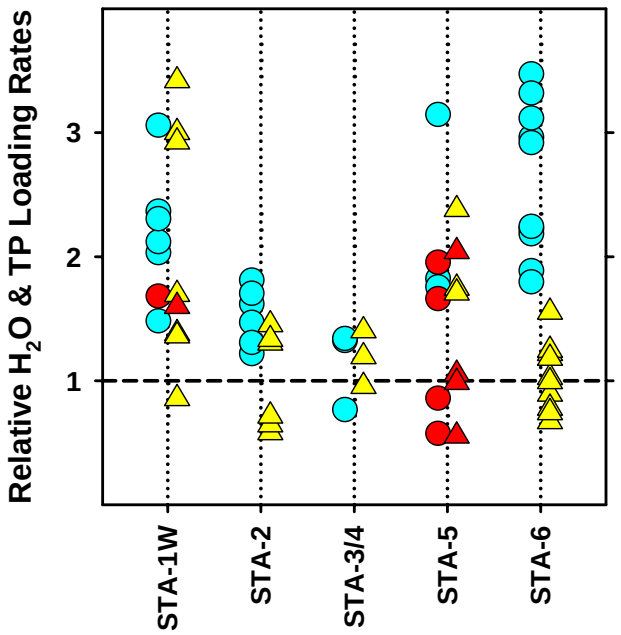


Figure 5-64. Relative annual water (●) and total phosphorus (TP) (▲) loading rates in the STAs. Relative rates for each STA were computed by dividing observed annual TP and water loading rates by the rates assumed during design. Symbols above the dashed line indicate observed loading exceeded the design rate. Red symbols are the relative loading rates associated with those instances where observed TP treatment performance did not achieve the performance predicted the by original STA design model (see **Figure 5-63)**.

RESPONSES TO COMMENTS ON CHAPTER 6

Fred Sklar with Chapter Co-Authors

Subject: District Responses to Panel Comments (Ch. 6)
Document posted as: 2008 SFER_RTCs_Ch6_fs.doc
Originally Posted: 09 Oct 2007 09:06 AM

Joanna Burger

Comment #1: *This years Summary for Chapter 6 is a bit brief, although the inclusion of the Table is excellent, and puts the research in perspective. However, it would be useful to have a few more details in the summary that give the objectives of the chapter, tie together the major projects and findings, and briefly give future directions.*

Response #1: We agree the Summary is too brief and we will correct this.

Comment #2: *There is a need for an integrative summary that explains how the pieces in the subsections fit together to form an integrate project that examines all levels of biological organization. The framework is there, it is not explained or described. For example, using wading birds as bioindicators transcends all levels of biological organization examined in this chapter, yet it is hard for the reader to see the questions that are asked at each level and how then contribute to understanding the ecology of the system and will lead to restoration.*

Response #2: The Summary and the Introductions to each section will be edited to show how the research projects are integrated.

Comment #3: *HYDROLOGY … need some context to understand the importance or relevance of the data.*

Response #3: This water level section has always been in place to indicate the hydrologic conditions relative to ecological indicators such as wading birds, tree islands and peat oxidation. They are most relevant when we discuss the wading birds.

Comment #4: *WILDLIFE ECOLOGY. …Workshop of scientists from the Everglades system and elsewhere might help shed light on the dynamics…*

Response #4: We agree that the relationship between wading bird foraging/nesting behavior and hydrology is not a simple one. Our long-term nesting data encompasses many years of variable reproductive effort over a range of hydrologic conditions and it is probably large enough now that we can start to tease apart the ecological factors affecting the timing, distribution and magnitude of nesting. To that end, We will build a collaboration with appropriate ecologists to begin modeling these relationships. In the meantime, we summarize below some of the key findings for the 2007 nesting season and provide limited interpretations.

1. Prey densities were found to be fairly low throughout the system except in WCA-1. Prey production is positively related to hydroperiod and water depth, thus limited prey production in 2007 was probably a result of dry conditions during the 2006 wet-season. WCA 1 had a relatively wet wet-season compared to other parts of the system and this may account for its higher prey production.
2. An early onset to the dry season did not prompt an early nesting response. Hydrologic conditions were appropriate for early nesting, but prey densities may have been too

low for birds to attain breeding condition that early. That said, we have little knowledge of the proximate and ultimate factors responsible for the onset of wading bird breeding and further research is needed.

3. Pre-breeding foraging distributions did not track well with hydrologic conditions.

   As explained in the report, this was probably related to significant declines in prey abundance in important foraging areas such as WCA 2 and WCA 3.

4. Record numbers of foraging birds did not translate into a large nesting effort. Extreme low stages on the Kissimmee floodplain and other wetlands precluded foraging for much of the 2007 dry season, such that birds from these systems were forced to migrate to longer hydroperiod marshes. This exodus may have been responsible for the marked increase in the Everglades population. While prey densities in the Everglades were sufficiently high to attract and support these extra birds, they may not have been high enough to initiate a comparable breeding response.

5. Prey densities did appear to track nesting behavior.

   We note in the report that the nesting response was generally good where prey densities were high (WCA 1) but poor where they were low (WCA 3). These differences in prey production were partly a function of hydroperiod and water depth during the previous wet season; i.e., areas with deeper water and longer hydroperiod produce more prey. This suggests that wading bird reproduction is dependent not only on appropriate dry-season hydrologic conditions (a strong recession and shallow water) to increase prey vulnerability, but it is also tied to the hydrologic conditions of the preceding wet season which affects prey production. This is supported by the observation that the most successful breeding seasons since pre-drainage were associated with high stages during the preceding wet season and with appropriate dry season recession rates/water depths (i.e., 2002, 2004 and 2006). Years without this combination of conditions had relatively reduced nesting effort. Appropriate modeling is needed to verify these observations.

   The study to examine whether food supplementation would increase reproduction in White Ibis chicks is well thought out and will fill an important data gap within the system. Since the timing of the report is such that only preliminary data can be presented, it would be useful to also give the final data from the previous year as well as the current preliminary data. This will allow for a better evaluation of the overall study. The results are particularly intriguing because of the differential effect as a function of hatch order. That the chicks all fledged at the same age corroborates other studies with colonial birds. While the preliminary conclusions are generally warranted, the data are not designed to test whether mercury had an effect; mercury could have depressed reproductive success of both control and experimental groups by the same among, and with this experiment, it would not have been clear. It is extremely helpful to have the statistics presented (Table 6-4).

This is addressed under questions and comments, please see below.

Comment #4a: *Did wading birds feed nearby but outside the enclosures, how long did it take to draw them in, did they deplete the prey, and so on are questions that need considering by the researchers. There are other explanations for the results, and these need to be examined as well.*

Response #4a: A small number of wading birds did feed outside the enclosures, but the majority fed inside the enclosures where prey densities were much higher. We do not feel that this affected the study in any way.

Wading birds did deplete the prey somewhat throughout the course of the morning, but potentially confounding effects were limited by the short 3-hour observation period and the randomized timing of monitoring of each treatment. We attempted to control for variations in prey density through daily restocking.

We believe the explanation provided in the report is the most feasible explanation. Exploring additional options would require a much more lengthy discussion and additional studies.

Comment #5: *Using a rapid assessment methodology is critical for long-term monitoring of ecosystem health, particularly in a system as large as the Everglades, over the time frames necessary. Some discussion of the use of such indices in other places should be included for a method that may be used generally within the Everglades. Data for more than 2 years is essential to fully develop and test this measurement tool. While it could be extremely useful, more data are required to determine if the wet season/dry season effects remain constant, and the index is a good predictor of conditions.*

Response #5: See the PowerPoint slides associated with this chapter. Updated in document.

Comment #6: *PLANT ECOLOGY. …One problem with the tree seedling stress experiment is that the pots do not provide sufficient soil beneath the roots to imitate the natural conditions. Understanding the effects of nutrient and hydrological gradients on tree roots is an important, and often neglected aspect of tree ecology. The experiment is well designed, but I would feel more comfortable with some citations that the methodology has been used elsewhere with good results. Do the cores adequately reflect root growth? The results with respect to root (and leaf) productivity could be easier to read if there were a table showing how each factor affects root growth (it would help to have leaf productivity on this also).*

Response #6: About pot size, most roots of field tree island seedlings and samplings were about 10-20 cm in depth. The 6" pot is about 20 cm in depth, which was similar to field rooting zone. Also, the experiment was planned to run one year and under a low nutrient water condition, it was not expected the pot size would create root bound based on field observation. Further, the logistics of the field-soil collection, we selected this pot size. Finally, we did not find obviously root bounding at our final harvest.

Comment #7: *ECOSYSTEM ECOLOGY. Ecosystem studies in the Everglades are necessarily complex because of the greatly fluctuating hydrology and other environmental conditions. Nonetheless, studies concentrate on understanding different aspects of ecosystem functioning, including in 2008, rapid assessment of periphyton, phosphorus dynamics, and accelerated recovery of impacted areas. As with other areas of ecology, it is critical to develop rapid methods of assessment that can be used both spatially and temporally in the Everglades, and can be done with a minimum effort in time and money. The use of chemotaxonomy has great promise both as an assessment tool and to inform management decisions. However, the objectives need to be clear: are the chemotaxonomy tests being conducted to decide whether the tool can be used as a surrogate to identify the species present, or to identify the environmental conditions? Since this is a relatively new approach for the Everglades program, more explanation is required of the regression trees so that the reader can both interpret them, and understand how they could be used for management.*

Response #7: This has been updated in the document. See the PowerPoint slides

Comment #8: *The Phosphorus reflux studies are extremely important, and are showing that porewater is an important source of phosphorus, which in turn has management implications for restoration. Understanding the movement of phosphorus between porewater and the water is another important and key component.*

The accelerated recovery of impacted areas is really a fire project, and should be so called. It is unclear what the time frame for this work is, and how long the plots will be monitored; surely a long monitoring time is required to ascertain the long-term effects. It might be useful in future reports to put the fire regime in a table, with the effects on sawgrass, cattails, pH, phosphate, and other effects so the reader can quickly ascertain what has been learned from each treatment (or series of treatments).

Response #8: As current version of the Report, it seems that "the accelerate recovery of impacted area is only a Fire project". However, it is actually not. The 'Acceler8 Recovery." is a program and consists of several projects.

Comment #9: *Fire and herbicides can also be used to maintain open areas, and this is another project under the ecosystem ecology section. Again, it would help to have a time frame for the entire study, as well as for the various treatments envisioned, along with appropriate rationale. With all the experiments, especially the cattail habitat improvement one, it would be useful to have concluding statements that discuss whether the changes were positive or negative, and in relation to what; also what are the management implications. The initial data indicates that opening areas has positive benefits for a number of factors, but it is critical to continue monitoring these effects, perhaps for longer than two more years. At some point, the openings may start to fill in with succession, and this should be documented.*

LANDSCAPE ECOLOGY. One of the very positive aspects of the ecological work in the Everglades is attention to different structural levels, from individual species and species groups, to the landscape. While this is a daunting task, it is critical to understanding the ecology necessary to restore the Everglades. The landscape ecology section,

The CERP vegetation mapping (from aerial photography) is an important task that will provide a basis for monitoring and recovery of Everglades vegetation. This will be particularly useful in conjunction with the pre-drainage Everglades landscape and hydrology book currently in preparation. With the two, it will be possible to identify the areas with the greatest change and in need of the greatest restoration. The forensic ecology approach is ideal, and a sufficient number of sources are being used to present an excellent picture of the Everglades in the mid 1800s.

While the vegetation mapping, and pre-drainage Everglades landscape mapping will provide a picture of the general habitat within different regions and areas of the Everglades, the smaller habitat variations on the ridge and slough scale will be difficult to plot from the 1800s. The soil profiles of macrofossils work will begin to reconstruct historical vegetation, initially with Shark Slough. This is an important project will allow hypothesis testing retrospectively of sawgrass communities.

The landscape pattern change study seems essential to understanding changes that have occurred in the system, but again, the basic information for the study is lacking, including objectives, hypotheses, start date, length of the study, researchers or agencies involved. Still, the methods seem appropriate and relevant to understanding the patterns, and this will also contribute to understanding the Everglades before drainage.

Response #9: Updated in document.

Comment #10: *The Muck Fire Model is another important analysis for understanding drought in the Everglades, one of the key ecological events that affects all levels of ecological organization. Concentrating on fire effects and on those for wading birds was reasonable, but some forethought should be given to science issues before such events occur. Again, this section would profit from a clear statement of objectives, hypotheses, and approaches before the details are presented.*

Comment #10: Updated in document.

QUESTIONS AND SUGGESTIONS

Comment #11: *Lines 9-17: Some statement of overall objective, major findings, and future directions needs to be given.*

Response #11: We agree and will edit this section.

Comment #12a: *Table 6-1 is excellent, and the authors are to be commended. Slightly more explanation in the summary itself would put the findings into context. I wonder if the years of the study could be added to the end of the middle section for each study?*

Comment #12b: *Section on Hydrologic patterns: it would be useful to have a beginning statement of objectives and an overview of the effects of the patterns. Is there any need for concern about water levels, and if so, why?*

Response #12: Water levels are a constant concern because it affects almost every aspect of the Everglades. This year it affected wading birds and the scheduling of the fires set by the CHIP and FIRE projects, but not much else, so it appears to be minor. In reality, this hydrology is the set-up for next year, which may be the worse drought in history.

Comment #13: *Lines 168-185: This section provides a good introduction to this section, and what is required for the hydrology section.*

Response #13: OK.

Comment #14: *Lines 208-214: A brief statement of potential reasons for this drastic decline would be in order here.*

Response #14: We intended that the first paragraphs in this section be purely descriptive. The potential reasons for the declines are included in a later paragraph (lines 243-268). We have added more details above and will incorporate these into the report.

Comment #15: *Lines 230: The loss was not offset, I would think, because the overall nesting effort was so depressed this year.*

Response #15: This is true, it was only partly offset. We will amend the sentence.

Comment #16: *Lines 254–256: This is an interesting finding, and it might be useful to elaborate on why the authors believe this happened*.

Response #16: A possible explanation is given in the next sentence. However, this was not very clear given a poorly constructed paragraph and additional final edits. We will improve the explanation to better link the paragraphs. This finding is explained in greater detail above.

Comment #17: *Lines 267–268: The disparity between presence of foraging birds and nesting is disturbing, and requires further work.*

Response #17: Agreed. Please see the general comments above.

Comment #18: *Line 276: What happened with tricolored heron surveys (this should be added to the footnote.*

Response #18: Aerial surveys are inappropriate for surveying dark wading birds and nests are typically counted from the ground. This year, the extreme dry conditions precluded airboat access to the colonies and system-wide ground surveys were not conducted. All other birds in the graph have white plumage and were counted from the air.

Comment #19: *Lines 292: It would be useful to simply add a brief sentence for the rationale of the study, rather than refer the reader to last years report. Since the primary objectives are then listed (lines 296), it should be clear if these are overall or for the past year.*

Response #19: We will amend the report to incorporate the rationale and clarify the objectives.

Comment #20: *Lines 296–310: Does this discussion relate to the whole study, to this year?*

Response #20: We will make it clearer that we present data from 2007. We did compare the 2007 to those of 2006 but only in the last paragraph of the discussion.

Comment #21: *Line 334: At what age did young depart?*

Response Please see line 365.

Comment #22: *Lines 348–on: Since the timing of the report is such that only preliminary data are presented, perhaps the final results from the previous year can be included.*

Response #22: We can incorporate data from 2006 but it will make the section considerably longer. In 2006 there was very little difference between treatments in the growth and survival of nestlings and we believe that this simple result is best described as a short sentence in the discussion.

Comment #23: *Line 374: I would be VERY cautious about stating that mercury did not have an effect since the effects of mercury might be small but still significant.*

Response #23: We agree that the current data are not designed to test effects of mercury on nestling fitness, and that mercury could have had an important but undetected effect. We will remove the statement and wait until we have results from the feather samples before making conclusions.

Comment #24: *Lines 382–384: This study may have to be done for more than 3 years to adequately characterize the differing hydrological/prey cycles.*

Response #24: The main goal of this study is to test the hypothesis that white ibis reproduction is food limited at the nestling stage. We have achieved this after two breeding seasons. Another important goal is to characterize the role that hydrology plays on food limitation. This is trickier to test because food limitation is believed to be a function of both hydrology and prey density. Annual prey production now appears to be more variable than was initially believed. Thus to get a basic understanding of the role of hydrology on food limitation, we need to examine at least three contrasting hydrologic years (wet, dry and average) when prey densities are similar. So far we have shown that food is limited in a dry year but not in an average year, and the two years had similar, high densities of prey. Our goal is to continue this study for an additional year during wet conditions. Wet conditions are likely to be favorable to prey production and under such conditions we expect prey densities to be high and similar to those of our previous study years. We can wait for another few years if necessary to ensure we get such conditions. In addition, we may decide to continue the study further if water conditions and prey densities are such that it will help us further tease apart the role of these factors on food limitation. For example, this wet season has been very dry and we expect next year's prey densities to be relatively low. If we conducted the study under such conditions we would predict a greater difference between treatments than we observed this year because the control chicks would suffer the combined effects of both dry conditions and low prey density.

Comment #25: *Lines 453-end: The results of this experiment require additional data to understand what happened (how many birds came, when, for how long, what species).*

Response #25: Most species of wading birds found in the Everglades foraged in the experimental enclosures [Great Egrets (*Ardea alba*), Wood Storks (*Mycteria americana*), Great Blue Herons (*Ardea herodias*), White Ibis (*Eudocimus albus*), Glossy Ibis (*Plegadis falcinellus*), Little Blue Herons (*Egretta caerulea*), Tricolored Herons (*Egretta tricolor*), and Snowy Egrets (*Egretta thula*)].

Wading bird use at any given time ranged from 0-31 birds per enclosure and from 0-78 birds summed throughout the enclosures. The duration spent in the enclosures was highly variable, ranging from less than a minute to 3 hrs (the entire observation period). Most birds arrived at first light. Time activity budgets ranged from 1-15 minutes.

Comment #26: *Line 470: This sentence seems awkward; it is not a function but rather a task performed by...*

Response #26: Assessing anthropogenic impacts on lakes, streams, and marshes is a task performed by environmental agencies worldwide.

Comment #27: *Line 491: Some discussion of the relationship between macroinvertebrates and microinvertebrates should be included. How good an index are marcroinvertebrates?*

Response #27: Micro invertebrates are not suitable for this type of procedure. These animals are generally less than 150 um in size and cannot be identified without the aide of microscopy. Indices using macroinvertebrates are common in bioassessments and rapid assessments.

Comment #28: *Figures 6-10-12: some indication of whether the differences were significant should be given on the figures.*

Response #28: Analysis was performed on macroinvertebrate data collected in an impacted and reference marsh during wet and dry season sampling events. Additional analyses are necessary to generate comparable descriptive statistics.

Comment #29: *Line 603: Need to give some indication of how long these experiments will run for, i.e. how many years.*

Response #29: This experiment will last for three years and sampling will be bimonthly. More narrative will be added to the chapter.

Comment #30: *Line 622-: The hypotheses should be given much earlier so the reader can follow the description.*

Response #30: Will correct.

Comment #31: *Line 631: should give the dates of planting, not "recently" since the reader will read this in 2008, but it was written in 2007. When exactly was the planting?*

Response #31: Will correct.

Comment #32: *Lines 663–667: The Everglades are being affected by many other things, such as invasive species and other runoff besides agriculture.*

Response #32: Updated in document.

Comment #33: *Lines 711–123: Are the pots sufficiently large to mimic the amount of soil that normally is below the seedling roots. Further, the pots no doubt impede water flow through the soil.*

Response #33: Updated in document.

Comment #34: *Lines 727-742: Statistical data should also be given.*

Response #34: Updated in document.

Comment #35: *Lines 779: Is this only a one year study?*

Response #36: No, this is a two-year study.

Comment #36: *Lines 790-800: Are there other studies that validate the use of cores to estimate root features? How can you be sure which tree the roots come from?*

Response #36: As suggested, we have added more references that help to validate the use of cores to estimate root biomass. We cannot be sure which tree the roots are coming from; however, we know the environmental conditions under which those trees are growing. The scope of this study is at the community level as opposed to the population/species level.

Comment #37: *Lines 809-810: Maybe roots relate to the strength of the water movement through the tree island, and not just the quantity or periodicity.*

Response #37*:* It is possible that roots relate to the strength of the water movement but the hydroperiod (frequency and length of inundation along with water depth) drives the plant response to either short or long hydroperiods.

Comment #38: *Lines 824-826: This sentence is not clear to me.*

Response #38: As suggested, we edited that sentence to clarify.

Comment #39: *Lines 834-7: I am unclear whether turnover really relates directly to active growth. That is, do the fine roots function until they decompose, or is there an in-between period?*

Response #39: Turnover is not directly related to active growth. Turnover is an indirect estimation of root decomposition and how rapidly roots turnover in response to local environmental conditions. In this sense, a high turnover would suggest that roots are being produced and decompose at a relatively fast rate and at the same time a high turnover would also suggest that the functional time of fine roots (nutrient uptake) is shorter.

Comment #40: *What is the effect of differential aeration at the heads and tails of islands?*

Response #40: The effect of differential aeration at the heads and tails is directly related to water regime (short vs. long hydroperiods). In this sense, short hydroperiods allow for longer aeration periods in the soil. In contrast, long hydroperiods will limit the aeration in the soil. Thus, longer aeration periods allow the plant community to grow under a less stressful condition which in turn allows the plant community to grow faster and be more productive.

Comment #41: *Figures 6-18-19. Which are significant?*

Response #41: No formal statistical analyses have been performed on root production data; however, a t-test suggests that on the heads of 3AS2 and 3AS3, root production is significantly higher relative to that of the neartail of those tree islands. In contrast, the same t-test performed on data from 3AS5 indicates that there are no differences between head and neartail.

Comment #42: *Line 852: Why is this indirect?*

Response #43: This should read "both direct and indirect." It is meantioned here because it is at the ecosystem level that we tend to study feedback mechanisms.

Comment #44 *Lines 883–888: Need a clear statement of objectives, with hypotheses.*

Response #44: As suggested, we have updated this in the document.

Comment #45**:** Lines 890–893: Here the researchers are identified, and this is not so in other parts of this (and other) chapters. Perhaps there should be consistency.

Comment #46: Lines 888: Is the objective to identify the algal and other species, or the environmental conditions?

Response #45 (& #46): As suggested, we have updated this in the document.

Comment #46: *Figure 6-20: It is not clear how to read this, what it means, what is actual data versus the regression, and how they would be used for management.*

Response #46: As suggested, we have updated this in the document.

Comment #47: *Figure 6-23 and 24: Do we need to know amounts of water to relate to these TP concentrations?*

Response #47: The amount of water flowing into the enclosures does not affect the TP concentration and hence is not reported here.

Comment #48: *Figure 6-25: how many data points is this based on? and what is the variance?*

Response #48: There were seven porewater equilibrators with 24 cells. As suggested, the variation is provided in the revision.

Comment #49: *Lines 1037: how was the sampling determined? What days and what time of day?*

Response #49: All determinations of nutrients including TP were done according to standard methods (e.g., APHA 1998). Sampling dates are shown in Figure 6-26 (weekly). Sampling typically took place in the morning hours.

Comment #50: *Lines 1047-: Perhaps I missed it, but what is the relationship between inflow and porewater inputs of phosphorus?*

Response #50: Porewater P serves as a source of P to the water column when the inflow TP concentration is lower than the porewater TP.

Comment #51: *Line 1064: I am not sure why you call it an accelerated recovery project when it is really a fire project?*

Response #51: Answered above.

Comment #52: *Line 1082: how big were the plots?*

Response #53: 300 m x 300 m

Comment #54: *Lines 1082: How long will the plots be monitored?*

Response #54: The project will last at least for 4 years.

Comment #55 *Lines 1112-: Is there a master plan for the burning, and for how to incorporate natural fires?*

Response #55: As the project tends to study "repeated prescribed fires, about 3 fires, there is a master plan for when to conduct the 3 fires. The current project has no intention to incorporate natural fires.

Comment #56: *Line 1194: Were there any data collected on periphyton in the system? If not, are there plans to do so?*

Response #56: Yes, periphyton is among the parameters studied.

Comment #57: *Line 1217: It seems to me that soil seedbank and seed germination are very different, and each should be discussed separately.*

Response #57: The project using seed germination or "seedling essay" to estimate soil seedbank size and dynamics.

Comment #58: *Lines 1254–1260: Something should be said specifically about the effects of fire on both sawgrass and cattails.*

Response #58: We have not gotten enough data to present sawgrass yet, as the report is primarily focusing on highly- enriched plot with no sawgrass.

Comment #59: *Lines 1272: Any ill effects of glyphosate?*

Response #59: Glyphosate is being applied at rates approved for the aquatic environment which tests have shown have no detrimental effect on aquatic organisms. The glyphosate concentration in surface water samples collected within 4 hrs following application averaged 0.324 mg/L, orders of magnitude less than the LC50 concentration of 120 mg/L (bluegill sunfish) for fish common to this region.

Comment #60: *Lines 1265-on: What is the time period for the study, what is the rationale for each treatment (fire, glyphosate), and how will effects be measured over the long term?*

Response #60: The design and rationale were presented in the 2007 SFER (please see lines 1262-1266), as well as presented in detail on the web site. The study is planned as a 3 year study. Fire was used to create the opening, which the herbicide application alone would not accomplish. The combination of herbicides is the implementation of a standard District aquatic plant management tool. Potential herbicide accumulation is our metric for long term effects.

Comment #61: *Line 1287: What does periodically mean (daily, monthly, seasonally, yearly?)*

Response #61: No set time period was specified, because the frequency of sampling is not equally spaced. Sampling occurred as soon as possible after spraying, one month and then became result dependent, i.e., we sample until we see no elevated levels of herbicide. The text will be revised to reflect this.

Comment #62: *Line 1318: Again, some numbers and statistical values would be useful.*

Response #62: Please see Table 6-8.

Comment #63: *Table 6-9: the abbreviations are unclear (what is EC and so on. What are the two reference sites, and where were they located (this should be on the table legend).*

Response #63: The abbreviations were previously denoted, please see lines 1278–1279. For clarification, these will be added to all tables in the revised document.

Comment #64: *Figure 6-36: significance could be indicated by a star above the relevant bars; otherwise the reader does not know which is significant.*

Response #64: A star will be added as recommended.

Comment #65: *Figure 6-38: on a black and white copy it is hard to read the graphs.*

Response #65: The final Figures will be produced in colour, so this should not be a problem. The Figure is revised in the document.

Comment #66: *Line 1370: I presume you mean in the experimental area? (not in the reference site).*

Response #66: These 11 species refer to those observed in the open plots. Ten species were observed in the reference plots (all species but the black crowned night heron) and four in the control plots. We will add this information to the report.

Comment #67: *Figure 6-38: on a black and white copy it is hard to read the graphs.*

Response #67: We agree, the graphs need to be viewed in color.

Comment #68: *Lines 1402–1414: I assume the secretive bird discussion relates to the experimental area (from the graph, but this is not clear in the text).*

Response #68: This discussion on species composition relates largely to the control (cattail) plots. We will amend accordingly. Only the last sentence referring to total number of birds is relevant to the graph.

Comment #69: *Line 1436: Do you expect the open areas to stay open, if so, for how long.*

Response #69: We do not know whether the plots will stay open, it is one of the factors we are evaluating in our study—whether the ecological benefits of these openings outweigh the potential negative costs of maintaining the openings, e.g., herbicide application. Our expectation is that plots in the transition area have the greater probability of remaining open.

Comment #70: *Line 1471: How is the vegetation mapping available to scientists and the public: on the internet?*

Response #70: Our vegetation mapping products are submitted to RECOVER, who is sponsoring this effort and ultimately should be available via the CERPZONE.

Comment #71: *Line 1531 on: Again, when was the study initiated, how long will it run, what are the main objectives? Who is doing the study?*

Response #71: Updated in Document.

Comment #72: *Lines 1560–62: When are these studies anticipated, or are they part of the current plan?*

Response #72: Updated in Document.

Comment #73: *Lines 1577–on: This section needs a clear statement of objectives, hypotheses, start and end date for the study, researchers or agencies involved. How are the data to be analyzed quantitatively, and how can they be presented to stakeholders?*

Response #73: Updated in Document.

Comment #74: *Lines 1677–1695: What are the objectives, hypotheses, time frames, agencies or scientists involved?*

Response #74: Updated in Document.

JoAnn Burkholder

Comment #75: *Although foraging conditions should have been about the same as WY 2006 in WCA-2A, reports of large or many flocks were greatly reduced. Provide clarification here as to possible reasons? (lines 102–103)*

Comment #76: *Can the authors suggest reasons for the disparity between large numbers of foraging birds correlating with a large nesting effort in previous years, but not WY2007? (lines 266-268).*

Comment #77: *The authors aptly call for further work to allow better characterization of the role of hydrology x food limitation on nesting success (in 2007 and in general), especially how dry conditions and a rain-induced reversal event affect nesting success. Since "wet year" data will be important for overall interpretations, the authors hope for a wet year in WY2008. If that does not happen, can the experimental study be extended until a wet year occurs, since "wet year" data are very important for overall interpretations?*

Responses #75, 76, 77: All three points above are very similar to comments made by J. Burger and have been addressed.

Comment #78: *In the ridge-and-slough experiments under Plant Ecology, how will flow be measured (precision often difficult, especially at low flow velocities)? How much destructive harvesting will occur per sampling event (lines 645–646)?*

Comment #78: *How was it determined, prior to the experiments, that the pot size was deep enough to simulate the depth of the soil layer that typically is below the seedling roots?*

Response #78: Updated in document.

Comment #79: *In the tree island root evaluation study, how was it verified, prior to the experiments, that the soil core size was adequate?*

Response #79: To verify that the soil core size was adequate we carried out a power analysis: Belowground biomass was quantified in 10 soil cores randomly extracted from a tree island. From the biomass data, a coefficient of variation (CV) was calculated for each of the 10 possible sample sizes (n=1-10). The standard error was then calculated around the CV of the maximum replication scenario (10 cores), resulting in the target variation. Four cores were the minimum number of soil cores that met the target variation and enough to sufficiently capture the spatial heterogeneity in belowground biomass across the tree island and provide an accurate measure of ecosystem belowground biomass.

Comment #80: *How long a record is there of the historic periphyton communities (line 1059)?*

Response #80: Updated in document.

Comment #81: *In the Fire Project, cattail biomass (both above- and belowground) significantly increased over pre-fire levels after the February fire (in the moderately enriched site), but not after the July fire (in the highly enriched site) (Figure 6-34). Do the authors attribute this increase mostly to a nutrient affect, and/or to other factors?*

Response #81: This is an excellent question, we have been searching for possible reasons. One of the reasons was the timing of burn, at the beginning vs end of the growing season, which probably played a critical role in the initial vegetation recovery processes following the two fires. The February fire occurred right at the end of the typical dormant time for the cattail, when belowground storage of nutrients has peaked and the plants are ready to utilize these stores for growth. The July fire, on the other hand, occurred when the aboveground biomass had peaked and the plants normally begin shifting allocation belowground to recharge their stores for the next growing season. The timing of burn affected another important factor that influence cattail growth, hydrological conditions (water depth here). Water levels were dropping and remained very low or sub-surface for several months following the February fire which presented near perfect growing conditions for the new plants. However, water levels following the July fire at the highly enriched site were rising very quickly and remained high. While cattail is acclimated to deeper water conditions, if the water rises faster than the new plants can grow they will drown. Furthermore, water depths have impacts on surface water TP, as it tends to decrease with increasing water depths, but increases with very low water levels. Overall, all these factors might contribute to the greater than expected re-growth at the moderately-enriched site and the less than expected re-growth at the highly-enriched site. We have added a few sentences to that section describing the response of biomass to the two fires and an explanation for the observed patterns.

Comment #82: *In the CHIP, water quality of open and control sites was compared up to ~3.5 weeks post-burn. Have the authors characterized the water quality of open sites post-herbicide application and, if so, how did it compare to that of fire-opened and control sites?*

Response #82: We have collected the samples, but have not received all the QA/QC'd data back from the lab yet to be able to conduct the statistical analyses.

Comment #83: *In the Muck Fire Model analysis, can the authors define alternatives 1-3, and provide further explanation as to why there was a preliminary finding of no significant impact (except for elimination of foraging areas near canals) for alternatives 1-3?*

Response #83: Updated in document.

Comment #84: *In Figure 6-44, some bird colonies do not seem to have gauges nearby. Where are the additional gauges referenced in line 1729 located? – are their locations designed to address this problem?*

Response #84: Updated in document.

Comment #85: *Integrative Review. Chapter 6 covers hydrological patterns (1 project) and four main ecological areas: wildlife (4 projects), plants (3 projects), the ecosystem (3 projects), and the landscape (5 projects). The aim was to select projects of focus (17 in total) based on short-term operational needs and long-term restoration goals. The projects generally were presented so that overall goals were clear and well-linked to the descriptions. There was, however, little cross-referencing to other Chapters, and little by way of integrative data summaries and analyses bridging projects. Table 6-1 is excellent - very valuable in providing an overview framework. It would be helpful for the Summary to include 1-2 paragraphs of how the various subsections are being integrated to examine all of the levels of biological organization, and brief indication of future directions.*

Response #85: A more integrative data summary will be written.

Comment #86: *While the potential for integration of this index is high, some serious technical problems in the design call into question the overall utility of this index. Altered design is encouraged to include replication and rigorous statistics, and to consider more than field-identifiable organisms and more than simply presence/absence. The efficacy of this index cannot be evaluated based upon the data presented.*

Response #86: Updated in document.

Comment #87: *It would be helpful to include brief explanation as to how these sub-studies are being integrated into the stated overall goal of identifying ecotypes of special concern and focusing on their biogeochemical linkages.*

Comment #88: *In the CHIP, improved integration would be helpful in the "Higher Trophic Level Responses" sub-section; for example, the section focused its description on wading birds and mentioned (as personal communication) that prey densities in WCA-2 were relatively low in WY2007, without cross-referencing to the excellent information presented about prey densities in the Wildlife Ecology section. Another sub-section of the CHIP, "Microbial Change", presented few replicated data on microbiota and seemed a very preliminary description.*

Responses #87 & 88: As we put together this report we only had data available from the intensive January 2007 sampling, which did not have a complete sampling because the area dried out before all sampling could be conducted. All floc and soil data are based on replicated sampling. However, as we were conducted a preliminary test on what PLFA would show us, we conducted those analyses on a composite sample. More detailed and replicated analyses will be presented in future reports. To avoid confusion, we will remove the PLFA data from this report.

Comment #89: *While the concept is promising as an integrative tool, required calibration of the technique and microscopic groundtruthing appear, thus far, to be lacking.*

Response #89: Updated in Document.

Comment #90: *Additional writing would be helpful to indicate how these projects are being integrated within this section and with other sections.*

Technical Review

Comment #91: *Table 6-1 – very helpful as mentioned; however, has some grammatical errors.*

Comment #92: *Hydrologic Patterns – were defined to have provided "high ecological suitability". This seems misleading, given the fact that wading birds poorly (nesting patterns) fared so poorly.*

Responses #91 & 92: See the wading bird replies

Comment #93: *Periphyton Pigments… – the conclusive statement ("Chemotaxonomy provides…") is in error; the method cannot be evaluated unless required calibration is first conducted (see below).*

Response #93: We have updated this in the document.

Comment #94: *Phosphorus Reflux – Why was there only one control enclosure?*

Response #94: Updated in document.

Comment #95: *Change in the Ridge and Slough Pattern – Please clarify "some threshold".*

Response #95: Updated in document.

Comment #96: *Hydrologic Patterns for WY2007 – This is an excellent section, a pleasure to read; very helpful comparison of WY2006 and WY2007.*

Comment #97: *REFER TO FIG 6-44—Pp.6-4, 6-10 etc. – a map showing these WCAs, the ENP, and gauges mentioned would be helpful.*

The authors use both metric and English units.

Line 48 – averages or medians?

Line 146 - …wet season were sufficient…

Comment #98: *II. Wildlife Ecology – The focus of four included projects continues to be on interactions between wading birds, aquatic prey species, and hydrology, with the short-term goal of preventing further environmental degradation, and the long-term goal of restoring historical wildlife populations.*

1. Wading bird nesting patterns – WY2007 was a poor year for wading bird nesting, with a 36% decline in nests compared to WY2006. Continued focus on wading birds (especially great egret, snowy egret, tricolored heron, white ibis, and wood stork) as indicators of wetland ecosystem health, and the four parameters used to assess recovery of pre-drainage wading bird nesting patterns (lines 196-200), are highly merited. The loss of the major (Alley North) rookery in WCA-3 was clearly described; estuarine rookeries were also minimal in WY2007, and nests in the ENP dramatically declined, attributed to two large reversal events in March – early April.

2. Food limitation on wading bird reproductive success (3-year study, to include comparison of years with different hydrologic conditions) – It seems that the overall hypothesis (lines 369-370) tested in this experiment is that white ibis nesting success is limited by food supply, whereas two sub-hypotheses are given in lines 308-310. Under the section, "Scientific Details", more is needed because little detail is provided. It would be helpful to add justification as to why 10 g fish were fed, why the selected physiological parameters were used (triglycerides, glycerol, corticosterone from blood and fecal samples – lines 329-330), why the sampling frequency (10 and 20 d), the number of replicates within each slough (lines 335-337), etc. Also, please clarify "surrogate nestlings" (line 338).

Responses #96, 97 and 98: The report format is intended to provide a summary of our studies and as such we are discouraged from providing too many details. We will respond to the questions here but we will wait for permission from the editors before adding to the text.

Fish: the most important justification for using 10g of fish is that it is sufficient to provide a growth/survival response during periods of food limitation but it is not too large that the adults lose their provisioning response. We state this in the report. We decided on 10g by using published accounts of the size of parental deliveries and by conducting feeding trials with non experimental birds during breeding seasons prior to the study. Moreover, 10g is about as much as a nestling can swallow during one sitting and to visit the colony more than once in a day would

create excessive disturbance. Ultimately, 10g induced enough of a growth/survival response to detect a difference between the groups.

One approach to understanding how wading birds respond to changes in landscape level prey availability is to measure physiological parameters that respond to nutritional input. For instance certain plasma metabolite parameters are indicative of changes to physiological condition (e.g., triglycerides, glycerol; Guglielmo et al., 2002), plasma and fecal steroid parameters can reflect body condition (e.g., corticosterone) in adults and chicks (Marra and Holberton, 1998; Kitaysky et al., 1999a, b; Williams et al., 1999; Kitaysky et al., 2001; Heath et al., 2003; Lanctot et al., 2003). Additionally, stress proteins respond to a variety of stressors, including: temperature (Gehring and Wehner, 1995; Zatsepina et al., 2000; Martínez et al., 2001), toxins (Maríno et al., 1999), parasites (Nagasawa et al., 1992; Merino et al., 2002), and nutritional stress (Moreno et al., 2002).

Sampling periods were spaced approximately 10 days apart, starting when chicks were approximately 10 days old. Given that White Ibis chicks hatch asynchronously, become stressed from handling and blood sampling can be detrimental to chicks less than 5 days olds, we waited until the first hatched chick was around 10 days old so that the third hatched chick would be old enough to sample. The 10 day interval between sampling events allowed for a maximal response difference between our fed and unfed chicks. We predict that the control birds would have a greater change in physiological parameters over the 10d period than fed chicks. Shorter time intervals could be confounded by between nest variance.

The "Surrogate" refers to a group of nestlings that were not part of the experiment.

Comment #99: *Provisional analyses indicated that extra food significantly increased nestling mass growth and survival of "B" chicks (2nd chick born), supporting the hypothesis that white ibis nesting success is limited by food supply. Age of mortality and mean age of dispersal were not affected by treatment or hatching order.*

Line 300 - …responses are being quantified…

Figure 6-9 legend, 3rd line - …Sample sizes are means ± 1 SE.

Response #99: Done.

Comment #100: *Prey availability and foraging success of wading birds – Prey availability was identified is the major factor limiting reproductive success in wading birds, yet factors affecting prey availability are poorly known. The objectives of this set of experiments (beginning and end of dry season, January and April; vs. nesting season Feb.–June) were to assess effects of submersed aquatic vegetation (SAV, year 1) and emergent vegetation (year 2) x water depth on prey availability for wading birds. The authors focused on foraging site selection and foraging success, rather than attempting to measure prey availability directly. They hypothesized that prey would be more available in shallow water with lower SAV densities.*

The "Methods" section needs further explanation and supporting references – how were the two depths (10 cm, 25 cm) selected, or the 3 SAV densities? Why Utricularia? Why 20 mosquitofish m^{-2}? How realistic were the amounts (in liters?) of plants added to impose treatments? Were there important differences between macrocosms 1 and 4?

Line 437 - …ensured constant initial fish density…

Line 454, 455 - …index, suggest that birds preferred shallow water…

Response #100: Each enclosure was stocked with 0 L/m^2, 2 L/m^2 , or 5 L/m^2 of bladderwort (*Utricularia* sp.). This species of submerged vegetation was chosen because it is native to the Florida Everglades, structurally complex, and one of the most common submerged plants in

slough areas of the interior marshes (Loveless 1959, pers. obs.). Sampling in the Everglades as part of an EPA MAP study showed that it is common to find densities of 5 L/m2 of this species (Gawlik, unpub. data). The *Utricularia* was collected from within the surrounding LILA compartments and was evenly distributed throughout each enclosure to avoid patchiness.

Previous observational and experimental studies have suggested that the optimal foraging depth for wading birds is about 10 cm and the maximum depth is about 30 cm. The two experimental depths cover this range.

Enclosures were stocked with the most common fish species in the Everglades. They were of a known size, density, and caloric content, based on formulas in Kushlan et al. (1986). Sizes were > 2 cm in length because that is the minimum size preferred by most wading birds. Past studies have shown that a high stocking density (20 fish/m^2) will attract the largest variety of wading bird species, and this density is similar to that of the mean fish density found in wading bird foraging habitats of the Everglades.

The four macrocosms of LILA were constructed to be as similar as possible. There are minor differences but this is accounted for using a randomized block design with macrocosm as the blocking factor.

Comment #101: *4. Macroinvertebrates for rapid assessment of environmental conditions in subtropical wetlands – Although the premise of this study is well-founded – that macroinvertebrates can be valuable indicators of ecosystem conditions – and although it is a description of preliminary findings, this section seems weak. The approach used in developing the qualitative macroinvertebrate index (only field-identifiable fauna, only presence/absence) seems too superficial and limited to be fruitful. The "Methods" section was also seriously lacking: When did sampling occur during the wet and dry seasons? What criteria were used to classify a marsh as "impaired" (how impaired?) versus "reference"? Were only 1 reference and only 1 impaired marsh considered? Did this study include replicates? For example, Figure 6-13 states that [a] "Sample" was collected during 2005. – There is little that can be said about one sample; much more data collection would be needed to evaluate the efficacy of this qualitative index. How were the taxonomic-based metrics developed (basis? selection?). What statistics were used? – Line 553 mentions a "trend", and line 558 mentions "trend analysis"; this statistical term cannot be invoked unless the specific statistical analyses are described, with supporting references. The Results and Discussion sections need editing and clarification as well. In Figure 6-10, the key should be enlarged (partly indiscernible), and the labels should also be enlarged.*

Line 474 …impacts associated with…

Line 498 …or absence, respectively…

Response #101: Line 474 EDIT: There are several procedures designed to help identify negative environmental impacts associated with land use (e.g., IBI, WRAP, WAP, UMAM, LCI, Stream Index, etc)

Line 498 EDIT: Analyses were predicated on presence/absence data, thus individual taxa were assigned 1 or 0 based on presence or absence, respectively specific requests will be addressed in the re-write (revisions)

Here are some bullet statements for slides:

State and Federal agencies have legal responsibility to monitor and protect aquatic ecosystems (e.g. lakes, streams, wetlands etc.). Permits are issued to regulate usage of these waters and surrounding lands.

In order to successfully provide "usage" permits, agencies must be able to assess an ecosystem's condition (impacted vs. un-impacted) quickly and cost effectively (i.e. Rapid Assessment).

This project was initiated by the USFWS with the focused goal of developing "RAPID ASSESSMENTS" using plants, fish and macroinvertebrates. This project concentrates on a macroinvertebrate rapid assessment procedure.

The selected Rapid Assessment Procedure will allow a minimal number of individuals (i.e., 1-2 scientist) given a limited amount of time (i.e. 0.5-1 hour) to collect and process data and make an immediate general statement regarding ecosystem condition.

The USFWS established a MACROINVERTEBRATE WORKING GROUP comprised of scientist from academic, governmental and consulting agencies to develop a rapid assessment procedure which utilizes established macroinvertebrate bio-assessment metrics.

Comment #101a: *While the intent of this procedure is to assess the environmental conditions of sub tropical wetlands for permitting, it is our hope that with further developments will enable impact identification to any subtropical wetland. The use of field identifiable taxa and presence/absence data seems "too superficial and limited…"*

Response #101a: -the intent of this tool is not to survey the invertebrate community, or identify bio-indicators but rather to use invertebrates to assess generalities about wetland condition.

-the rapid assessment is designed to use easily acquired qualitative data to assess wetland condition

-all data for this assessment must be collected within 1-hour at the site thus requiring field identifiable taxa to be used

Comment #101b: *Did this study include replicates?*

Response #101b: -in this preliminary assessment replicates were not used however the macroinvertebrate working group has recently collected samples from impaired and unimpaired marshes. These data can be incorporated into the analysis during subsequent revisions.

Comment #101c: *How were the taxonomic-based metrics developed?*

Response #101c: -metrics were derived from combined sources including but not limited to: workshops with scientist working in sub tropical wetlands

literature from other agencies that have used similar tools

Comment #102: *III. Plant Ecology – In three projects of focus in WY 2007, there was continued focus on hydrology, toward understanding the dynamics and dominance of dominant plant species and algal assemblages.*

1. Ridge and slough transplant experiments – A new slough competition study was initiated at the Loxahatchee Impoundment Landscape Assessment (LILA) Facility. The authors provide nice explanation that the central portion of the Everglades historically was a flow-way with a corrugated ridge-and-slough landscape; and that loss of spatial patterning has been attributed to reduced flow, but the experimental basis to predict whether increased flow will restore the natural vegetation is lacking. This study aims to experimentally examine how flow rate and depth interact with plant structure to build ridge and slough habitats. The three keystone wetland species selected (sawgrass, spikerush and water lily) are morphologically distinct. The hypothesis (lines 622-625) and the experimental design are clearly conveyed, including the helpful diagram in Figure 6-14. It will be interesting to follow the progress of this valuable experiment.

2. Tree seedling stress evaluation, based on a complex, ongoing greenhouse experiment – This well-conceived, well-written section targets the slough, ridge and tree island mosaic complex that has been rapidly disappearing in the Everglades. It is directed toward the goal of determining how much of the changes in structural and functional integrity of the Everglades "are due to

policy and management practices, and how much of the natural integrity is likely to return" depending on management changes. The authors describe experiments to examine the influence of the frequency and intensity of hydrologic extremes on recruitment of tree seedlings on tree islands, including species responses to (1) constant hydrology (drought, optimal, flooded) – tested in WY2007; (2) fluctuating hydrology (sequential order of drought and flood); and (3) the potential mitigating influence of an interspersed period of average (non-extreme) conditions. The three species selected for study represent a range of flood tolerance (supporting references needed – lines 690-693). In the methods, it would be helpful to clarify how it was known that the 6-inch (change to metric) pots were sufficiently large to prevent root crowding. Were nutrients other than P important, and checked (lines 701-703)? What was the basis (and supporting references) for selection of the treatment regimes? The statistical information should be included (lines 727-738). The legends for Figures 6-16 and 6-17 need to include further explanation, and the heavy black print needs to be altered (very difficult to read). [Note: Line 666 – not only agricultural influence; please modify.]

3. Tree island root evaluation – Extensive hydrological changes in the past 60 years have been related to the disappearance of 60-90% of the tree islands in two WCAs. The authors made a strong case for the premise that the dynamics of fine root production, mortality and decomposition across nutrient and hydrological gradients and hydroperiods may strongly influence restoration success. They assessed fine root dynamics in previously established plots on three tree islands including a tropical hammock with short hydroperiod, a cocoplum-dominated tree island with moderate hydroperiod (< 6 months inundated), and a willow tree island with artificial flooding (< 6 months inundated). Although their experimental design was clear, it would be helpful to include a diagram. The nutrients assessed (and sampling regime, frequency etc.) should also be clarified.

Response #102: This has been updated in the document.

Comment #103: *The data from this study indicated that fine root production was highest at the head of tree islands with contrasting short/intermediate hydroperiods and high TP (low TN:TP ratios). In contrast, root biomass was higher near the tail of these tree islands, and highest in the flooded tree island. Turnover of fine roots was higher in the low-water-depth, P-rich soils of the near-tail areas, suggesting that fine roots decompose more slowly in these less-than-optimal conditions. The authors stated (lines 841-843) that the results suggest that soil formation on tree islands primarily occurs through organic matter deposition as litterfall and slow turnover of fine roots. They presented no data for litterfall or soil formation, however, so this statement requires further clarification (supporting references from other studies).*

Line 750 - …the root of the problem is the… [great sentence otherwise!]

Response #103: This has been updated in the document.

IV. Ecosystem Ecology

Comment #104: *The overall goal of the three projects included in this section is to identify ecotypes of special concern and focus on biogeochemical linkages therein.*

1. Rapid assessment of periphyton chemotaxonomy – The authors describe a preliminary study of application of the CHEMTAX method to assess algal composition, and, from there, development of a classification regression tree analysis of algal groupings (based on the pigment signatures) to estimate six water quality parameters (TP, TKN, DO, pH, temperature, specific conductance, DO). The statement in lines 875-876 is in error: Chemotaxonomy (CHEMTAX) has very rarely been used in freshwaters (see Schlüter et al. 2006, Freshwater Biology 51:1474-1485), and has been frequently misapplied in estuaries (see Lewitus et al. 2005, Estuaries 28:160-172). The

authors need to define and describe "periphytometers". In addition, fundamental concerns about this study need to be addressed:

Information was not provided about required, fundamental methods development. Effective application of chemotaxonomy requires calibration with cultured isolates of important (abundant) species from the targeted system (Mackey et al. 1996, Marine Ecology Progress Series 144: 265-283). CHEMTAX is frequently misused because this important caveat is ignored. Application of CHEMTAX calibrated with oceanic isolates to estuarine or freshwater systems leads to inaccurate predictions of phytoplankton taxonomic composition (Schlüter et al. 2006, Lewitus et al. 2005). Lewitus et al. (2005), for example, demonstrated that application of the CHEMTAX matrix developed for oceanic species (Mackey et al. 1996) to salt marsh estuarine samples resulted in relatively poor predictive capabilities compared to a matrix generated primarily from estuarine isolates.

Before CHEMTAX can be soundly applied to periphyton of the Florida Everglades, the technique should be calibrated with, at a minimum, major species (cultured) from the habitats sampled. Microscopic verification should also be a prerequisite to application of the method (Lewitus et al. 2005). The authors seem to have this "backward" (lines 947-948), given their statement that such traditional taxonomic analyses should be done only after lack of correspondence between measured and predicted conditions is discerned. The lack of such ground-truthing may, in fact, have contributed to the apparent (perhaps false) lack of correspondence. After the two required steps for use of this technique are completed for the Florida Everglades periphyton samples – that is, calibration with major species cultured from the habitats sampled, and microscopic groundtruthing – the data from this preliminary study should be reanalyzed to assess the amount of variation explained within the classification regression trees (lines 927-928). At present, the conclusions presented without these two required steps (lines 950-964) unfortunately lack scientific basis.

Line 945 - …less variable

Line 946 - …predicted conditions

Line 962 - …periphyton biofilm nutrients…[note: tissue is an inappropriate term for periphyton]

Response #104: We whole heartedly concur with Dr. Burkholder's statement that "effective application of chemotaxonomy requires calibration with cultured isolates of important (abundant) species from the targeted system". However, some points need to be clarified.

IN THE PRESENT STUDY—Group-specific relative abundances were derived from marker pigments using a multiple linear regression approach and not the CHEMTAX procedure.

1) The equation is specific to "Everglades" periphyton and is "calibrated" with best available data and is being updated as we obtain more information.

2) The regression coefficients (i.e., molar accessory pigment/chlorophyll a ratio) were derived from:

3) Identification of the phylogenetic groups and composition from taxonomic analysis of more than 2000 algal samples collected over a 13 year period from a variety of environmental conditions.

4) Molar ratios of dominant taxa for each major phylogenetic group were determined from Everglades isolates, laboratory cultures, and applicable literature values under different light and nutrient regimes. To date more than 30 taxa (cyanobacteria, desmids, diatoms, and filamentous green algae) from the Everglades have been examined and the work continues.

We do recognize that this method and equation, as with all algal methods, has limitations.

However, as a first approximation for comparison within the Everglades We believe that the current equation has utility as a tool to assess the "relative" group differences.

We plan to improve this application by utilizing the matrix procedure CHEMTAX.

How are we doing this?

- We are following the recommended protocols to develop a matrix specific to the Everglades. We did notintend to apply matrices developed for other aquatic ecosystems.

- In some cases, pigment extraction methods can influence chemotaxonomic assessment more so than variation within an individual cell or group. We developed a protocol that efficiently and accurately extracts pigments from the diverse array of Everglades periphyton.

- Pigment data obtained for each sample collected as part of this three year project will be calibrated using paired taxonomic analysis and environmental conditions. This is being completed for both algae samples collected using periphytometers (expected n > 500) and natural periphyton (expected n> 450).

- To date, one Ph.D. student has begun, as part of her research, to evaluate the effects of environmental conditions on pigment ratios of the major algal taxa, building on the existing Everglades database.

- In addition, a MS student began this fall to develop the Everglades specific matrix required for CHEMTAX.

Other concerns will be addressed in the Chapter 6 revisions.

Periphyton-mercury studies in the context of mercury cycling within periphyton or trophic transfer are not being studied, nor planned to be studied by the Everglades Division. We believe that mercury is of great environmental concern for the Everglades. The studies needed to elucidate these pathways are being investigated by other agencies that are better staffed and equipped to deal with the complexities of mercury. Our periphyton studies are designed to investigate other important environmental issues (e.g., water quality and hydrology) that can be coupled with mercury-specific studies to present a comprehensive picture.

Comment #105: *Evaluation of phosphorus flux (Reflux Study) – The authors described ongoing work in a 4-year project (through 2008) in the northern, cattail region of WCA-2A. The project is related to the long-term goal of improving wetland regions impacted by excess P. The objectives are to (1) quantify in situ sediment P fluxes to the water column; (2) use field enclosures to evaluate management practices (herbicides, burns) to immobilize P in the sediments; and (3) to apply a dynamic model to simulate sediment P flux under different conditions.*

A. Phosphorus export (objective 1) – an experiment was conducted to compare P export by 3 control enclosures vs. 3 enclosures to which "SAV-treated" water lower in total phosphorus (TP) was added. Along with the TP concentration, the authors should describe the P species in the SAV-treated water. The data indicated that the SAV-treated units were exporting P. Additional measurements of porewater indicated that porewater was rich in soluble reactive phosphate (SRP), with low but significant P flux from the sediment to the overlying water column. The authors should briefly describe, with supporting reference, the equilibrators used.

Figure 6-22, line 1 - …the experimental enclosures…

Lines 993 - 1003 – change + to ±

Line 1003 – …One possibility (based on data presented below) is…Figure 6-25 – error bars are needed

Response #105: This is updated in the document.

Comment #106: *B. Management practices vs. sediment P flux (objective 2) – 9 enclosures were used (3 control, 3 with herbicide, and 3 with herbicide + the submersed aquatic macrophyte, coontail) to evaluate effects of these management practices on sediment P flux. Brief rationale is needed for the experimental design, including a brief description of these mesocosms, rationale for the use of coontail (and why this macrophyte species was selected), the amount added (again with supporting rationale), and the water quality of the SAV-treated water. Why was glyphosate selected as the herbicide? How did the authors ensure that the herbicide added did not leach into other plots (there is no information provided on how far apart the treatment and control plots were)? How was DOP measured? The P data should be reported with consideration of the detection limits of the methods used. The authors report an expected spike of TP in outflow water post-herbicide application. Did they follow the TP post-herbicide application long enough to detect when it declined back to pre-application levels?*

Line 1034 - …with herbicide were inoculated…

Lines 1036 - 1046 – change + to ±

Figure 6-26 – treatment is cut off in the keys

Response #106: A brief statement of rationale for the experimental design is now provided. A brief description of these mesocosms is provided in the second paragraph of this section. Forms of phosphorus in the SAV-treated water is provided in this revision. *Ceratophyllum* is not rooted, so it will not be recycling sediment P like a rooted aquatic. Also, *Ceratophyllum* is better suited to the P conditions found in northern WCA-2A, and has been reported in this area. Glyphosate is quick acting, effective on cattail, and degrades quickly.

Comment #107: *The "Implications of Results" section was nicely presented; the data indicate that porewater is an important source of P to the water column in cattail-dominated areas, and recovery of these areas will not be likely until both inflow P and porewater P are reduced. The authors logically call for more research to assess the rates and mechanisms controlling P flux from porewater to the overlying water.*

3. The Fire Project (Accelerated Recovery of impacted areas) – The rationale for this important project is to assess whether repeated prescribed fire is effective in accelerating ecosystem recovery of cattail (and willow)-dominated, P-enriched areas by favoring re-establishment of sawgrass and other native species (App. 6-1-20). The project is designed to document (and hopefully distinguish) natural versus accelerated recovery at the landscape level (App. 6-1-20). The stated objectives are to use repeated prescribed fires to encourage a long-term species shift from cattail back to sawgrass, and to accelerate burial of P-enriched peat below the active root zone. The experiment (when was it initiated?) follows a before-after-control-impact-paired series design and includes 6 plots (each 300 m x 300 m) with upstream, within-plot and downstream sampling stations. There are 2 unenriched controls; 2 highly (P) enriched sites dominated by cattail; and 2 moderately enriched sites with a cattail/sawgrass mix. Treated plots are being burned periodically (wildfire affected 1 moderately enriched plot in Feb. 2006, as the first fire in the Fire Project; prescribed fire was applied to 1 highly enriched plot in July 2006). Data analyses are in progress; the authors emphasized short-term ecosystem responses from the latter fire in this preliminary report.

In the burned, highly enriched plot, immediate responses were: ~80% of the detrital biomass burned; ~15% of the live aboveground cattail biomass burned, and all of the aboveground biomass subsequently died; pH increased, SRP increased ~1000% and then declined to pre-burn levels within 2 weeks; porewater P increased less (how much?), but this increase was more lasting (how long?); and periphyton increased within 2 weeks in apparent response to the increased light and nutrients (why were these data not shown? – would be helpful to include).

Cattail seed germination decreased, but 1 week post-fire, new ramets were produced and regrowth of burned but still-viable plants began; in fact, within 6 months culm density was at least 50% higher than pre-fire. Cattail leaf height increased rapidly until it was 70% of pre-fire levels, suggesting that this plant allocated sufficient energy to leaf biomass that would sustain growth in the recovery phase. Cattail biomass (both above- and belowground) significantly increased over pre-fire levels after the February fire (in the moderately enriched site), but not after the July fire.

Response #107: Text has been added to the appropriate sections to address these questions. A graph showing periphyton phosphorus concentration changes with fire was added and error bars and n values were added to graphs where appropriate. Error bars were not added to the temperature graph. The data represent a daily-averaged value (temperature readings were taken every half hour from one station). Error bars would only reflect hourly fluctuations and not site variability. This was made more explicit in the text and graph. To better show the TIP fractionation changes with fire, the graph has been changed from a stacked bar graph to a grouped bar graph with error bars, and its significance was added to the text.

Comment #108: *Figure 6-28 – legend should mention that the top left figure is pre-fire.*

Comment #109: *Figures 6-31, 6-32 – error bars and "n" values should be added.*

Comment #110: *Figure 6-33 – were these differences statistically significant? Surely seem to be, but the legend should indicate error bars or confidence intervals.*

Comment #111: *Line 1067 - …enrichment resulted in…*

Comment #112: *Line 1228 – The writing seems to have been inadvertently cut; the authors should describe what happened to plant biomass, rather than simply referring readers to Figure 6-34.*

Comment #113: *Line 1257 - as evidenced by the…*

Comment #114: Cattail Habitat Improvement Project *(CHIP) – Overall (as nicely stated in the Conclusions, lines 1429-1437), the results from the first 6 months of data collection support the hypothesis that openings are ecologically better (higher nutrient fluxes, more nutritional plants, more foraging by wading birds).*

The goal of the CHIP is to provide a preliminary assessment of the role of active management in accelerating improvement of cattail habitat (App. 6-1-19). The reader is sent to a multi-step web site to find the original hypotheses, experimental design, rationale and methodologies for this 3- to 4-year project. Yet, some of the hypotheses are stated later in the writing (e.g. lines 1333-1335). The website contains several succinct boxes with brief descriptions of the hypotheses, rationale etc., and these should be included here. It would also be helpful to include Figure 1 from the first page of that website (map of TP at 0-10 cm depth in the Everglades), either here or in Chapter 1 of the 2008 SFER.

Response #114: We agree it may be helpful to put this in context with the larger system, however, the TP map was previously presented in the 2006 SFER and we did not believe it should be reported again this year.

Comment #115: *The overall goal of the in situ large-scale experimental study in the CHIP (replicated 6.25 ha openings, 2x2 factorial, treatments as control vs. open, locations as enriched and transitional) is to assess how well cattail areas can be restored, considering two major objectives: (1) assess whether created openings (via fire and herbicides) will lead to increased wildlife diversity and abundance, and (2) compare the ecosystem functions of these open areas versus natural sloughs (same hypotheses for both, App.6-1-18). The experimental treatments are applied with the aim of maintaining plots at 10% or less cattail cover, and presents preliminary*

findings from the first comprehensive sampling in Jan.-Feb. 2007. Thus far, herbicide (as glyphosate or glyphosate + imazapyr) was applied in May 2006, August 2006, and March 2007, and a prescribed burn was applied in July 2006. It would be helpful for the authors to also briefly explain why these herbicides were selected, the dose applied, and impacts of the herbicides and primary breakdown products on the ecosystem.

Response #115: The herbicides that were applied are routinely used by the District Aquatic Plant Management Division to treat plants throughout the District. A combination of 7.5 pts/acre AquatNet™ (aquatic labeled glyphosate), 1 qt/acre Habitat™ (aquatic labeled arsenal), 1 qt/acre SunWet™ (mentholated seed oil) and 4 oz/acre NuFilm are applied via helicopter to maintain the open plots. The helicopter applies the herbicide at an altitude of 25ft, with an airspeed of 50 mph using a 40 ft boom.

Comment #116: *A. Water and floc nutrient chemistry - The surface water quality of open and control sites was compared up to ~3.5 weeks post-burn. In the overlying water, the P species were described as significantly higher in open versus control sites. Floc data were also collected, apparently at 6 months post-burn: floc of open plots had significantly higher TP but lower SRP, lower total carbon (TC) and total organic carbon (TOC) than control plots, with no change in TN or ash pre- vs. post-burn. Brief description should be added of which water quality variables were measured, and numbers of replicates (only P and C species are measured in the text; changes in the other variables shown in Table 6-7 should also be described).*

Lines 1321–1322 - …the Ivanoff et al. (1998) fractionation procedure, which…

Table 6-7 – clarify n values, units, and significant integers considering the techniques/detection limits.

Table 6-8 – clarify n values and significant integers considering the techniques/detection limits.

Also, please clarify why SEs are given in Table 6-7, but SDs in Table 6-8.

Response #116: N is noted as the freq, we will make the change to clarify. A brief description of water quality variables will be added to revised report.

Lines 1321-1322 correction made.

Table 6-7 –done

Table 6-8 – done

Also, please clarify why SEs are given in Table 6-7, but SDs in Table 6-8.

- this was an error, both will be replaced with SE.

Comment #117: *B. Microbial change – As stated in App. 6-1-29, an understanding of changes in the structure and functions of microbial communities in peat accumulation and nutrient turnover will be essential for successful restoration of the Everglades. However, in the Chapter 6 draft, few replicated data for microbiota are presented; this section presents very limited, preliminary information. In addition, the DO data seem misplaced and might better be included under (A) above, as "Water Quality and Floc Nutrient Chemistry".*

Line 1344 – Does this mean that aerobic respiration values were measured on only one day? Or for 24 hours? Please clarify.

Line 1346 – The immediate appearance of a periphyton community was mentioned, with no supporting information or data. Please add – elsewhere in the Chapter, periphyton are described as an important component of Everglades ecosystems, and would seem to merit further explanation here.

Lines 1348–1350 – How frequently were the diel DO data taken? Where were the data taken – at one site in each plot? Please clarify. The fact that DO "sags" were more pronounced in the treatment plots relative to the control sites is an important difference that should be emphasized in the writing.

Lines 1350–1357 – A "n" value of 1 means that these measurements all were unreplicated. Unreplicated data cannot be used to support the statements made here; this writing, and Table 6-9, should be omitted. Had replicates been taken, the parameters discussed would have required brief definition/rationale for readers, and brief description of methods (prokaryotes/ eukaryotes, PFLA markers; why the data were interpreted to indicate increased fungi and protozoans, etc.).

Figure 6-36 – The legend should briefly describe how these measurements were taken (method – basis 1 date?; n values). A key should be included.

Figure 6-37 – Needs a key.

Line 1344 – Does this mean that aerobic respiration values were measured on only one day? Or for 24 hours? Please clarify.

Response #117: Aerobic respiration was determined following a 24 hr incubation.

Comment #118: *Line 1346 – The immediate appearance of a periphyton community was mentioned, with no supporting information or data. Please add – elsewhere in the Chapter, periphyton are described as an important component of Everglades ecosystems, and would seem to merit further explanation here.*

Response #118: As noted previously, this report is based on data collected in January 2007. Unfortunately, water levels had already dropped prior to the scheduled periphyton sampling event, so only a limited number of sites could be sampled and no conclusions drawn.

Comment #119: *Lines 1348-1350 – How frequently were the diel DO data taken? Where were the data taken – at one site in each plot? Please clarify.*

Response #119: The fact that DO "sags" were more pronounced in the treatment plots relative to the control sites is an important difference that should be emphasized in the writing. DO data were collected every 30 mins from the end of the platform that extents into the plot interior. Plots specifics can be found in the research plan document Newman et al 2006.

Comment #120: *Lines 1350-1357 – A "n" value of 1 means that these measurements all were unreplicated. Unreplicated data cannot be used to support the statements made here; this writing, and Table 6-9, should be omitted. Had replicates been taken, the parameters discussed would have required brief definition/rationale for readers, and brief description of methods (prokaryotes/ eukaryotes, PFLA markers; why the data were interpreted to indicate increased fungi and protozoans, etc.).*

Response #120: You are correct, the PLFA was unreplicated, it was based on one composite sample per treatment compiled from each of the plots. This was a preliminary test to determine what it may show. It will be removed from the revised version.

Comment #121: *Figure 6-36 – The legend should briefly describe how these measurements were taken (method – basis 1 date?; n values). A key should be included. .. Microbial respiration was determined via CO_2 generation (Wright and Reddy 2001).*

Response #121: The request for details appears to be a reoccurring theme, Fred how do you want to handle this given we already have a peer reviewed document with all the details incorporated?

Comment #122: *Figure 6-37 – Needs a key.*

Response #122: A key will be added to all the figures.

Comment #123: *B. Higher trophic level responses – Low water levels in Jan. 2007 prevented sampling of invertebrates and fish, so this section focuses entirely on wading birds. Wading bird abundance (11 species) was significantly higher in open plots than in control or unenriched plots. An attempt was also made to assess cryptic or "secretive" birds (5 species), based on visual sitings. Highest numbers were found in enriched and transitional control plots.*

Line 1369 - …to be conducted…

Figure 6-38 - legend should clarify n values.

Line 1431 - …Given the intensity of…

Response #123: Done

Comment #124: *V. Landscape Ecology – This section provides generally excellent, essential information about long-term changes in large-scale structure and function.*

A. CERP vegetation mapping – The vegetation mapping products, developed from 1,400 aerial photographs (2004-), should provide a valuable baseline for RECOVER.

B. Book on the pre-drainage Everglades – Sounds as though this will be an exciting, excellent contribution. The forensic approach is excellent. It would be helpful to include more explanation (legend) for Figure 6-40.

C. Soil profiles of macrofossils – This important work takes an innovative approach, initially targeted for Shark Slough, in using macrofossils (especially sawgrass and other macrophyte seeds; also fossil pollen, spores, exoskeletons, shells, etc.) with appropriate dating techniques, as well as certain biomarker proxies to reconstruct historical vegetation on a smaller scale (10s of meters) and characterize boundary movements between ridge and slough communities. The data will provide valuable insights about the extent/direction of management changes that are needed to restore more deep-water sloughs and prevent further landscape degradation.

Line 1525 – Briefly describe the biomarker targeted, and their utility.

Line 1537 – Briefly explain how it was determined that a 10-cm core diameter size is sufficient for this evaluation, and mention the number of cores taken per site.

Response #124: Researchers at the District, FIU, ENP, North Central College, and Indiana University have begun developing a method using macrofossils in conjunction with biomarker proxies to reconstruct historical vegetation throughout Shark Slough (Figure 6-41a) and determine whether this method could also characterize vegetation changes over short spatial scales (tens of meters to characterize patterns of boundary movements between ridge and slough communities. This study addressed the hypotheses that increased sawgrass abundance over the twentieth century has occurred throughout Shark Slough.

The method entails recovering macrofossils (mainly seeds) of sawgrass and other Everglades plant species from soil complements and other proxies such as fossil pollen and spores. However, it may also detect vegetation changes over a scale of 10 meters or less (Saunders et al., 2006), making it a suitable method for analyzing past changes in ridge and slough boundaries over the past several decades. In this study, soil cores were collected at sites distributed along length of historic Shark Slough (Figure 6-41a), from WCA-3B (north of the Tamiami Trail) to the estuarine ecotone of Shark Slough (site SRS-4). A modified piston-corer (10-cm diameter) was used to obtain deep cores (to bedrock) in sawgrass and slough habitats for obtaining ^{210}Pb and ^{137}Cs soil dates (characterizing circa 1880 to present), and accelerated mass spectrometry ^{14}C dates of fossil seeds (only SRS-4 data is available for this report).

All cores were extruded at 1-cm intervals, and 30 to 40 gfw of soil from each layer was used for

counting macrofossils. Macrofossils were recovered by washing soil samples through different mesh screens (> 1 mm and 500 μm-sized openings) to capture the material containing macrofossils. This material was dispersed in water, and seeds and other macrofossils (exoskeletons, shells, plant tissues) were identified using 30 times monocular lenses. Fossil seeds and plant tissues were identified using archived and photographed specimens obtained in situ from live plants and surficial soils (top 4 cm), as well as published descriptions of seeds and plant phytoliths (Bonilla-Barbosa et al., 2000; Winkler et al., 2001).

Downcore profiles from modern sawgrass communities at WCA-3B, NE-SRS, SRS-2, and SRS-3 are all suggestive of wetter conditions prior to 1940 and drier conditions afterward (Figure 6-41b). At SRS-2 and SRS-3, the recent drier conditions are indicated by the dominance of sawgrass seeds and reduced abundance of deepwater slough taxa in the top 10 cm. At NE-SRS and WCA-3B, there is no corresponding increase in sawgrass seeds after 1940. Analyses of additional macrofossil taxa and molecular markers are underway to further resolve the vegetation changes that have occurred at these sites. Soil collected from the SRS-4 site was too young to characterize pre-1940 conditions, although a recent increase and subsequent decline in sawgrass since 1950 is suggested. The trend toward recent, drier conditions seen across Shark Slough landscape (Figure 6-41b) was evident from core transects conducted at the SRS-2 and SRS-3 sites.

Comment #125: *D. Landscape pattern change – Historically (pre-drainage), the Everglades were largely formed of ridge-and-slough patterned peatlands. A pilot study was conducted to examine the direction, timing, and characteristics of landscape pattern change, considering a library of aerial photographs (roughly decadal, 1940-2004) in three landscape-scale rectangles (4 km x 6 km) in WCA-3 spanning control (least historically degraded landscape pattern, although drier in the 1940s), moderately degraded (west of the Miami Canal) and highly degraded (east of the Miami Canal) landscape patterns. The analyses indicates that surface patterning may not change for several decades, even after severe changes in hydrology, and then rapidly changes after "some threshold" is passed.*

Lines 1613-1617 – It would be helpful for the authors to suggest the characteristics of this threshold.

Lines 1598-1601 – The methodology for determination of quadrant values for various parameters is not yet available (reference is a submitted manuscript), and so, should be briefly described.

Figures 6-42, 6-24 – need a key for the color-coding, and needs larger print to make labels readable.

Response #125: Updated in document.

Comment #126: *E. Muck Fire Model – This ecological risk assessment aims to improve predictive ability about the effects of drought, here considering the extreme, sustained drought of WY 2007. The South Florida Water Management Model was used to predict water level stages for a baseline (no change) and assess, from three (unspecified) alternatives, the operational scheme that would be most ecologically sound while lowering the minimum allowable stages for the WCAs to increase water supply. The two major ecological concerns that were considered were the potential for peat fire and impacts on wading bird (wood stork, white ibis) nesting success. The analysis included some impressive details, such as consideration of prolonged soil moisture depending soil type and on depth to subsurface flow. The preliminary finding of no significant impact from the alternatives, except for an adverse effect of eliminating forage areas near canals, is surprising (lines 1706-1713); it would be helpful for the authors to provide insights as to why this outcome occurred. The District's effort to expand the muck fire hazard*

index to include 74 hydrologic monitoring gauges is commendable, but the muck fire hazard index (and its previous basis / number of gauges) was not previously mentioned.

Lines 1674, 1711-1713, 1722 etc. – Describe the three alternatives in the introductory information for this sub-section.

Lines 1728-1730 – Define the fire hazard index up front (1st para. of this sub-section), including the number of gauges upon which it previously was based.

Line 1730 – Briefly describe/define the EdenWeb.

Lines 1730-1732 – Identify the two ecological conditions – I assume that they are the potential for peat fire and wading bird nesting success (?) (lines 1673-1674), but this information needs to be tied together.

Figure 6-46 – should also include a metric scale. Also, the site labels should be altered for clarity

Response #126: Updated in document.

RESPONSES TO COMMENTS ON CHAPTER 7A

Beth Williams, Jim Carnes and Larry Gerry

Subject: District Responses to Comments on Ch. 7A
Document posted as: 2008 SFER_RTCs_Ch7A_bw.doc
Originally Posted: 05 Oct 2007 10:26 AM

General Response: The author and contributors appreciate the time and attention of the 2008 South Florida Environmental Report Peer Review Panel and its individual members in reviewing Chapter 7A: Comprehensive Everglades Restoration Plan Annual Report. The panel's comments are gratefully acknowledged, and clarifications, corrections and other responses are provided below.

Comment #1:*"Bi-Directional" Project Influences (Dr. Richard Meganck, United Nations University for Water Science and Education)*

Can an example of "bi-directional" (line 107) project influences be provided during the public comment period? It is not clear from studying the text what is actually implied.

Reference: Lines 102 – 108 to provide context.

Precursor projects are those that were assumed to be completed before certain CERP projects and components would/could be implemented. They are related to CERP projects in that they address issues in the same natural systems. These projects and CERP have bi-directional influence on each other. Key among these projects are the Critical Restoration Projects and the Modified Water Deliveries to Everglades National Park Project.

Response #1: CERP projects and their precursor projects compliment each other, influence one another and affect the same natural systems, thereby affecting one another. Neither the author nor the contributors like the editor's use of "bi-directional" here, and the sentence has been re-written for the final document.

To clarify the point within the context of the paragraph, however, there were certain projects that were assumed would be completed and in-service before the CERP projects were completed. Further, it was assumed that the CERP projects would not be successful – or even operational in some cases – without the essential precursor projects.

The Tamiami Trail Culvert Project at Collier County, for example, was authorized under the Water Resources Development Act of 1996 to (among other objectives) install culverts eastward on U.S. 41 from County Road 92. This Critical Restoration Project was a necessary precursor of the CERP Southern Golden Gate Estates (now Picayune Strand) Hydrologic Strand Project, the success of which is dependent upon on the flow of water under the Tamiami Trail.

Comment #2: *Pairing of "Precursor" Projects with CERP Projects (Dr. Richard Meganck, United Nations University for Water Science and Education)*

Are all "precursor" projects paired with or studied in relation to a CERP project? I did not think that to be the case.

Response #2: No. The Lake Trafford Restoration and Southern CREW Critical Restoration projects, for example, each stand alone. While both are included in the Southwest Florida Feasibility Study, neither are a pre-requisite for any project in the study. Other projects, such as the Kissimmee River Restoration, are simply earlier restoration efforts.

Under the authority of Section 528 of the 1996 Water Resources Development Act, the following projects were launched to develop specific water quality related projects that were deemed essential to the restoration of the Florida Everglades. The scope of these original "Critical Restoration Projects" included:

East Coast Canal Structures (C-4), to construct a gated water control structure in the C-4 basin. The purpose of this project, which was completed in 2003, was to raise surface and ground water levels, increase aquifer recharge and reduce seepage.

Tamiami Trail Culverts, which was originally proposed to construct 77 culverts under Tamiami Trail (U.S. 41) at 30 locations, in order to restore more natural hydro-patterns to Southern Big Cypress National Preserve. Part 1, the western portion of the project in Collier County has been completed.

Florida Keys Carrying Capacity Study, a comprehensive study of the Florida Keys to determine the ability of its ecosystem and infrastructure to withstand all impacts of additional land development activities and associated population growth. This study, which was completed in 2003, provides an information database and an analysis of consequences that may be used by local planners to determine the level of land development activities that will avoid adverse impacts to the Florida Keys ecosystem.

Western C-11 Water Quality Treatment, to construct a spillway structure in the C-11 canal to separate clean seepage flows from stormwater flows and construct a pump station to pump clean flows into Water Conservation Area 3A. The purpose of this project, which is complete, is to correct pumping of untreated agricultural and urban stormwater runoff from the western C-11 basin into Water Conservation Area 3A.

Seminole Big Cypress Reservation Water Conservation Plan, to construct water control and treatment facilities in the western portion of Big Cypress Reservation. The purpose of this project is to improve quality of agricultural water runoff within the reservation; restore storage capacity, and return native vegetation.

Southern CREW Project Additions and Imperial River Flowway, to acquire 4,670 acres and restore land to a natural state, the purpose of which is to reestablish more natural flow patterns in the Southern CREW, restore Imperial River's natural flow-way to Estero Bay and reduce river nutrient loads. This project is in the final stages of acquisition.

Lake Okeechobee Water Retention and Phosphorus Removal – Taylor Creek and Nubbin Slough, for construction of two large stormwater treatment areas, acquisition of conservation easements on lands and removal of landowner improvements. The purpose of the project restoration of certain wetlands and improved water quality by removal of phosphorus from waters entering Lake Okeechobee. Construction of the Taylor Creek and Nubbin Slough Stormwater Treatment Areas was completed in 2006.

Ten Mile Creek Water Preserve Area, to construct an above-ground reservoir with a pump station and a gated water level control structure, in order to provide seasonal or temporary storage of stormwater from the Ten Mile Creek basin. The USACE completed construction of this structure, however upgrades are needed.

Lake Trafford Restoration, to dredge 8.5 million cubic yards of organic sediment from Lake Trafford, with disposal on agricultural lands, in order to improve lake water quality and subsequent flows to Corkscrew Swamp Sanctuary and the regional ecosystem watershed, as well as to the Florida Panther National Wildlife Refuge. The District has essentially completed dredging operations.

Comment #3: *Project Effectiveness Relative to Overall Water Quality (Dr. Richard Meganck, United Nations University for Water Science and Education)*

How is the effectiveness of a particular Acceler8 project evaluated in terms of its impact on overall water quality when it is downstream from a problem area that may also be slated for a particular action under CERP? This question is posed in light of the renewed commitment by the District to employ a more holistic management scheme yet be able to evaluate the effectiveness of any particular investment to overall water quality.

Response #3: This is a challenge, which is typically addressed during the development of planning and modeling scenarios. Acceler8 projects will improve the quality of existing water currently entering the Everglades. CERP projects will improve the quality of additional water flow to the Everglades. Measurable and meaningful improvements in water quality must occur upstream of these projects. The focus of the Northern Everglades Initiative, which was launched this year to focus resources on Lake Okeechobee and the Caloosahatchee and St. Lucie estuaries, is expected to yield great water quality improvements. The projects, programs and initiatives all work together. If Dr. Meganck has a specific project in mind, and this question leads one to believe that he may, then this chapter's presenter, Larry Gerry, Director, Everglades Restoration Planning Department, can address it

Comment #4: *Cost and In-Service Effectiveness of Underground Seepage Barriers (Dr. Richard Meganck, United Nations University for Water Science and Education)*

Can any clarification as to the effectiveness of constructing barriers (lines 252-254) to reduce seepage be offered? Are such actions cost effective and on what basis? Will there be impacts to ground water, or possibly salt water intrusion from the reduction of such seepage controls? As I understand this particular project, there is only a pilot project contemplated in L-30 (L-31N) and some action in the C-111 canal to the benefit of the Everglades. Others actions may be planned, but I am not certain as to the priority of such efforts nor the timetable.

Reference: Lines 252 – 254 to provide context (unneeded descriptions of preceding bullets are deleted and successive bullets are deleted in their entirety here).

Each CERP project contains one or more of the following features:

• Surface Water Storage Reservoirs …

• Aquifer Storage and Recovery ...

• Stormwater Treatment Areas ...

• Operational Changes ...

• Seepage Management. Barriers will be built to stop the rapid underground seepage of water out of the Everglades, which today results in the loss of millions of gallons of water each year.

Response #4: The design and implementation of large scale seepage management facilities must be done in a way that prevents harm to existing populations, utilities, and the environment. The potential for impacts must be thoroughly investigated prior to full-scale implementation of individual Everglades seepage management project features.

We are moving forward with a pilot study to test the effectiveness, constructability and cost of seepage management technologies, with the goal of keeping new, clean CERP water in the Shark Slough and out of adjacent urban canals. WE are currently in the early planning stages for this feature and a determination of cost-effectiveness will be made in the future.

The L-30 (L-31N) Seepage Management Pilot Project has considered approximately 50 seepage management technologies. No known technology was overlooked – a ground freezing option even was reviewed. A screening matrix was applied to these 50 or so technologies, and the list was winnowed down to 12 options, which through engineering analysis, yielded four alternatives:

Alternative 1: Steel Sheet Pile.

Alternative 2: Soil-Cement-Bentonite Wall.

Alternative 3: Canal Lining with Wells and Pumps.

Alternative 4: Soil-Cement-Bentonite Wall and Shallow Sheet Pile Window with Wells and Pumps (the hybrid alternative) – the Recommended Alternative

Preparation of the decision document, the Pilot Project Design Report (PPDR), began in earnest in December 2005, and the Notice of Intent to Prepare a NEPA document was issued in May 2006. The timeframe of this project, however, looks to the year 2011, as seepage management is one of the most complex CERP features due to its likely effects on utilities, potential for saltwater intrusion, and possibility of estuary impacts.

Comment #5: *Water Reservation Approval and Allocation (Dr. Richard Meganck, United Nations University for Water Science and Education)*

Is it a correct assumption that the State House and Senate must approve reservation of, through a series of Water Resource Development Acts and based on a request from the District, the water that has been identified for each CERP project? If this is the case, under what circumstances would the District revert to "otherwise legally allocate" (line 286) water resources for a project?

Reference: Line 286 shown within context.

Under federal authorization, and prior to initiating construction, the District must reserve through adoption of water reservations, or otherwise legally allocate, the water for the natural system.

Response #5: No. For CERP Projects to achieve the natural system benefits as identified in the PIRs two categories of water must be protected: Existing natural system water that is identified at the time the PIR is developed, and the water made available by the CERP project.

The District will reserve or protect through its allocation authority the water made available by CERP projects for the naturals system. The federal Water Resources Development Act of 2000 requires that the Secretary of the Army may not execute a Project Cooperation Agreement until the reservation or allocation of water for the natural system identified in the Project Implementation Report is executed under state law.

The Regional Water Availability Rule protects existing Central and South Florida system water in the Everglades (defined as covering Palm Beach, Broward and Miami-Dade counties). Initial water reservations or similar future rulemaking efforts will be used in areas not covered by the Regional Water Availability Rule, such as the Indian River Lagoon – South project.

The Rule prevents increased consumptive use withdrawals from natural systems (waterbodies) for consumptive use. It is the District's Governing Board's decision that water needed for Everglades restoration and restoration of Loxahatchee River watershed is not allocated for consumptive use. This specifically, prevents increased consumptive use withdrawals from the Lower East Coast Waterbodies (Everglades) and conveyance canals, and from the North Palm Beach County/Loxahatchee River watershed waterbodies and major conveyance canals.

Comment #6: *Acceler8 Design Activities (Ernie Marks, Florida Department of Environmental Protection).*

1. Line 417 – Statement that design activities are near completion for "all of the Acceler8 projects." Is this just for District A8 projects? Projects that have been given to the USACE have a different schedule. Suggest defining "near completion" (for example-post-60%/Intermediate Design).

Reference: Lines 415 – 417 to provide context.

The District initiated the Acceler8 program to expedite the design and construction of several important CERP and Long-Term Plan restoration projects and STAs. Design activities have been completed, or are near completion, for all of the Acceler8 projects.

Response #6: The CERP Annual Report covers the District's fiscal year, October 1, 2006 through September 30, 2007, hence the disclaimer, "This status of current CERP projects will be

updated at the end of the District's FY2007 in the final 2008 SFER." In order to meet the production deadlines for peer review of the Draft Volume I chapters, this report was written in large part during July and August. It will be updated after the close of the District's fiscal year.

The general statement in the draft will be replaced in the final report, with project specific examples, including some milestones that will spill into the new fiscal year, so that the report is fresh and as current as possible as it goes to press in early 2008. Excellent progress has been and continues to be made in design of Acceler8 projects. Some of the pending Acceler8 design milestones include: C-111 Spreader Canal (Frog Pond Reservoir) 30% Design (October 12); C-43 Pump procurement Plans and Specifications (October 15); EAA STA Compartment B Build-out - STA Preliminary (30%) Design Report Package (October 18); LOFT – Lakeside Ranch – Brady Ranch Pump Station Configuration (October 19); L-8 Reservoir –Temporary pumps 100% Plans, Specifications, Calculations, Summary of Comments and Cost Opinion (October 19).

In addition to the great progress in design, under Acceler8, 5,274 acres of new Stormwater Treatment areas have been constructed, and an additional 12,700 acres are under construction. The 190,000 acre-foot Everglades Agricultural Area Reservoir is under construction. Preliminary activities are bringing the C-43 and C-44 Reservoirs close to construction ready status. And during the final week of September, the Supreme Court of Florida issued a revised opinion, revising a prior ruling, and now allowing the District to continue using its selected method – Certificates of Participation – of financing Everglades restoration projects.

Part of the evolution of Chapter 7A has been to move the full, detailed project status reporting, as required by Florida Statute (the "470 Report") from the main chapter into Appendix 1. Appendix 1, which includes financial information, is prepared jointly by the District and the FDEP. Readers will find detailed revenue, expenditure and unencumbered fund balance information in Appendix 1, as well and the status of each individual CERP programmatic element, project, Critical Restoration Project and Acceler8 Project.

Readers are reminded that Acceler8 is an initiative of the State of Florida, which is being implemented by the District to expedite the design and construction of certain projects and components of CERP and other programs and initiatives that are compatible with the goals of CERP. The CERP/Acceler8 projects for which the Corps has assumed the lead from the District are simply off the fast track and back in to the regular sequencing and scheduling of CERP projects.

Comment #7: *Chapter 7A/B Accountability Review (Robert C. Ward, Florida Department of Environmental Protection)Chapter 7A, lines 511-529, discuss the status of RECOVER, but do not indicate an implementation timeline for formal assessments of CERP's impact on ecological condition. From reading Chapter 7B it appears that RECOVER is in a baseline monitoring phase while projects are constructed. When will RECOVER begin to report the results of project implementation?*

Response #7: RECOVER's baseline monitoring program was not all begun at one time; particularly in cases where it leverages data collected by other entities or for other purposes. As a consequence, in some cases we may have a 20+ year baseline data set whereas in others we may only have 2 to 3 years of data. Power analysis has been used to establish required baseline monitoring durations for most parameters and these values range from 3 to 5 years to up to a decade depending on parameter and geographic area. However, overall, in those portions of the system where early construction of restoration projects is anticipated, sufficient baseline monitoring data has been acquired to be to support a shift to project implementation effects monitoring as projects come on line.

Comment #8: *Chapter 7A/B Accountability Review (Robert C. Ward, Florida Department of Environmental Protection) Has the agreement, earlier this year between the Department of*

Interior, Corps of Engineers, and the State of Florida, creating 'interim goals for restoration' impacted RECOVER's implementation and reporting plans?

Response #8: The referenced agreement was executed in accordance with the CERP Programmatic Regulations. Currently RECOVER is revising the Monitoring and Assessment Plan (The MAP), Interim Goals and Targets (IG/IT), and the structure of the System Status Report (SSR) based on lessons learned over the past several years; with the overarching goal of better aligning these metrics and reporting devices. The agreement did not affect RECOVERS implementation and reporting plans.

Comment #9: *C-1 Canal MOU (Ernie Marks, Florida Department of Environmental Protection). Line 428+ - Suggest including reference to completion of design and construction of the C-1 Canal Improvements. Should reference to the proposed MOU Section 24 Impoundment and Pump Station for design, construction and operation by VOW be included here?*

Reference Line 428 – 434.

Acme Basin B Discharge Project (Long-Term Plan project): Construction is under way on the Acme Basin B Acceler8 Project. Pump station 7 was relocated to the west of Flying Cow Road to be designed, constructed, and operated by the Village of Wellington. The preliminary 30 percent design is complete for the Section 24 Impoundment and pump station, and value engineering was completed on Section 24 to reduce construction costs. The Village of Wellington plans to construct a nature center adjacent to the Section 24 Impoundment, relying on the impoundment's wetland features as an attraction.

Response #9: Your suggestions are appreciated, and will be included in the final main chapter report or in Appendix 7A-1, the CERP Annual (470) Report, which encompass the District's Fiscal Year 2007: October 1, 2006 through September 30, 2007.

Comment #10: *Biscayne Bay Coastal Wetlands (Ernie Marks, Florida Department of Environmental Protection). Line 435+ L-31E culverts permit has been issued & pre-final plans for Deering are due in late October. Cutler Flow-way design is scheduled for completion in November 2007. Reference Lines 435 – 440.*

Biscayne Bay Coastal Wetlands Project: Design work on the Acceler8 components of the Biscayne Bay Coastal Wetlands Project are under way (Deering Estates, Cutler flow-way, as well as L-31E culverts). Applications have been submitted for the 404 and 1502 permits for the L-31E culvert and Deering Estate project components. Pre-final design was completed in June for the L-31E culverts, as was the intermediate design for the Deering Estate flow-way. Intermediate design of the Cutler flow-way is scheduled for completion in September 2007.

Response #10: Thank you for this update, which will be included in the final main chapter report or in Appendix 7A-1, the CERP Annual (470) Report, both of which encompass the District's Fiscal Year 2007: October 1, 2006 through September 30, 2007.

Comment #11: *Year of Transfer (Ernie Marks, Florida Department of Environmental Protection). Line 441+ – June 2007? Please clarify what year is being referenced. Reference Lines 441 - 446.*

Broward County Water Preserve Areas Project: In June, the District's Governing Board approved the transfer of the design completion and construction on C-9 and C-11 Impoundments. These impoundments are Acceler8 features of the CERP Broward Water Preserve Areas Project. In June, the District's Governing Board approved the transfer of the WCA 3A/3B Seepage Management Area project (Acceler8 Initiative) to the USACE for completion of design and construction.

Response #11: This being the CERP Annual Report, when a year is not stated, it is the current year, 2007, a convention that is observed throughout the report. One such example appears in the reference to the comment above. The author and contributors are careful to distinguish activities

during Fiscal Year 2007, which crosses two calendar years, as well (October 2006 through September 2007).

Comment #12: *C-43 Permits (Ernie Marks, Florida Department of Environmental Protection).*

Line 447+: pre-final plans submitted in September 2007 with 1502 permit for construction pending. Reference Lines 447 – 450.

C-43 Basin Storage Reservoir Project: The conceptual engineering and design are complete for this Acceler8 project. Preliminary Engineering, 30 percent design and the final Biological Assessment are complete. Project permit applications are under review by federal and state agencies.

Response #12: Thank you for this timely information. Additional updates that will be included in the final report include: Completion of the Final Project Implementation Report, which was posted in the Federal Register on September 21. The Reservoir Design is continuing as planned, with the 90 percent constructability review scheduled for October 3. Project funding issues are awaiting the District's Governing Board's resolution.

Comment #13: *Picayune Strand Design Status (Ernie Marks, Florida Department of Environmental Protection).*

Line 451+ – Please include the status of design activities. Reference Lines 451 – 453.

Picayune Strand Hydrologic Restoration Project: In June 2007, the District's Governing Board approved the transfer of the construction of the Picayune Strand (Southern Golden Gate Estates) Restoration project (Acceler8 Initiative) to the USACE for construction

Response #13: The Project Manager will provide an update that will be included in the final report.

Comment #14: *EAA Reservoir A-1 (Ernie Marks, Florida Department of Environmental Protection).*

Line 454+ – Design of the reservoir has not been "completed". Intermediate plans for structures and pre-final plans for the embankment will be complete by 9/07. Design of bridge for US 27 is still preliminary. Reference Line 454 -457.

Fran Reich Preserve Project: The District has accepted a proposal by the USACE to complete the design and then construct the Fran Reich Preserve project (Acceler8 initiative) as a part of the federal government's share of CERP. Start of construction will be contingent on Congressional authorization of the projects and subsequent appropriation of funds.

Response #14: The U.S. 27 Bridge is not part of the Fran Reich Preserve Project. The project in question is more likely the EAA Reservoir A-1 Project, for which we thank you for this update. Also included in the final report will be the following milestones. Guaranteed Maximum Price (GMP) 1 task is complete. GMP 2 is 19.2 percent complete (the crusher set-up is 72% complete); crushing plant components are being assembled; start-up is scheduled for November 16, with production to start in December. GMP 3 is 37.5 percent complete; 3.2 miles of canal excavation are complete; with the remainder of the contract expected to be complete in May 2008. For GMP 4 negotiations were held during the final week of September; a final price from the selected contractor is expected on Monday, October 1, 2007.

Comment #15: *Indian River Lagoon – South Project (Ernie Marks, Florida Department of Environmental Protection). Line 464+ –Construction contracts have been delayed. Clearing work is underway or complete. Please update as necessary. Reference Line 464 and subsequent lines.*

Indian River Lagoon – South Project: Construction of restoration features at Allapattah Ranch, a component of the Indian River Lagoon – South project is under way. Construction started on the C-44 Reservoir/STA project (Acceler8 Initiative). Construction started in October 2006, and

three contracts are currently under way for site preparation and reconfiguration of existing irrigation and drainage canals. Some site preparation is already under way. Trees were cleared from 1,590 acres.

Response #15: Thank you. The Project Manager's update will be included in the final document.

Comment #16: *C-44 Construction (Ernie Marks, Florida Department of Environmental Protection). Figure 7A-2 – C-43 is 90% complete. C-44 construction is preliminary activities, not the reservoir.*

Captions in the Map's Call-Out Boxes Read:

C-43 Reservoir Test cells complete; Design 60% complete

C-44 Reservoir/STA Test cells complete; Construction underway

Response #16: Thank you for these technical corrections, as of the end of September, on this graphic, which was prepared in June. Please note that the intent of the graphic was to provide a quick and easy visual, not to mislead the readers into thinking that construction of the actual C-44 Reservoir is in progress.

Comment #17: *Appendix 7A-2 (Ernie Marks, Florida Department of Environmental Protection).*

This comment was submitted after Department staff review of the draft 2008 SFER Appendix 7A-2: Picayune Strand Restoration Baseline Report. Please include preliminary conclusions on success of efforts to date.

Response #17: Thank you for your time and attention in reviewing the Picayune Strand Restoration Baseline Report. Preliminary conclusions on success of efforts to date will be addressed in the final report

Comment #18: *Appendix 7A-3 (Ernie Marks, Florida Department of Environmental Protection).*

The following comments are offered based on Department staff review of the draft 2008 SFER Appendix 7A-3: Permitted Conditions Annual Reports for A8 Projects.

Response #18: The Department's thorough review and comments are appreciated. These comments were provided in their entirety to the District's Acceler8 permitting staff, and will be addressed in the final Appendix 7A-3: Permitted Conditions Annual Reports for A8 Projects. The following responses (underscored) have been (or will be by week's end) logged on the web board.

1. *Reporting section does not mention Acme. C-44 TIWCD add "reconfiguration."* Agreed. Will include Acme and add "reconfiguration" to TIWCD.

2. *Table 1 – Please clarify. Ten Mile Creek is not an Acceler8 project.* Ten Mile Creek to be removed from section, reported elsewhere.

3. *Table 1- Please include correct permit numbers (EAA = 0242172-003-EM; TIWCD = 0254895-003-EM, etc.)* Agreed. Will review all permit numbers for accuracy.

4. *PSRP: Verify May 4 date. Volume 1, 7A has February for initial road work completion and construction meetings have June 2007 for substantial completion date of the larger road removal. Please correct. Revised statement that "this work has been completed as part of the removal of 65 miles" to "this work was completed in conjunction with" since there were 2 contracts. DEP needs to receive close-out documents for permitted activities on PSRP.* Will verify/correct dates for road work completion. Will review wording and correct as needed. Close-out documents are in submittal process.

5. *EAA Reservoir: Suggest deleting "to date" since this report period is through 9/07. Provide updated completion information and verify %complete (35% is low based on numbers in report – construction meetings have 66%). or "problems encountered/actions" there should be something brief on the blasting (i.e. coordination with FDOT on shutting down US 27 and adjustments to ensure all canisters ignite).* Report will be updated to include completion status, blasting coordination update and events that have occurred since the initial draft was written.

6. *C-44: Add "Temporary Reconfiguration". The statement that the project was built according to the permitted plans with no deviations is not entirely correct. Original plans had the Minute Maid bridge to remain, but it was replaced with culverts when bridge issues arose during testing phase. This should be captured as a "problem encountered". Also, the Running W canal needed to be extended based on the results of the testing (maybe this is a "conclusion regarding success" item).* Agreed. Will address in final document.

7. *Note that culverts on Janes were shortened to avoid impacts so there were changes to permitted plans. Need to receive close-out documents. For the "conclusion regarding success", it would seem that a sentence or two on preliminary results would be appropriate. Was there was in issue with burning during the dry season?* Will review with Project Manager and add details as requested. Close out docs are in submittal process.

Comment #19: *Appendix 7A-4 (Annet Forkink, Florida Department of Environmental Protection)*

The South Florida Water Management District Resources Assessment Department prepared a Draft Annual Water Quality Assessment Report for the L-8 Reservoir Project to evaluate the results of the Testing Project monitoring program. The report covers the period from May 1, 2006 through April 30, 2007.

Response #19: The District appreciates your careful attention and thoughtful comments in the matter of the draft Appendix 7A-4: Annual Water Quality Assessment Report for the L-8 Reservoir Project. These comments were provided in their entirety to the Resource Assessment Department to be addressed in the final document. The following responses (underscored) have been logged on the web board.

1) *Executive Summary, second paragraph: To clarify permit conditions, please change the following sentence as follows*: *"The* ***discharge*** ~~*only*~~ *water from the L-8 reservoir Project* ~~*that*~~ *is required to meet Class III water quality criteria* ***at*** ~~*is*~~ *the discharge location, and it* ***shall*** ~~*can*~~ *not adversely impact water quality in the M canal which is classified as Class I water."* These changes have been made in the final document.

2) Page 2, second paragraph: *It is stated that the criteria limit for copper cannot be calculated because hardness data were not collected. Why were copper data collected without also collecting the hardness necessary to calculate compliance? It is agreed that there is most likely not an issue with copper within the pits or downstream in the L-8 canal. Given the high conductivity in the pits and canal the hardness is probably high enough to prevent an exceedance of the copper criteria. In the future, all necessary ancillary information needs to be included in order to determine compliance.* According to the original permit the District was not required to sample for hardness so it was never done. In the new permit, metals were eliminated from the monitoring program.

3) Page 9, third paragraph: *Please explain the abbreviation Qftg. Quaternary Fort Thompson Group*. The text on page 9 of the Appendix has been updated in the final report.

4) Page 15, Table 2: *Please include Mercury criteria as mentioned in the text.* This change has been made in the final document.

5) Data Summary Tables: *Please provide summary tables for pesticides and sulfate as well an evaluation/ summary of the data.* Pesticides and Sulfate were never on the monitoring list.

6) Summary Figure: *Please provide a summary figure for flow and stages*. Flow and stages are now summarized in the final document.

7) Page 21: *The report notes that Gross Alpha was elevated at the L8 canal inflow site, just after the August 2006 outflow event. The District and the Department should continue to work together to evaluate the conclusions as discussed in the report.* Agreed. Thank you for this comment.

8) Page 30, first paragraph: *Please replace the word "Bass" with "game fish".* The type of fish to be sampled is specified in the permit. The report, which reflects the permit, can not be changed.

9) Conclusions: *High chlorides and conductivity levels that occurred during the discharge event are not mentioned. The extent of this draw down, the influence of groundwater seepage and the effect on water quality deserves some discussions.* Agreed. This change has been made in the final document.

10) *General comments: A. The report covers the period from May 2006 through April 2007. During the period of this report (May 2006 through April 2007) there were no inflow events and only two outflow events. Only the August 2006 outflow event extended beyond a one-day discharge period. It needs to be considered that there was only one major outflow, as it appears that this discharge event elevated Gross Alpha, Chlorides and Conductivity in the L-8 Canal (at the inflow monitoring station). The report does not discuss this. Furthermore, the project has not yet captured surface waters from the L-8 Canal. Since this is the ultimate goal of this project, it should be explained that the water quality data collected may not be indicative of future operation. The section that discusses the operation should provide a discussion about the actual operation that took place. These items should also be included in the results section and the conclusions.* Thank you. The final report will address some of these comments.

B. *The District may want to consider not to include all custody records and field notes in appendix C, but to include a "available upon request coversheet", to help reduce the number of pages and size of this document.* Before this permit was required to be reported in the SFER, all of the data were saved on a CD. Before this Appendix is included in the final document, however, staff will confer with the District's Environmental resource Assessment Department regarding this recommendation vis-à-vis the released Notice of New Data Disclosure Policy, which is now in effect for the *2008 South Florida Environmental Report*. This policy was issued to ensure that all interested parties, including the public and other government agencies, have complete access to all data and information that is communicated and published in the annual South Florida Environmental Report.

RESPONSES TO COMMENTS ON CHAPTER 7B

Kimberly Chuirazzi

Subject: Response to Comments for Draft Chapter 7B
Document posted as: 2008 SFER_RTCs_Ch7B_kjc.doc
Originally Posted: 01 Oct 2007 08:33 AM

Comment #1: *Can the experience of the RECOVER team in working with multiple variables and developing project performance measures and monitoring plans (lines 86-87, 95,109-111, 133-139) contribute to the goal of developing an integrated water quality monitoring program as discussed in Chapter 1B?*

lines 86-87: …it continues to better integrate the set of systemwide performance measures and interim goals and targets…

line 95: … development of project performance measures and monitoring plans.

lines 109-111: The System Status Report is unique in that it examines trends in physical, chemical, and biological/ecological variables that the CERP is expected to affect in the context of conceptual ecological models and groups of working hypotheses that are described in the 2006 Assessment Strategy for the Monitoring and Assessment Plan.

lines 133-139: Water quality monitoring and assessment is based on hypotheses that restoration of more natural quantity, quality, timing, and distribution of fresh water will alter salinity regime and affect dissolved and particulate nutrients delivered to the estuaries, which, in turn, will affect primary production and food, internal nutrient cycling rates and biogeochemical processes, and phytoplankton blooms. Salinity and chlorophyll a are utilized as indicators to assess water quality status and trends.

Response #1: RECOVER staff are actively participating in an internal working group that is attempting to optimize water quality monitoring in Water Conservation Area 2A. RECOVER has a vested interest in the success of this effort since nearly all water quality data used in its assessment activities is leveraged from other water quality monitoring programs. However, it should be noted that RECOVER generally has had a far easier time in designing monitoring programs since it has primarily needed to be responsive to only 2 key mandates, detection of system-wide change and providing data for adaptive management, whereas the District's water quality monitoring program has evolved in response to a far more diverse and complex group of mandates.

Comment #2: *The comment beginning with line 280 on the trends and status of the seagrass beds in the Southern Indian River Lagoon and the St. Lucie Estuary are directly related to discharges from Lake Okeechobee and hurricane intensity. Is it a correct assumption that the CERP activities identified in Chapter 7A for these areas will reverse these trends or are there other actions contemplated? Perhaps a more fundamental aspect of this question refers to the level of coordination between the RECOVER and CERP work programs.*

lines 28 –287: Less than 50 percent of potential seagrass habitat (<1.7 m deep) in the Southern Indian River Lagoon and St. Lucie Estuary is covered by seagrass. This estuary has 19,799 acres of potential seagrass habitat. From 1986 to 1999, seagrass coverage ranged from 7,808 acres in 1999 to 9,864 acres in 1996. An initial review of seagrass mapping data from 1999–2006 shows that seagrass acreage in the section of the lagoon between Stuart Causeway and St. Lucie Inlet,

which is influenced by St. Lucie River discharges, remained fairly stable from 1999 through 2003. Acreage of dense, continuous seagrass declined dramatically following the 2004 and 2005 hurricanes and associated Lake Okeechobee discharges.

Response #2: In so far as seagrass losses in the Southern Indian River Lagoon and the St. Lucie Estuary are related to Lake Okeechobee discharges, the various CERP and A8 sponsored water storage features located around Lake Okeechobee and in the watershed, coupled with related changes in the lake's operating schedule, will provide improvements in the volume, timing and distribution of water thereby reducing frequency of high volume discharge events. It is generally recognized that storage volume provided by existing planned projects is not enough to fully resolve the problem of high volume discharge events and various state programs, including the new (2007) Northern Everglades and Estuaries Protection Program are targeted at providing additional water storage and treatment features. Nevertheless, it needs to be recognized that regardless of how much storage is built there will almost certainly continue to be catastrophic natural events that exceed the system's capacity to prevent large-scale environmental damage.

Comment #3: *Is the marine phosphorous referred to in line 382 of this chapter naturally occurring? Are the groundwater P loadings noted also naturally occurring or can they be traced to man-influenced activities? Are there historic baseline/trend data concerning the increasing concentrations of periphyton TP in the Southern Everglades or is there some other explanation for this increase? (perhaps a particular type/intensity of hurricane dredging and re-suspension of P?)*

lines 381-383:…marine phosphorus (P) and freshwater nitrogen (N) sources as well as marine-derived P loadings from groundwater.

Response #3: Since there is relatively little baseline data available, it is difficult to discuss any of these results, including periphyton P concentration, in terms of trends. Rather, they are newly elucidated relationships that will require further monitoring and study to fully understand them. In general, marine environments tend to have high P and low N contents relative to freshwater systems. Given the location of the study area, significant local anthropogenic phosphorus inputs are unlikely. However, at the same time, we are aware of major non-local sources of anthropogenic P input to the Gulf of Mexico. It is possible that the 2004 and 2005 hurricanes pushed large quantities of marine sediments up into coastal areas and may be a potential contributor to the high P concentrations encountered. Similarly, we do not have a concrete answer to the question of whether groundwater P in this area has an anthropogenic origin but we are currently supporting some research that may help to clarify this issue.

Comment #4: *The comment under lessons learned beginning on line 636 seems to imply a level of application-monitoring that will be extremely difficult to attain. It is one thing to determine "pre" and "post" conditions, but quite another to distinguish between a number of applications occurring after a baseline has been established. Is what proposed realistic and, if possible, how will it contribute to the overall CERP goals in such a way that it can possibly be applied in other areas?*

lines 636-639: While monitoring and assessments have been focused, to date, on establishing pre-CERP condition, future assessments will require forecasting changes based on functional relationships between stressors and ecological effects to distinguish CERP-impacts from non-CERP impacts.

Response #4: The reviewer is essentially correct and this text needs to be refined. Given RECOVER's monitoring experience over the last several years, we have become very focused on impacts of major stochastic events such as hurricanes and droughts. The intent of the referenced text was to suggest that it is both possible and necessary to distinguish between restoration effects and system responses to major environmental perturbations. RECOVER is well aware that is will

generally be impossible to distinguish between system-wide restoration effects from various projects of the same type (e.g., reservoirs) in the same geographic subregion, or to distinguish restoration effects from other gradual environmental changes on a system-wide level.

Comment #5: *The lesson learned beginning online 643 seems to be a self-fulfilling prediction as interim goals can only be reached by successfully reaching an unspecified number of performance measures. The panel has consistently supported the concept of restoration being progress in reaching any number of broad indicators in the general direction of the project/program goals. Are you proposing something more definitive leading to a more precise measure of success? If so, can you please elaborate.*

lines 643-646: Assessments have focused attention on the relationship between performance measures and interim goals and how they may be used to develop "triggers" or "thresholds" for initiating an adaptive management response.

Response #5: In the continuing effort to refine RECOVER's monitoring and assessment program we are striving to develop a better alignment between regional performance measures, system-wide performance measures, and interim goals and targets. However, the referenced statement in the Lessons Learned section primarily focused on our perceived need to develop thresholds or triggers keyed to system-wide performance that would initiate adaptive management feedback loops for individual restoration projects.

Comment #6: *In the panel report on the 2007 SFER, mention was made to the logic of providing a short explanation of the ecosystem benefit quantification methodology referred to in lines 170–173 (2007 report) as it could be confused with the performance measures. I did not find text to clarify this potential confusion. Can you shed any light on the importance of this matter or any possible solution?*

Response #6: RECOVER has responsibility for two key evaluative products designed to assist project development teams (PDTs) in their work. The first of these is a performance measure consistency review that assures performance measures selected by the PDT to evaluate various project alternatives are congruent with approved RECOVER performance measures and consistent with project goals and intentions and CERP system-wide goals. The second product is a regional evaluation, which is a semi-quantitative narrative based on modeling output and best professional judgment. It describes how the project will perform in the larger CERP context. While both of these products are required components of the project implementation report (PIR), they are not directly used in evaluating and ranking projects for Federal funding. Rather, a different evaluative tool, identified as ecosystem benefits quantification, is developed that expresses project effects as habitat units and includes a cost benefits analysis component. While RECOVER may assist in the development of this section of the PIR, primary responsibility for producing it resides with the US Army Corps of Engineers. Recently, concerns have been expressed at senior levels that the current approach to benefits quantification is seriously flawed and RECOVER is currently engaged in developing suggestions for alternative methodologies.

Comment #7: *Chapter 7B is a 2007 report with a 2005-06 reporting period. Most of the 2008 SFER has a 2006–2007 reporting period.*

Response #7: That is correct. Part of the disparity is due to the fact that the 2008 SFER is a report that is in development now with a publication date in 2008, whereas the System Status Report is in its final editorial phase and will be published in mid-November 2007. The System Status Report is assembled from work of a large number of contracted independent scientists and monitoring entities and it is a long and arduous process to integrate and synthesize data within and across the various geographic modules. It is unfortunate that the need to present the System Status Report in the much abbreviated format reflected in Chapter 7B of the SFER masks this

unique attribute of the document. RECOVER would welcome your review of the complete System Status Report, which will shortly be posted at evergladesplan.org.

Comment #8: *Figure 7B-3 utilizes a stoplight map to summarize chlorophyll a. A legend to explain the colors is missing.*

Response #8: Text explaining the meaning of the colors used in the referenced stoplight figure will be added to the figure caption in both Chapter 7B of the SFER and in the RECOVER System Status Report.

Comment #9: *The stoplight is used only in this one figure, but it seems to have much wider potential application. Are there plans to expand use of this visual way to report quantitative information?*

Expanding this line of thinking, is it possible to demonstrate alternative ways of visually presenting baseline conditions in the System Status Reports – as a way of testing the communication effectiveness of various indicator presentation formats? The stoplight method is one presentation format that is widely accepted. Edward Tufte (http://www.edwardtufte.com/tufte /index) has produced a number of books that discuss options for the visual display of quantitative information. Such 'testing' also presents readers with the opportunity to familiarize themselves with options for the visual display of CERP performance measures, thus assisting those designing the final performance measure in choosing visual graphics.

Can the stoplight method report conditions across time in the same ecosystem area – as is done with time series in Figure 7B-6?

Response #9: This figure was excerpted from a draft South Florida Ecosystem Restoration Report Card that the Science Coordination Group is developing. While it may be suitable for this purpose, the editors of the System Status Report feel that it does not reflect the level of integrative science that the conceptual ecological model- , hypothesis cluster-based format that is one of the guiding principles of the System Status Report. On the other hand, the editors, in conjunction with the District's Department of Creative Services are in the process of developing a graphic summary document to accompany the full System Status Report and are investigating stop light graphics and other novel ways of representing ecological data in easily comprehensible formats. I have passed on the Edward Tufte web address to them.

Comment #10: *RECOVER is a challenging, but very necessary, aspect of managing water resources and related ecosystem health in the 21st century. The issues facing RECOVER are similar to those facing all large ecosystem health management efforts. Thus, RECOVER is on the cutting edge of learning how to report ecosystem health in a sustainable water management context.*

Response #10: We concur.

RESPONSES TO COMMENTS ON THE DRAFT 2008 SFER — VOLUME I, CHAPTER 8

Tracey Piccone

Subject: Response to Chapter 8 Comments by Tracey Piccone
Document posted as: Piccone response to Ch 8 comments_2008_SFER.doc
Originally Posted: 27 Sep 2007 08:05 AM

Responses to Peer-Review Panel comments

Neal E. Armstrong

Comment #1: *All comments were generally favorable from an accountability level review, however, one comment noted that the reader is consistently left with the impression that they know little about THE PLAN. It would help is a succinct description of the elements of the Plan was included in the Chapter.*

Response #1: Earlier versions of the SFER did include a high level summary of the Long-Term Plan but it was taken out in the 2007 version as part of the District's approach to streamline reporting and eliminate redundancy. Further details on the plan can be found in the 2006 SFER – Volume I, Chapter 8, as well as the District's web site at www.sfwmd.gov/STA.

Richard Meganck:

Comment #2: *As this chapter addresses water quality in the EPA, is it logical that it be maintained as a stand-alone chapter or merged with chapter 3A in future SFERs (Status of Water Quality in the EPA)?*

Response #2: Chapter 8 is highly interrelated with more than just Chapter 3; it also highly interrelated with Chapters 4, 5, 6, 7A, and 13. Chapters 3, 4, 5, 6, and 7A contain status updates and results for various Long-Term Plan projects. Chapter 13 summarizes the Everglades program expenditures, including the Long-Term Plan annual and future costs.

Comment #3: *In the short discussion about Adaptive Management, (beginning with line 162), reference is made to STA optimization activities and BMPs. It is clearly stated that the results of these activities are being used to develop plans for sediment removal in canals upstream of STA inflow structures. Yet in line 169 it is stated that the first sediment removal project is scheduled to "occur in FY 2008." If the experience of adaptive management is already being employed, was there a pilot phase that produced data to support the earlier statement? If not, on what basis can the statement that these activities are being used to develop future plans be made?*

Response #3: The sediment testing and characterization study was completed in FY2007 and the results of the study were used to develop plans and specifications for dredging in FY08 of District canals upstream of STA inflow structures. I am not completely clear on the question so further discussion can occur at the 2008 SFER workshop if this response does not address the comment.

Comment #4: *The process of the District submitting requests to modify the EFA seems logical as presented, (beginning in line 176). However, I do not recall that the EFA has been altered in previous years. If this supposition is correct, when are results expected from the four projects approved and discussed? How will any results be integrated into the overall water quality*

chapters of the SFER? It seems that the implications for other water quality projects are potentially very important.

Response #4: The 1994 EFA was revised once, in 2003, but the District does not request revisions to the EFA, instead it requests revisions to the Long-Term Plan. Numerous revisions to the Long-Term Plan have been proposed by the District and approved by FDEP. This is the Adaptive Implementation component of the Long-Term Plan which was required in the EFA:

Revisions to the Long-Term Plan shall be incorporated through an adaptive management approach including a process development and engineering component to identify and implement incremental optimization measures for further phosphorus reductions.

The overall EFA water quality goals do not change when the Long-Term Plan is revised. Therefore, other SFER chapters are not impacted unless they are chapters that contain Long-Term Plan projects and they are revised accordingly when Long-Term Plan revisions are approved.

Comment #5: *I am not clear as to how the outputs from water quality projects in the STAs and on-farm BMPs are being utilized by the FDEP permitting process as related to the EFA and ultimately water quality that enters the EPA. Is the State receiving this information and how are they using it to adjust the application of the EFA (apart from activities initiate by the District and discussed in the Adaptive Management section of this chapter. Any clarification on this issue would be appreciated.*

Response #5: When the FDEP reviews requests for Long-Term Plan revisions, they consider whether or not the Long-Term Plan revision impacts any project specific permits, and if so, the permits are to be revised accordingly.

RESPONSES TO COMMENTS ON 2008 DRAFT SFER – VOLUME I, CHAPTER 9

Amy Ferriter[3] with Chapter Co-Authors

Subject: Responses to Chapter 9 Comments
Document posted as: SFER Review Responses Chap9.doc
Originally Posted: 26 Sep 2007 04:22 PM

Joanna Burger

Comment(s) #1: *OVERALL.One of the advantages of the CERP and RECOVER programs for the Everglades is the potential to respond to new and emerging problems that the overall ecosystem faces. Examining and understanding nonindigenous species is on of the key components of any Everglades recovery program. The holistic approach of trying to catalogue all nonindigenous plants that seem to be (or could be) a problem in the Everglades is a daunting task, but an essential one, and this chapter is an excellent start. The chapter provides an excellent overview of the species biology of several nonindigenous invasive species.*

There remain two main problems with the chapter and approach to these species: 1) It is not clear what is being done with most species, or groups of species, to control them, and 2) It is not clear that the program is pro-active in identifying potential problem species before they become a problem. A third problem has to do with organization of the report: it skips from topic to topic. For example, the agencies involved are mentioned in several places, which is unnecessary, and the areas being covered are also mentioned several places. There should be an introductory section that lists the objectives, agencies, areas to be covered; followed by the monitoring and assessment sections.

SUMMARY. The summary places the problem of nonindigenous species within the context of restoration in the Everglades, and appropriately indicates the overall lack of knowledge for many of these species. For the general public, it would be useful to have some overall observations or conclusions about the impacts of these species (and some indication of the key invasive and problematic ones) in the summary.

THE NONINDIGENOUS SPECIES PROBLEM IN SOUTH FLORIDA. A number of agencies and organizations have recognized the problem of nonindigenous species, particularly nuisance plants and animals whose populations are affecting native species. This problem seems to be one that has received the administrative attention it deserves, and several groups are working together to develop a database that can be used by all to track invasive species. The chapter rightly identifies one of the main problems: that invasive species work has centered around those with agricultural or other economic effects, rather than those species that cause ecosystem disruption. A table might be useful to identify the agencies and groups that are involved with the nonindigenous species problem, and what their tasks are.

BIOLOGICAL MONITORING FOR NONINDIGENOUS SPECIES IN SOUTH FLORIDA. One of the key management tools is to track the spread and abundance of nonindigenous species so that the spatial and temporal aspects of the problem are known to all managers, public policy makers and the public. Much of the monitoring is still aimed at the large, invasive tree species that can be easily monitored from the air to arrive at good estimates of acreage of each species. While this is useful for these species, it does not address smaller plants and most animals that would not be visible from the air.

AN ASSESSMENT OF NONINDIGENOUS SPECIES IN SOUTH FLORIDA. The authors are to be commended for including animals in this chapter, despite the lower quantity and quality of much of the data. It is a start on a very difficult task, and Table 9-2 is excellent (although some indication of severity could be indicated by a larger letter X).

[3] Boise State University, Boise, ID

The exotic plant indicators are excellent, and a similar plan should be instituted for animals. It would also be useful to take the most invasive plants and have one chart that shows them in all the regions (e.g. Table 9-4 and so on).

The descriptions are excellent, and include a short history, effects, and where it occurs, the control measures. In all cases, it would be useful if there were an introductory sentence in each subsection that discussed the plants to be described for that section. It would also help if for each major plant species (or animal for that matter), a statement was made about its legal use (that is, is it sold, illegal to plant it?). The cross-referencing for descriptions of the same species in different modules is excellent (although in the final version it would be helpful if the editors actually put in page numbers so the reader can easily find the sections on the same species).

Florida Keys: Feral cats, as duly noted, as a problem throughout the world, and very extensive public relations programs are necessary. This effort should be greatly increased throughout South Florida and the US generally. We have not done enough about this particular problem.

I wonder whether the monitoring efforts should include an eradication program as they are occurring. That is, would it be wise at this point to remove all pythons found, especially in view of their eating endangered species.

Florida Bay: This section needs some re-organization to have the same organization as others. Descriptions should include the same order of ideas from a natural history, to extent of the problem, to control measures for each problem species.

Greater Everglades: This section is extremely important, and details the greatest problems faced by the Everglades. The efforts to control the most invasive and problematic plant species are on-going, and simply require more money, time and effort to prevent large-scale ecological changes to the Everglades. The occurrence of two haplotypes of Brazilian pepper is extremely interesting, with major consequences for control, duly noted. This illustrates the complexity of the control issues, and makes the report outstanding.

The python seems to be the species of greatest concern for a wide range of key native animals species in the Everglades, and one that will have myriad cascading effects. Every effort should be made to control them (legal, educational, removal, and reproductive control). Since pythons are egg-layers, a study should be initiated to determine where they nest and to eradicate the eggs. Breeding them in captivity should also be made illegal.

The recent invasion of Sacred Ibises breeding is extremely interesting, and since it is so recent, it can be controlled at this point, and this should be done now, before it becomes another Cattle Egret in North America. No efforts of control are mentioned, and they should be considered.

Response #1: While no control efforts have yet been devised for this species, researchers at Florida Atlantic University are actively engaged in work on this topic. Information will be included in the SFER as available, but likely will not be part of the 2008 report.

Comment #(2): *Big Cypress. This section is clearly written, and clear. The complexities of the feral hog problem typify the problems of invasive species generally. There are often interests that want a given species to remain, and how to deal with different stakeholders is critical (and this topic may deserve a species workshop overall).*

Northern Estuaries – West. Given the problems with reptiles in this and other modules within the region, it seems prudent to convene a workshop to address these problems, figure out the best control measures for each species, and talk about overall funding, as well as a public education program. Some of these species promise to create even bigger problems if they expand into some of the other regions.

Northern Estuaries –East. The feral hog removal experiment seems quite critical to understanding the problem in other regions of Florida, and deserves a little more attention (especially for the public readers of this report, and in light of conflicting stakeholder interest in the species). There should be expansion of the types of damage they caused, and to what species.

Lake Okeechobee. It is nice to see plants listed that has been controlled in a region. More such examples would alert the public to the positive benefits of such programs. One of the important aspects of any control

program is also to show the positive benefits, and where a species has been effectively controlled, or where managers have developed a regime that will be effective in keeping control or managing the invasive plant.

Kissimmee Basin. Some initial description of the area should be included, along with a list of the most critical species. It was useful to have a statement about which plant species (Limpograss) posed the greatest threat to restoration of the Basin (and other modules would do well to include such statements as backup to the tables). Again, it would be useful to state which plants are and are not being considered for control (and which ones are being controlled).

SUMMARY OF NEEDS AND GAPS. This is an excellent section because it places the chapter in perspective. The emphasis on animal control is good, and very necessary, especially in light of the rapid and alarming expansion of some of the snakes and iguanas. Some of the research gaps are quite large, and the program needs to develop manageable sub-goals that can assigned to particular units, managers, or entities.

General: Make each section more consistent with respect to the information included.

Response #2: Acknowledged. Each section's content will be revisited by the authors.

Comment #3: *Start each module plant/animal section with the list of species to be individual discussed.*

Response #3: Acknowledged.

Comment #4: *For the cross-references to species discussed in multiple sections, give the page numbers for easy reference.*

Response #4: Acknowledged.

Comment #5: *Include control measures for each species.*

Response #5: This information was included in previous years. In the interest of streamlining the Chapter, it was not included this year. The authors will refer readers to the previous Chapter for this information.

Comment #6: *The inclusion of a summary of needs and gaps is excellent, and places the elements of the chapter in perspective.*

Line 83: Is the MOU available for the our review committee?

Response #6: The MOU is not signed by all of the parties, but will be available within the next couple of months.

Comment #7: *Line 87: Is Weedar available for distribution to the public?*

Response #7: The system is public, interested entities would need to work with the District to assess feasibility of using the system outside the agency.

Comment #8: *Lines 99–116: It is not clear what the role of the SFWMD is in this process, since US Fish & Wildlife Service is the lead agency.*

Response #8: The District supports this work, but has no regulatory authority for importation and release. As noted throughout this Chapter, more work needs to be done on how to detect pest species early on and how to deal with these species once they become invasive.

Comment #9: *Line 115–116: What studies are being done to determine if these unintended effects are real and important for native fishes?*

Response #9: As stated in our response to Table 9-3 comments, numerous agencies are involved in efforts to study invasive nonindigenous animals, such as fish, but much of this work is fragmented and not as well documented as the control of nonindigenous plants. Measuring the results of any interaction between invasive nonindigenous fishes and native fishes in expansive

and dynamic south Florida environments is very difficult. Most efforts have been focused on determining the extent of nonindigenous fish populations, while some work has been focused on the life history of single species, such as the Asian swamp eel and Mayan cichlid. Empirical scientific research leading to strong inference about cause and effect between nonindigenous and native species is required to provide useful and value-neutral recommendations for management. It may be necessary to allocate additional resources on par with nonindigenous vegetation research in order to achieve this goal for fishes and other invasive nonindigenous animals.

Comment #10: *Lines 1–131: It might be useful to have a table that lists the different agencies with their responsibilities and tasks with respect to the nonindigenous species problem.*

Response #10: This information is available on the Environmental Law Institute (ELI) website in a report entitled *Filling the Gaps: Ten Strategies to Strengthen Invasive Species Management in Florida.* This will be referenced in the Chapter in the interest of saving space

Comment #11: *Lines 200–206: It might be useful to particularly target landscapers and nurseries that sell nonindigenous species.*

Response #11: Some of this work has been done through the Florida Exotic Pest Plant Council. The authors will include a summary of this information.

Comment #12: *General: Some religious groups have as one of their tenets the need to release animals; some people actually purchase animals to release, and these are often released into inappropriate habitats, illegally. Are there efforts to reach these people?*

Response #12: This audience has not yet been targeted specifically for education and outreach. The suggestion is a good one.

Comment #13: *What is the overall objective of the chapter: this needs to be more clearly spelled out.*

Response #13: This Chapter provides a "Status" report for nonindigenous species. As stated on pages 9-1 and 9-2, "this chapter reviews the broad issues involving nonindigenous species in South Florida and their relationship to restoration, management, planning, organization, and funding. This chapter also provides an overview of nonindigenous species using an "all-taxa" format for understanding and presenting an inclusive picture of the magnitude of the far-reaching invasive species threats that exist in South Florida…This document provides a complete listing with annotations for those species considered to be serious threats to Everglades restoration…In addition to providing a comprehensive look at nonindigenous species across taxa, this document takes an important step toward trying to determine what, if any, control or management has been initiated for targeted species." The authors hope that by providing this information in the geographical format of the overall restoration project (i.e. Modules), that researchers and staff involved in developing restoration models will begin to build nonindigenous species into future work.

Comment #14: *Line 286: The use of fixed wing aircraft is surely not very useful for a wide range of small plants and animals. How are these monitored?*

Response #14: There are some limited monitoring programs in certain areas of the District. The SRF program is the only monitoring system that covers the entire geographical area of the District.

Comment #15: *Table 9-1: Need to know what the total acreage is that those given relate to; that is, there are 355,200 acres of Melaleuca out of what?*

Response #15: Acknowledged. This information will be included.

Comment #16: *Lines 327–347: It seems to me that the areas covered belongs in the introductory section. The information that starts with 347 seems to be the real beginning of this section.*

Response #16: Acknowledged. This information will be moved to the Introductory Summary section at the beginning of the chapter.

Comment #17: *Lines 360–on: The agencies involved should be pulled out in its own section so that the ideas flow.*

Response #17: While a table clearly delineating the agencies involved and their respective roles in nonindigenous species management and Everglades restoration would be useful to the reader, the authors feel that specific examples of agency involvement are better stated next to the respective species discussion rather than in a separate section. Not all agencies work with all species and in all areas. The authors feel it is useful to the reader to see agency involvement and control efforts underway for particular species while simultaneously reading about each particular species.

Comment #18: *Table 9-2: I assume X just means occurrence; this needs to be added. Is there any way to indicate the really large problems (perhaps with a larger X).*

Response #18: The meaning of "X" will be added to the table key and summary. To date "really large problems" are not clearly defined by animal experts. This is being debated within the FIATT forum. The authors could make the "X"s larger for species that are discussed specifically in the Chapter if the panel feels that is appropriate. The authors will add information on "EDRR" species and "range extensions" to the table.

Comment #19: *This is an excellent table. Line 461: There has been little mention in the chapter of control, and perhaps this aspect should be added to some of the sections. Table 9-3, which lists expenditures by RECOVER is useful, but hard to evaluate with respect to other problems.*

Response #19: Descriptions of control methods were removed from previous versions of this chapter due to earlier panel suggestions for keeping the document more concise and removing as much generic information as possible. This Chapter deals only with the status of current management programs. Other species are not currently tracked to the detail needed for a comprehensive table. The WEEDAR system hopes to be able to provide this sort of information in the future.

Comment #20: *Table 9-3: Are these data available for any of the invasive animal species?*

Response #20: This information is not currently available for invasive animal species. Numerous groups and agencies work to control nonindigenous animals in South Florida. To date, these efforts are much more fragmented and not as organized/well documented as the control of nonindigenous plants.

Comment #21: *Lines 495–508. This is an extremely important paragraph, and could be expanded to include some information on management of these species. Perhaps these species should have their own section with a little more details.*

Response #21: The authors will consider adding some management information for these species.

Comment #22: *General for the Modules: It is not clear who has compiled the data for each of the modules. The data, and photographs, in the modules are excellent because it makes the problem real for the reader.*

Response #22: Acknowledged. It will be stated in the next draft of this Chapter how information was gathered for each Module. In general, the data and information comes from agency land managers.

Comment #23: *Lines 528–531: What can be done about the problems of invasive species on private lands (and those sold at nurseries?)*

Response #23: Educating the public and plant/animal distributors may greatly increase awareness of nonindigenous species issues on private lands and/or releasing such organisms near public lands. The enactment of more strict legislation will also bring to light the importance of proper nonindigenous species handling and management in the private sector. This chapter states the importance of public education and strict legislation throughout, but focuses mostly on public lands when discussing control as this is where the District and other public agencies are charged with managing nonindigenous species.

Comment #24: *Table 9-4: The inclusion this year of the letters as well as the colors is excellent, since many people will print these in black and white.*

Lines 558: Might be useful to have an introductory few lines to this section.

Response #24: Acknowledged.

Comment #25: *Lines 610–636. What is the effect on other native species of the bait program?*

Response #25: The authors will add a summary of information on native species if it is available.

Comment #25: *Lines 714–on: It might be wise to encourage removal whenever they are found.*

Response #26: At this point in time, removing or hunting pythons in the Everglades is regulated by FWCC. Consequently, the authors do not wish to encourage the general public to take part in a "free-for-all" of python removal. There are many native species of snakes also present in the Everglades, and accurate identification and proper gun safety training are very important.

Comment #26: *Lines 729: An introductory sentence is required here, and in other sections, that lists the species to be discussed.*

Response #27: Acknowledged.

Comment #27: *Lines 818–821. Here, and elsewhere, it would be useful just to list the species so the reader knows where the section is going.*

Response #28: Acknowledged.

Comment #28: *Line 846: What efforts are being made to discover the impacts?*

Response #29: The authors will expand this information, as available.

Comment #29: *Line 920: What effects does it have on native species? Are there specific data on its differential effects on other frogs?*

Response #29: As stated on line 921, there is increasing data supporting the statement that the Cuban treefrog competes with native species by feeding on similar prey and colonizing a wide range of habitats. The University of Florida produced a very informative extension document for this species (http://edis.ifas.ufl.edu/UW259). Included in this document are other references for looking further into the issues of Cuban treefrogs in Florida. In addition, the University of Florida extension website lists new research projects currently being conducted on the Cuban treefrog in Florida for which data are not yet available (http://ufwildlife.ifas.ufl.edu/cuban_treefrog_research.shtml).

Comment #30: *Lines 1126: The description of the specific effects of the Australian Pine on the sparrows is excellent, and is the kind of information needed for some other species.*

Response #30: Acknowledged and agreed. Unfortunately, while it is easy to assume and observe that nonindigenous species have direct negative impacts on native species, gathering empirical

data to support these observations is often very expensive and time-consuming, requiring many years and dedicated funding. The authors agree that more should be done in this realm, but the authors also admit that more should be done in almost every realm of nonindigenous species management. The funding for control efforts, alone, is insufficient. The authors have almost universally supported the "control-first" concept, except where research was directly needed to support control efforts. In addition, there is enough ecological research (generally, not always as specific as explaining how one plant so negatively impacts one animal) to support the need to prevent and control exotic species. Some additional key research the authors feel is critical is the development of invasion risk assessment tools to help us prioritize species for control. These have been developed for plants in Florida using an Australian model, but we need to evaluate the usefulness of the tool. a similar effort is needed for animals.

Comment #31: *Lines 1277–on: Shouldn't there be legislation to prevent the use of this species in the pet trade? Although there are laws for problem species (up to lines 1291), these don't seem to be strong enough for this species.*

Response #31: Acknowledged and agreed. The enactment of more strict legislation can take a long time, even following the demonstration that select species do more harm than good. The authors hope that with documents such as this Chapter, and other items which highlight the damage nonindigenous species can do, that the need for more strict legislation will become apparent to policy makers.

Comment #32: *Lines 1292–1302: It seems to me that efforts should be made to reduce breeding.*

Response #32: Acknowledged. The difficulty of removing this species from the Everglades is enormous, but significant efforts are underway. One tactic for harvesting pythons from the Everglades has been to plant a radio-chipped female and collect all males attracted to her release of pheromones during the mating process, thus preventing successful mating and reproduction.

Comment #33: *Lines 1428–29: More details on the current position of USFWS relative to control would be useful. This seems a very unusual case that bears more discussion among scientists.*

Response #33: Acknowledged. The information presented in lines 1428-1429 is the most up-to-date information available on this topic. The authors hope that this Chapter brings to light such information and so encourages more discussion among scientists.

Comment #34: *Lines 1448–1465: What is the effect of these eels on native populations?*

Response #34: The USGS Nonindigenous Aquatic Species Database states that the impact of introduction is largely unknown, and the FFWCC Non-Native Fishes Laboratory cites the small mouth, weak swimming ability and poor vision as factors that will limit the affect of this eel on native fishes. In addition, the most current information about the distribution of this species largely limits it to canals, and thus its current impact on the ecology of native Florida species remains questionable. However, it's ability to survive dry seasons in moist mud and breathe air do provide enough concern about its potential to exploit south Florida environments that it should remain a species of concern.

Comment #35: *Lines 1700–on: A little more information on the hog use by other species would be appreciated.*

Response #35: There is a lack of information available about the usage of the feral hog by other species. The Florida panther is considered a top predator in its habitat, and there are very few additional species near this trophic position that would attack a feral hog. The feral hog, itself, is relatively high in its invaded food chain and can have multiple impacts on the species beneath it. Consequently, there is much more information and data available for the effects feral hogs have on other species.

Comment #36: *Lines 1746–1758. What efforts are being made for control early so this does not spread throughout the Everglades?*

Response #36: Only one individual was found and was destroyed. They are not believed to be breeding in the wild.

Comment #37: *Lines 1772: List the species to be discussed here before launching into a subsection.*

Response #37: Acknowledged.

Comment #38: *Lines 1913–1922: Funding for this control program seems absolutely critical — what can be done to reinstate it?*

Response #38: Agreed. State and Federal agencies will need to fund this important work if it is to continue.

Comment #39: *Lines 1985–1991: Are other areas or counties considering similar programs?*

Response #39: There are scattered efforts along these lines nationally. One example—in Hawaii, the island of Maui has a serious problem with the coqui frog, which impacts property values and tourism because of noise. They have an active, government sanctioned control program. Other counties in Florida will most likely follow suit as nonindigenous animal control becomes more problematic and impacts the quality of life.

Comment #40: *Lines 2040–22: Are there any plans to consider developing a control program before it seriously affects both commercial interest and more ecological ones?*

Response #40: Not to date. Control will be challenging since the mussel is not in a closed system.

Comment #41: *Lines 2196: A clearer description of exactly when and where feral hog removal was accomplished needs to be included (especially in light of the concern for this species in other regions).*

Response #41: As stated in lines 2193 and 2194, feral hog removal was conducted only in Savannas Preserve State Park throughout 2003. For plot size and specific locations within the Park, readers may refer to the citations listed with the description of this experiment.

Comment #42: *Lines 2197–on: A little more detail about the program should be included.*

Response #42: The purpose of the Chapter is to inform readers about the status of all of the numerous nonindigenous species in South Florida and their current management (or lack thereof). Simultaneously, the authors are encouraged to keep the length of the Chapter to a minimum. In order to satisfy both (potentially conflicting) requirements, the authors have attempted to describe the main points of any applicable research recently or currently conducted rather than all of the details for each project. The authors hoped to alert readers to ongoing research and to provide readers with the sources of that information for further perusal at the readers' discretion. One item currently under development is a project tracking program that can be found at www.ecostems.org. The creators hope to use this program to document all ongoing research projects in addition to all control projects.

Comment #43: *Lines 2244–2256: In light of the problems invasive mussels have caused to other waterways, this seems to deserve considerably more attention. What will be done with this species next year?*

Response #43: The authors have reported work to date, but currently it is unclear if the District or any other agency will undertake additional work on this species.

Comment #44: *Lines 2258–2273: The first paragraph is really an introduction, and does not belong under plants.*

Response #44: Acknowledged. The paragraph will be moved to an introductory position within this Module.

Comment #45: *Lines 2295–2302: What state efforts are in place to control this species?*

Response #45: In addition to the mechanical and biological control efforts mentioned on lines 2298 and 2304, chemical applications are irregularly applied by state agencies. As stated on line 2296, this species is not consistently problematic.

Comment #46: *Lines 2305–2312: It is nice to see one listed that has been controlled in a region.*

Response #46: Agreed, alligatorweed is a success story.

Comment #47: *Lines 2485: A short description of the basin would aid the reader.*

Response #47: Acknowledged.

Comment #48: *Lines 2533: The evaluation of which species poses the greatest problem for restoration is this area is extremely useful.*

Response #48: Acknowledged and agreed. Unfortunately which species poses the greatest threat for restoration is not always readily apparent. Also, the problematic species are often not limited to just one per region.

Comment #49: *Lines 2492–4: How successful have the efforts been? are they continuing?*

Response #49: Yes, efforts are continuing and floating plants have decreased in these areas.

Comment #50: *Lines 2673: Any indication of hunter take? Why not increase also the number limit?*

Response #50: The authors will check with FWCC to update this feral hog hunting information.

Comment #51: *Lines 2800: This is an extremely important program—is it adequately funded? Need more details on the program.*

Response #51: Early Detection and Rapid Response (EDRR) is recognized as important nationally. Many other states are also struggling with how to actually implement this type of system as awareness and funding often lag, preventing a real "rapid" response. The authors will expand this discussion.

Comment #52: *Table 9-12: How was this excellent table arrived at? by whole?*

Response #52: The authors compiled this information from interagency meetings related to nonindigenous species.

Joann Burkholder

Comment #53: *The potential impacts of invasive species were described as an emerging, high priority for CERP planning (p.9-1). How does the District plan to consider exotic species, across South Florida ecosystems, in evaluating and refining performance measures based on desirable organisms or conditions that are adversely affected by them?*

Response #53: The District continues to be proactive in addressing nonindigenous species. Through the Indicator work described in this Chapter, the authors hope that nonindigenous species impacts become more "mainstream" in CERP planning and implementation.

Comment #54: *How does the District plan to develop (or collaborate to develop) more proactive approaches toward controlling exotic species in South Florida?*

Response #54: The District is working on a literature review of some of the nonindigenous animal species discussed in the Chapter and continues to work with groups such as ISWG and FIATT to encourage the development of control methods for these species.

Comment #55: *Chapter 9 again contributes an impressive, fascinating, and disturbing evaluation of the status of progress in understanding terrestrial, wetland and aquatic nonindigenous species in South Florida, and the complexities in attempting to approach their "management". This topic is among the most important considered in the 2008 SFER. Nonindigenous species fundamentally threaten the District's many restoration efforts; they are seriously undermining the efficacy of various performance measures. Yet, there is a critical lack of knowledge about these organisms and the extent of their impacts. Research and monitoring efforts mostly have focused on exotic species that cause economic rather than environmental impacts. The relatively limited environmental monitoring efforts tend to emphasize large, easily detected exotic species, but some of the worst among them (e.g. green mussels) are small and relatively cryptic. Funding limitations relative to the enormity of the task preclude development of an assessment/ monitoring program specifically for nonindigenous species. Thus multiple, often piecemeal or fragmented monitoring and research programs provide the available information about nonindigenous species throughout South Florida.*

The chapter updates what is known about nonindigenous species and their impacts in South Florida terrestrial and aquatic environments within CERP and RECOVER representing eight regional modules including the Florida Keys, Florida Bay and the Southern Estuaries, the Greater Everglades, Big Cypress, Lake Okeechobee, Northern Estuaries – East, Northern Estuaries – West (Caloosahatchee), and the Kissimmee River basin. Table 9-2 provides an excellent compilation of the exotic plant and animal species lists for these modules, while pointing out that the animal species information likely is not comprehensive because of limited availability of distribution data on exotic animals. The approach for developing a suite of ecological indicators on exotic plant species to evaluate CERP restoration progress is nicely explained (p.9-24). These indicators will not be similar to other RECOVER indicators because, as the authors state, nonindigenous species are inherently ill-suited to indicate ecological function, process or structure in a restoration context. The color-coded progress assessment ("stop light") technique remains an innovative, excellent tool for evaluating status and projected conditions, species by species, within each module. The descriptions of selected exotic species, their impacts, and efforts to track/control them are excellent and fascinating, as in previous SFERs. The authors' synthesis of information needs and gaps is clear and compelling, culminating in their identification of the top five priorities that must be addressed to realistically, effectively approach management and control of exotic species in South Florida..

Control efforts (or lack thereof) remain an important gap for many if not most exotic species. In an important advancement described by the 2008 SFER, a process assessment technique is being developed to determine what, if any, management or control measures have been undertaken on a species basis. Various entities are collaborating to develop a clear, integrated method for evaluating progress on controlling invasive plant species, and a parallel evaluation system for exotic animal species is planned within the next 2-3 years. These integrated methodologies will be valuable, if not essential, in assisting District efforts.

Suggestions. The Summary section should mention some of the worst exotic species problems (plant and animal), as well as some (albeit few) "success stories" in their management, control or eradication (e.g. Caulerpa in coastal areas) to show that, at least for some species, with concerted effort it can be achieved.

Response #55: Acknowledged. This information will be added to the Summary section of the Chapter.

Comment #56: *The various sections should be checked for parallel organization.*

Response #56: Acknowledged. Each section's content will be revisited by the authors.

Comment #57: *The chapter introductory information would be strengthened by a table (or flow chart?) of the agencies/entities involved in assessment/ management of (which) nonindigenous species within each module, and their directed activities. This may result in a "spaghetti"*

hodgepodge reflecting the problem that "everyone is in charge, so no one is in charge", but such a table should be attempted.

Response #57: This information is available on the Environmental Law Institute (ELI) website in a report entitled *Filling the Gaps: Ten Strategies to Strengthen Invasive Species Management in Florida.* This will be referenced in the Chapter in the interest of saving space.

Ellen van Donk

Comment #58: *I miss in this chapter a table with an overview of all the agencies and their responsibilities concerning non-indigenous species.*

Response #58: This information is available on the Environmental Law Institute (ELI) website in a report entitled *Filling the Gaps: Ten Strategies to Strengthen Invasive Species Management in Florida.* This will be referenced in the Chapter in the interest of saving space.

Comment #59: *Page 9-87. The summary of needs and gaps is very useful. Are all nonindigenous species in Florida a problem???*

Response #59: Not all nonindigenous species are problematic in Florida. Many species are purposely brought in for agriculture and other purposes and they do not spread beyond cultivated areas. These types of nonindigenous species can be an important component of Florida's economy. A small percentage of nonindigenous species do escape cultivation and disrupt ecosystems, displacing native species.

RESPONSES TO COMMENTS ON 2008 DRAFT SFER – VOLUME I, CHAPTER 10

Joyce Zhang and R. Thomas James

Subject: District Responses to Comments, Chapter 10
Document posted as: 2008 SFER_RTCs_Ch10_tj.jz.doc
Originally Posted: 11 Oct 2007 07:21 AM

Ellen van Donk

Comment #1: *The authors of Chapter 10 were responsive to the Panel's recommendations and comments. Chapter 10 has been enhanced from the 2007 report by additional material which addresses several points raised by the Panel last year. This chapter, however, still needs more integration with other chapters. The Kissimmee River is a major source of water and chemical constituents to the Lake, which in turn supplies water and materials to the EAA, the St. Lucie Estuary, and the Caloosahatchee Estuary. The impacts of the upper watershed on the lake, and of the lake on the St. Lucie and Caloosahatchee Estuaries and the EAA, should be described. The chapter should also include a description of plans to account for potential impacts on the lake from urban/suburban development affecting the upper watershed.*

Response #1: Integration has been added regarding the influence of the Kissimmee River on Lake Okeechobee and the influence of Lake Okeechobee Discharges to the St. Lucie and Caloosahatchee Estuaries. The strategies to reduce impacts from urban/suburban development in the Lake Okeechobee watershed are included in Lake Okeechobee Protection Plan.

Comment #2: *In Table 10-3 of the 2007 Report the project in Josephine Creek is mentioned. In the 2008 report the same table (Table 10-5 on page 10-22) is given without this creek. Is this project not important anymore??*

Response #2: The dairy in this basin was out of business. Consequently, the comprehensive nutrient management plan (P import=P export) will not be implemented. Currently, the property is under planned remediation practices.

Comment #3: *In the 2007 South Florida Environmental report there is a paragraph on pag. 10-53 concerning "Current velocities inside SAV beds in Lake Okeechobee". I can not find information on this subject in the 2008 report. Has this research been stopped??*

Response #3: The research was completed and will be incorporated in future SAV model simulations and research.

Comment #4: *On page 10-60 has been written that: "It is expected that the recovery sequence of SAV from the current drought conditions should be similar to that observed after the 2000-2001 drought. Once re-flooding occurs, Chara should rapidly expand across the nearshore areas in the southern region and then spread around to the western and northern regions. Assuming that light conditions remain favorable and the sedimentary seed bank is still viable, Chara should decline and vascular plants should become dominant. Research to evaluate the nearshore seed bank status will be conducted as sites become re-inundated". Further is stated that: "one impact of hurricanes has been the redistribution of muck sediments from the central pelagic zone to more nearshore and littoral region. On Pag. 10-82 is further written that low water levels on Lake Okeechobee provided a management opportunity for the District to cost effectively remove muck*

sediments from nearshore regions of the lake. Once these muck sediments are removed and water levels return to normal, the anticipated environmental benefits include improved water clarity, return of submerged plants and increased critical habitat for fish and wildlife".

I just wondered whether this removal of phosphorus laden muck sediments will also remove many seeds of submerged macrophytes. Return of submerged macrophytes will then be delayed.

Response #4: A seed bank study conducted in November of 2005 showed viable seeds in areas near scraped sites. Scraping was conducted to remove the overlying muck while minimizing the disturbance of underlying sediment and seedbed. We will monitor regrowth in the scraped areas.

Comment #5: *Is it not better to look at the seed-bank status before the removal?? Further I wondered whether Chara can grow in areas where the muck has not been removed? These plants do not like high P concentrations.*

Response #5: It would be impractical and unnecessary (at present) to perform a seed bank study prior to removal of sediments (takes too long). Chara has been found in muck/peat sediments in South Bay.

Comment #6: Is it not useful to expand the experiments described on Page. 10-64 "Light Influence on the Growth and Germination of Submerged Aquatic Vegetation" with more interacting factors e.g. phosphorus in the sediment?

Response #6: These will be considered in the future as time and resources permit.

Richard Meganck

Comment #7: *Are the LOWP-related storage areas referred-to in lines 87-88 all "off site"? If so, why is that the case, or why was it designed in that fashion?*

Response #7: The proposed LOWP-related storage sites, located in the northern Lake Okeechobee watershed, will provide regional STAs to reduce P load and alternative storage to help regulate water levels in the lake.

Comment #8: *I am confused by the reference in line 114 to average TP loads at 179ppb and that in line 118 at "over three times higher than the goal of 40 ppb." Is TP more than three times or four times the goal of 40 ppb?*

Response #8: To be revised.

Comment #9: *Reference table 10-8, Taylor Creek Tributary Dredging study, is there any indication as to how cost effective this methodology/technology is—based on the experience to date?*

Response #9: The main objectives of this project were to restore navigation, increase water storage, and remove P as a function of material removed. The P content was estimated to be 415 mg P/kg of soil. Based on the number of truck loads, we may remove 1 metric tone of P with a project cost of $950,000, which comes out to $431/lb of P removed. This project is not as cost-effective for P removal as compared with other regional projects, but this was not the sole purpose of this project.

Comment #10: *Reference table 10-8, Technical Assistance Review and Analysis of Existing Data for Evaluation of Legacy P in the Lake Okeechobee watershed. I am curious as to the validity of key research question number 2 given the range of climate/lake watershed conditions during any water year.*

Response #10: The hydrologic and water quality model that will be used to address key question #2 takes into account differences in weather, soil, land use and other hydrologic conditions over a long period of record.

Comment #11: *Reference the same study as in question number 2. What is the start date of the project? Aren't average data plus average climate data over s number of years needed to ensure the predictive capability of the plan/model?*

Response #11: The project started in June, 2007 and will be completed in December 2007. Analysis of gathered information is well underway. The Watershed Assessment Model (WAM) or other models will be used to address key question #2 with a minimum of 20 years of simulations to account for the variability of hydrologic conditions.

Comment #12: *Reference table 10-8, Wetland BMP Research, research question number 1. Is there a herd size to wetland size (man-made or natural) ratio that can be applied as a baseline for designing this type of research project?*

Response #12: The ratio of herd size to wetland size was not addressed in this study.

Comment #13: *Reference table 10-8, Wetland BMP Research, research question number 4. What has been District experience to date in natural and man-made wetlands in terms of storing P?*

Response #13: In general, the man made wetland STAs remove P. More research is needed to determine the P removal capacity of restored wetlands. It also depends on the hydrological loading rate (dairy or pasture), soil and management conditions.

Comment #14: *Reference table 10-8, Dairy lagoon Seepage characterization and Remediation Processes. Do ponds have to be drained before stored P can be effectively removed or are their techniques to remove P from bottom strata in standing water?*

Response #14: There are methods that can be used to remove the sediments from lagoons, without draining the ponds. It must be pointed out that these sediments usually contain more N then P. Our lagoon study at Davie dairy, to date, has shown that P isn't mobile and is staying in the lagoon sediments. The critical element to consider in removal of the sediments is the minimization of disrupting the established organic seal in the lagoon.

Comment #15: *How does the water quality monitoring work reported in the section beginning on line 788 interface with the work being done to develop a comprehensive water quality model for South Florida (reported in chapter 1B)?*

Response #15: The watershed water quality data have been used for baseline evaluation, trend analysis, and model calibration.

Joann Burkholder

Comment #16: *Chapter 10 mentions three long-term impacts on Lake Okeechobee, one of which is the rapid spread of exotic and nuisance plants in the littoral zone. Yet, District plans for addressing exotic/nuisance plant species seem to focus on herbicide applications. What are District plans for assessing the overall impact of exotic species (plants and animals) on the Lake ecosystem? It would seem that such information would be needed to assess the [changing] effectiveness of some performance measures.*

Response #16: The answer to these questions are covered in Chapter 9 of the South Florida Environmental Report. Numerous interagency teams are involved.

Comment #17: *Are studies planned to assess the assimilative capacity of Lakes Istokpoga and Kissimmee? (p.10-30)*

Response #17: These were completed a few years ago and can be found in an executive report White, J., M. Belmont, K. R. Reddy, and C. Martin. 2003. Phosphorus Sediment Water Interactions in Lakes Istokpoga, Kissimmee, Tohopekaliga, Cypress and Hatchineha. Submitted to the South Florida Water Management District in partial fulfillment of contract C-13942. 14 pp.

Comment #18: *It was dismaying to learn that Lake Okeechobee's limits for mercury are among the least restrictive of all advisories in Florida (p.10-47). What are District plans for assessing the bioaccumulation and impacts of mercury on fish populations in the Lake?*

Response #18: An study of fish in the past few years shows that Large Mouth Bass and Blue Gill taken from Lake Okeechobee have such low levels of mercury that they are safe for unlimited consumption (Evans David W. 2007 Annual Report for the period July 1, 2005 to September 30, 2006 CERP/RECOVER/MAP PROJECT Assessment of Mercury Bioaccumulation in Sentinel Fish in South Florida)

Comment #19: *Is historic information known about Nymphaea abundance in the Lake? Does the District plan to examine whether its increasing abundance is beneficial or detrimental to the Lake ecosystem? (lines 1247–1249)?*

Response #19: Nymphaea coverage increased in Moonshine Bay and along the lakeward edge of the marsh following the 2001–2002 drought. There were > 5,000 and 1,500 acres of Nymphaea in Moonshine Bay and along the marsh edge, respectively in 2003. Prior to the drought there was about 2,000 acres of Nymphaea in Moonshine Bay (from memory) and nearly none along the marsh edge.

District Staff are concerned that thousands of acres of spikerush in Moonshine Bay were displaced by Nymphaea prior to the current drought. One reason for our concern is that Nymphaea tends to produce more organic material that eventually falls to the marsh floor creating a flocculent/turbid substrate. Spikerush also is considered better habitat for apple snails. The current drought has reduce the areal coverage of Nymphaea. No management actions have been taken so far.

Comment #20: *The increased diatoms:cyanobacteria ration has been suggested to be linked to higher turbidity. An alternate suggestion that should be considered is the sometimes-very-high DIN concentrations/ loads (e.g. Table 10-10, p.10-45).*

Response #20: We will include this suggestion. Do you have any references to this effect?

Comment #21: *The information on water quality monitoring (p.10-36) would be strengthened by discussion of the compatibility of techniques used over time by the District and others (e.g. some District stations monitored biweekly since 1972 – have techniques been consistent over time, or changes calibrated?; did the District restructure the LOWOD farm-level concentration monitoring network to the LOWA micro-basin level monitoring network so that technique consistency was considered?).*

Response #21: The long term ambient monitoring has been consistent in terms of its monitoring protocols (sampling and analytical methods, parameters, frequency, and site locations). The same type of consistency existed for the LOWOD farm level monitoring but site locations and length of monitoring depended on permit compliance. The newly designed LOWA network was also developed to ensure consistency among monitoring protocols. Data from any of these three projects could be compared to each other since similar sampling and analytical methods were used. These three monitoring networks have comparable data when looking at the Lake Okeechobee watershed as a whole, but it is important to understand the specific data objectives for each of these networks when assessing water quality conditions and restoration/compliance effectiveness. Each of these programs target different hydrologic scales of contribution within the watershed. Data collected at the micro-basin or the parcel level provide different pieces of the watershed puzzle as compared to what we can deduce from samples collected at the tributary level.

Comment #22: *Lines 998–1000—The chapter describes atrazine and hexazinone as relatively nontoxic to mammals, but conflicting information occurs in the literatures, especially considering insidious, chronic impacts. Additional discussion with supporting references is needed here. Pesticides in water and sediments are monitored only on a quarterly basis at six sites in the Lake. The District is engaging in concerted herbicide application programs; additional monitoring emphasis (higher frequency) on these and other toxic substances (e.g. mercury) seems warranted.*

Response #22: The District has conducted a number of studies that tested herbicide levels shortly after treatment. (Pfeuffer, 1988a,b, 1990). Often the herbicide was at or near the detection limit of the analysis. Because the values of pesticides are very low in our monitoring program (Pfeuffer, 2006), the current frequency of monitoring is considered adequate. For the particular Atrazine: Atrazine is a selective systemic herbicide registered for use on pineapple, sugarcane, corn, rangelands, ornamental turf and lawn grasses, and non-crop areas. Environmental fate and toxicity data in Tables 1 and 2 indicate that atrazine (1) is easily lost from soil by leaching and in surface solution, with moderate loss from surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour LC_{50} of 76 mg/L for carp, 16 mg/L for perch and 4.3 mg/L for guppies (Hartley and Kidd, 1987). Also, in a flow-through bioassay, the maximum acceptable toxicant concentration (MATC) of atrazine was 90 and 210 µg/L for bluegill and fathead minnow, respectively (Verschueren, 1983). The draft ambient aquatic life water quality criterion identifies a one-hour average concentration not to exceed 1,500 µg/L more than once every three years on the average [United States Environmental Protection Agency (USEPA), 2003].

> HEXAZINONE: HEXAZINONE IS A NON-SELECTIVE CONTACT HERBICIDE THAT INHIBITS PHOTOSYNTHESIS. REGISTERED USES INCLUDE SUGARCANE, PINEAPPLE, AND NON-CROP AREAS. ENVIRONMENTAL FATE AND TOXICITY DATA IN TABLES 1 AND 2 INDICATE THAT HEXAZINONE (1) IS EASILY LOST FROM SOIL BY LEACHING, WITH MODERATE LOSS FROM SURFACE ADSORPTION OR SURFACE SOLUTION; (2) IS RELATIVELY NON-TOXIC TO MAMMALS AND FISH; AND (3) DOES NOT BIOCONCENTRATE SIGNIFICANTLY. HEXAZINONE IS PRACTICALLY NON-TOXIC TO FRESHWATER INVERTEBRATES WITH AN EC_{50} OF 145 MG/L FOR DAPHNIA MAGNA (USEPA, 1988)

Table 1. Selected properties for atrazine and hexazinone.

Common Name	Surface Water Standards FAC 62-302 (µg/L)	LD_{50} acute rats oral (mg/kg) (1)	EPA Carcinogenic Potential	Water Solubility (WS) (mg/L) (2, 3)	Koc (mL/g) (2, 3)	Soil Half-life (days) (2, 3)	Soil Conservation Service (SCS) rating (2) LE	SA	SS	Volatility frrom Water	Bioconcentration Factor (BCF)
atrazine	-	3,080	C	33	100	60	L	M	L	I	86
hexazinone	-	1,690	D	33,000	54	90	L	M	M	I	2

SCS Ratings are pesticide loss due to leaching (LE), surface adsorption (SA) or surface solution (SS) and grouped as large (L), medium (M), small (S) or extra small (XS)
Volatility from water: R = rapid, I = insignificant, S = significant
Bioconcentration Factor (BCF) calculated as $BCF = 10^{\wedge(2.791 - 0.564 \log WS)}$ (4)
B2: probable human carcinogen; C: possible human carcinogen; D: not classified; E: evidence of non-carcinogen for humans (5)
FDEP 62-302 surface water standards (7/04) for Class III waters except Class I in ( )

(1) Hartley, D. and H. Kidd. (Eds.) (1987).
(2) Goss, D. and R. Wauchope. (Eds.) (1992).
(3) Montgomery, J.H. (1993).
(4) Lyman,W.J., W.F. Reehl, and D.H. Rosenblatt. (1990).
(5) U.S. EPA (1996).

Table 2.Toxicity of atrazine and hexazinone to freshwater aquatic invertebrates and fishes (µg/L).

Common Name	48 hr EC_{50} Water flea *Daphnia magna*		acute toxicity (*)	chronic toxicity (*)	96 hr LC_{50} Fathead Minnow (#) *Pimephales promelas*		acute toxicity	chronic toxicity	96 hr LC_{50} Bluegill *Lepomis macrochirus*		acute toxicity	chronic toxicity	96 hr LC_{50} Largemouth Bass *Micropterus salmoides*		acute toxicity	chronic toxicity	96 hr LC_{50} Rainbow Trout (#) *Oncorhynchus mykiss*		acute toxicity	chronic toxicity	96 hr LC_{50} Channel Catfish *Ictalurus punctatus*		acute toxicity	chronic toxicity
atrazine	6,900	(1)	2,300	345	15,000	(1)	5,000	750	16,000	(2)	5,333	800	-		-	-	8,800	(2)	2,933	440	7,600	(2)	2,533	380
hexazinone	151,600	(1)	50,533	7,580	274,000	(2)	91,333	13,700	100,000	(1)	33,333	5,000	-		-	-	180,000	(1)	60,000	9,000	-		-	-

(*) Florida Administrative Code (FAC) 62-302.200, for compounds not specifically listed, acute and chronic toxicity standards are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, where the 96 hour LC_{50} is the lowest value which has been determined for a species significant to the indigenous aquatic community.
(#) Species is not indigenous. Information is given for comparison purposes only.

(1) U.S. EPA (1991).
(2) Hartley, D. and H. Kidd. (Eds.) (1987).

GLOSSARY

LD_{50}: The dosage which is lethal to 50 percent of the terrestrial animals tested within a short (acute) exposure period, usually 24 to 96 hours.

LC_{50}: A concentration which is lethal to 50 percent of the aquatic animals tested within a short (acute) exposure period, usually 24 to 96 hours.

EC_{50}: A concentration necessary for 50 percent of the aquatic species tested to exhibit a toxic effect short of mortality (e.g., swimming on side or upside down, cessation of swimming) within a short (acute) exposure period, usually 24 to 96 hours.

K_{oc}: The soil/sediment partition or sorption coefficient normalized to the fraction of organic carbon in the soil. This value provides an indication of the chemical's tendency to partition between soil organic carbon and water.

Bioconcentration Factor:

The ratio of the concentration of a contaminant in an aquatic organism to the concentration in water, after a specified period of exposure via water only. The duration of exposure should be sufficient to achieve a near steady-state condition.

Soil or water half-life:

The time required for one-half the concentration of the compound to be lost from the water or soil under the conditions of the test.

REFERENCES

Goss, D. and R. Wauchope. (Eds.) (1992). The SCS/ARS/CES Pesticide Properties Database: II Using It With Soils Data In A Screening Procedure. Soil Conservation Service. Fort Worth, TX.

Hartley, D. and H. Kidd. (Eds.) (1987). The Agrochemicals Handbook. Second Edition, The Royal Society of Chemistry. Nottingham, England.

Lyman, W.J., W.F. Reehl, and D.H. Rosenblatt. (1990). Handbook of Chemical Property Estimation Methods. American Chemical Society, Washington, DC.

Montgomery, J.H. (1993). Agrochemicals Desk Reference: Environmental Data. Lewis Publishers. Chelsa, MI.

Pfeuffer, R. 1988a, Herbicide Monitoring Program for the Active Ingredient Glyphosate Technical Publication 88-1, SFWMD, 24 pp

Pfeuffer, R. 1988b, Herbicide Monitoring Program for the Active Ingredient Fluridone [SONAR], Technical Publication 88-8, SFWMD, 17 pp

Pfeuffer, R. 1990, Herbicide Monitoring Program for N-Methylformamide and Fluridone Technical Memorandum, SFWMD, 27 pp

United States Environmental Protection Agency (1988). Chemical Fact Sheet for Hexazinone. September, 1988.

_____ (1991). Pesticide Ecological Effects Database, Ecological Effects Branch, Office of Pesticide Programs, Washington, DC.

_____ (1996). Drinking Water Regulations and Health Advisories. Office of Water. EPA 822-B-96-002.

_____ (2003). Ambient Aquatic Life Water Criteria for Atrazine. Revised Draft EPA-822-R-03-023. October 2003.

Verschueren, K. (1983). Handbook of Environmental Data on Organic Chemicals. Second Edition, V

Comment #23: *Figure 10-9 – SEs should be added for the microcystin and chlorophyll a data. Was this total microcystins?*

Figure 10-10 – Legend or panels should provide the r^2 values.

P.10-49, Figure 10-13 – How many sites had significantly higher water content in the upper sediments? Statistical information (test, p values; error bars in the figure) should be included.

Figures 10-12 – 10-14, 10-25 – Statistical information (test, p values; error bars) should be included.

Figure 10-15 – Legend should indicate when in 2006 the cores were collected, and the core size.

Response #23: Will be revised.

Comment #24: *Although this chapter provides an excellent compilation on environmental conditions, District activities, and restoration progress for WY2007, it would be strengthened by additional integration summarizing effects of the lake in WY2007 on the St. Lucie and Caloosahatchee estuaries. Hydrological and P/N loading information from the upper watershed helped integrate the upper watershed with the Lake during this extreme-drought year. The chapter would also benefit from more integration with Everglades effort – for example, lines 1018–1025 describe the relatively little known about sulfate (and mercury) in the Lake, and states that no sulfate research has been conducted on the Lake to date. It would be constructive to mention the planned research described in Appendix 3B of the 2008 SFER.*

Response #24: So far mercury is not an issue in the Lake (see above). Will consider additions on effects of the estuaries and the sulfate research.

Comment(s) #25: *Editorial changes:*

Lines 35, 151, 70 –phosphorus

Line 11 –should be four-fold (or more than four-fold)

Lines 139–143 – Percent changes should also be included.

Line 152 – include total cost.

Line 404– …(Figure 10)….

Line 406– watershed will soon be under…

Line 707– …and take into…

Lines 1250–1251 – add metric units.

Throughout – Submerged should be changed to submersed (Wetzel 2001, Limnology, 3rd edition, Academic Press).

Response #25: Will be revised.

Neal Armstrong

Comment #26: *The issue of legacy phosphorus is raised in the Lake's watershed (p. 10-31, lines 742-752), and two important questions are raised about the amount of phosphorus currently stored in the watershed (presumably in the sediments) and the time it will take to reach stable levels. While these questions are being addressed by a consultant for the watershed, the legacy phosphorus issue is also relevant within Lake Okeechobee, i.e., in its sediments. That is, the phosphorus retained within the Lake in a given year becomes legacy phosphorus the next year. What happens to this phosphorus? Is it recycled during the year when hypoxic conditions at the water-sediment surface permit its release from the sediments back to the water column? Is it stored with the sediment and buried deep enough so as not to be recycled? These are important*

questions not only for Lake Okeechobee, but for the BMPs, the STAs, and the WCAs. Hopefully, the study of legacy phosphorus in the watershed includes phosphorus sorption/desorption and sorption capacity characteristics of the soils under different conditions (e.g., wet, dry, hypoxic, aerobic), and phosphorus partition coefficients for those soils. At some point in time, the phosphorus removal systems will reach capacity to remove phosphorus and will have to have the accumulated phosphorus removed. This necessity is, of course, already recognized by the District in its calculations of phosphorus removed with dredging of exposed sediments in Lake Okeechobee. If phosphorus loading to Lake Okeechobee reaches the 140 mt/yr level (implying the legacy phosphorus in the watershed has reached stable levels), then the time it will take beyond that point for the legacy phosphorus in the Lake to stabilize will be substantial. This point has been raised in past SFER reports, but it is one that should be revisited when studies such as the one on legacy phosphorus is being reported.

Response #26: Model results will continue to be reviewed, revised and presented to consider the influence of decreasing P loads on the lake.

Comment #27: *Page 10-2, lines 43–54, it would be helpful to compare WY2007 flows to the long-term average flow as well as the WY2006 flow. Comparison to the previous year is a relative measure while comparison to long-term lake operation give better perspective;*

Response #27: To be revised.

Comment #28: *Page 10-2, lines 55–56, is there an explanation for "no substantial reduction in [phosphorus] loading" during the 1990's? Is this a case of phosphorus load reduction due to controls being matched by increases in pre-treatment phosphorus loads? Some explanation would be helpful.*

Response #28: Yes, it is caused by the agricultural growth and urban development in the watershed.

Comment #29: *Page 10-3, lines 109–117, the comment that WY2007 TP concentrations are higher than 5-year averages does not appear to have a strong basis when one compares TP concentrations of 173 µg/L and 179 µg/L, i.e., little difference; the difference in SRP of 54 and 78 is kinetics. Further, if sediment resuspension was the mechanism causing a difference, then why would TN and DIN in WY2007 be lower than the 5-yr average while TP is higher. This seems to be contradictory, and it is suggested that this explanation be reconsidered.*

Response #29: to be revised TN and TP trends are similar while SRP and DIN are not. The former may be more related to sediment water interactions while the latter could be biologically mediated (denitrification).

Comment #30: *Page 10-3, lines 118-124, the discussion about the TN:TP ratio of 11 and the DIN:SRP ratio of 5.4 favoring blue-green algae, please comment on the applicability of these ratios when the limiting nutrient concentrations for the blue-green algae are substantially lower than the ambient concentrations. In other words, the concentrations of TN and TP are so high that the algae do not "see" concentrations low enough to be limiting to growth and hence their growth rates and their dominance are not impacted by ratios of nutrients. The ratios may say that the blue-green algae are favored, but neither the blue-green algae nor the diatoms can discern that based on the TN and TP concentrations they "see" in the water column. The fact that diatom to cyanobacteria ratio is greater than one appears to bear that out.*

Response #30: At times of the year DIN has gone below 0.1 mg/L the point at which it is considered limiting (Smith, V.H., V.J.B. Jr., B.L. Jones, and K.E. Havens. 1995. Historical trends in the Lake Okeechobee ecosystem IV. nitrogen: phosphorus ratios, cyanobacterial dominance, and nitrogen fixation potential. Arch Hydrobiol Suppl. 107:71-88.). Because of the short period of time this occurs it is likely that overall the ratio does not impact the growth rate of algae.

RESPONSES TO COMMENTS ON CHAPTER 11

Steve Bousquin with Chapter Co-Authors

Subject: CHAPTER 11 - Responses to preliminary comments
Document posted as: 2008.CH11.SYTH.COMMENTS_g.doc
Originally Posted: 28 Sep 2007 08:31 PM

Attached is our document addressing preliminary panel comments on the 2008 SFER Chapter 11. We have indicated the topics we have selected for use in our workshop presentation. Please let me know if you would like to have additional topics included in the presentation for discussion.
—Steve Bousquin

[WS] (with yellow highlighting) = comment or topic selected for discussion in the 2008 SFER Workshop. ***(Editor's note: yellow highlighting has been removed in this appendix.)***

OUTSTANDING JULY 2007 COMMENTS ON THE FINAL 2007 CHAPTER 11 WITH RESPONSES

Comment #1: *An initial outline of the chapter's contents was not added.*

Response #1: A general index was added by the editors to Volume I of the 2007 SFER. General descriptions of the main chapter sections are included in the Introduction to the 2008 Chapter 11. A general index has been produced by the editors for Volume I of the 2008 SFER.

[WS] ***Comment #2:*** *We still expect that an explanation will be added about considerations to ensure that restoration provides sufficient nesting sites for colony occupation by wading birds.*

Response #2: Addressed in our response to a comment from Dr. Burkholder on the 2008 Chapter 11, and included in the workshop discussion items.

[WS] ***Comment #3:*** *We stimulate the idea that in the planning for the next KRREP phase proposals will be considered that study phosphorus assimilation and release in the river channel as well as the restored wetlands in the Pool D floodplain.*

Response #3: We are in the planning stage of a Phase II/III study to assess phosphorus assimilation and release. This study is described in our responses to the 2008 Chapter 11 comments, and details will be added to the chapter.

Comment #4: *identification of the sources of elevated phosphorus at the southern end of Lake Kissimmee is still a recommendation for next year*

Response #4: There were drought-related problems that prevented collecting these data in 2007, as described in the 2008 Chapter 11. We will continue this effort in 2008.

[WS] ***Comment #5:*** *Explanation of how the phosphorus and mercury information will be included as part of the overall Everglades evaluation of mercury contamination is still lacking.*

Response #5: Addressed in our response to a comment on the 2008 Chapter 11 and included in the presentation.

SYNTHESIZED PRELIMINARY REVIEW PANEL COMMENTS ON CHAPTER 11 2008 AND PRELIMINARY RESPONSES FROM AUTHORS

HYDROLOGY AND DROUGHT SECTION

Comment #6 (Burger): *Line 91–92: How many years have the low water conditions persisted?*

Response #6: (DHA) Note that it is rainfall and not water level on line 91–92. Low rainfall began in Water Year 2006 and has continued. We will clarify in the chapter.

Comment #7 (Burger): *Lines 200–on: What effect did the channelization have on the food web in the terrestrial environment that previously had more water flow?*

Response #7: (SGB/DHA) We may require clarification of the question. Portions of floodplain that were drained by channelization were almost completely converted to uplands, except in isolated small depressions. The communities would have therefore shifted completely resulting in elimination of the food web associated with these wetlands, from a wetland web (aquatic inverts, fish, wading birds, red-shouldered hawk, osprey) to an upland/pastoral food web (cattle, cattle egret, caracara, coyote, passerines, etc.).

Comment #8 (Burger): *Line 368: Considered by whom?*

Response #8: We will rewrite this sentence to clarify that KR flows are considered in the interagency meetings described in the previous sentence.

Comment #9 (Burger): *Line 529: What happens when water levels reach high pool stage?*

Response #9: Before regulation, lake stage typically peaked late in the wet season and water levels gradually declined during the dry season. The regulation schedules are shaped to allow lake water levels to reach the high pool at the end of the wet season. If water levels exceed the schedule line (enter Zone A), water has to be released from the lake for flood control. When water levels exceed the high pool stage there is risk that flooding of private property can occur. We will clarify in the chapter.

Comment #10 (Burger): *Lines 784–786: How numerous are the fish camps? how important to the local economy?*

Response #10: Two fish camps occur on the C-37 canal and approximately 10 fish camps occur on throughout the KCOL. In 2005, approximately 300,000 people used the four lower lakes (Toho, Cypress, Hatchineha, and Kissimmee) for various recreational activities, generating $7.3 million in sales and $1.2 million in wages, which are less than 1% of total sales and wages in Osceola County (Bell 2006).

*Bell, F. W. 2006. Economic sectors at risk from invasive weeds for the Kissimmee Chain of Lakes in Osceola County, Florida, 2004–2005. Report to the Florida Department of Environmental Protection Bureau of invasive Plant Management, Tallahassee, Florida.

WATER QUALITY SECTION

GENERAL COMMENTS AND QUESTIONS

Comment #11 (Burger:) *Line 387: It would still be useful to have one sentence relating to nutrient loads.*

Response #11: The following will be added to the revised chapter: Tables 10-2a, 10-2b, 10-3a, and 10-3b in Chapter 10 show discharge and nutrient loading for the Lower Kissimmee Regional Basin (between structures S-65 and S-65E) and the Upper Kissimmee Regional Basin (above structure S-65) for WY2007 and the LOPP's 1991-2005 baseline period. During WY2007, the entire Kissimmee Basin (both Upper and Lower regions) contributed 34 metric tons (mt) of phosphorus to Lake Okeechobee, or 17% of the lake's total incoming load. This amount is much less than the average annual loading of 169 mt during 1991–2005 (31% of the lake's total load) and was largely due to dry conditions in the Kissimmee Basin.

Comment #21 (Burger): *Lines 966-on: What is the current condition of floodplain vegetation, and is it returning to previous levels? The mapping project partly answers this.*

Response #21: Wetlands have increased substantially in the Phase I area on a trajectory in line with our expectation for wetlands overall, but the distribution of specific wetland types did not by 2003 approximate the historic mosaic. We do not expect full response until historic hydroperiods are restored. For additional information on vegetation status, see the vegetation Mapping

discussion in the Project Updates Section of Chapter 11. We will clarify in both sections of the chapter.

Comment #22 (Burger): *Are there any pre-1952 [vegetation map] data? When did the water regime start to change in this region?*

Response #22: We do not have vegetation maps prior to 1952. Changes in water regimes started in late 1800s with construction of ditches and canals.

Comment #23 (Burkholder): *It would be helpful to clarify (lines 469–478) more about the District's water quality sampling program – length of time, station locations, duration of data collection and parameters sampled at each station, frequency/consistency of sampling at each station, and consistency of analytical techniques.*

Response #23: We will include more detail – and a map - in the revised chapter.

Comment #24 (Burkholder): *When did the SFWMD begin its long-term water quality sampling program in the Kissimmee basin (line 469)?*

Response #24: Monitoring in the upper Kissimmee basin began in 1981. We will add that information to the revised chapter.

Comment #25 (Burkholder): *Line 943 – Additional explanation (number, frequency) about the composite samples is needed (line 943). Figures 11-11 and 11-12 are very helpful.*

Response #25: We will add more detail in the chapter about the composite samples. Composite samples collected by auto-samplers at each water control structure are collected weekly. The auto-sampler collects samples ten times per day and composites them in a single bottle for weekly pick-up. A more detailed description of sampling methods is in Volume I of the Kissimmee River Restoration Studies.

PHOSPHORUS

Comment #26 (Burger): *Lines 448–451: What is the relative contribution of agriculture versus the other sources to phosphorus problems?*

Response #26: As shown in Table 10-1 in Chapter 10, the Kissimmee Basin is mostly rural. The Upper Kissimmee Basin is 27% agricultural and 20% urban (mainly the cities of Orlando, Kissimmee, St. Cloud and the Walt Disney World region). Most of the remaining land is aquatic or natural area. The Lower Kissimmee Basin is 60% agricultural and 5% urban, with most of the rest in natural areas. There are no municipal point sources of pollution in the basin. Wastewater treatment effluents were diverted from the surface water system in the 1980s. Osceola County is one of the fastest growing counties in Florida, so the percentage of urban land use in the Upper Kissimmee Basin has increased significantly.

The unit load for urban land uses (0.66 lbs P/acre) is not much different from most agricultural land uses. For example, unit loading from pastures and rangeland ranges from 0.27 to 0.72 lbs/acre and citrus is 1.62 lbs/acre. Natural areas are 0.2 lbs/acre (LOPP Evaluation Report, 2007).

Comment #27 (Burger): *Lines 929–940. Have the phosphorus loads changed since 2001?By what amount?*

Response #27: Since 2001, discharge and loads have been generally greater than during the 1974−1995 baseline period. Loads were much lower in the drought year of WY2007. However, flow-weighted mean TP concentrations in C-38 remained relatively high in WY2007, as they have been since the baseline period. These high concentrations are consistent with observations during previous drought years, and possibly reflect pulses of phosphorus runoff following dry periods and a greater influence of upland runoff from lateral tributaries (and less influence from headwater discharge), especially in the lower pools.

[WS] Comment #28 (Burkholder): *Is the District planning to examine changes in P storage in the restored reach of the Kissimmee River (lines 1020–1031)?*

Response #28: In the current year, District staff are working to identify models, existing information to support these models, and additional data needs for assessing the restoration project's effect on phosphorus movement and retention and developing more reliable and defendable estimates of future phosphorus loading. Several approaches are being considered because a simple mass-balance approach to assess changes in P storage is very limited by uncertainties in discharge and P transport estimates from various sources. A plan that describes selected approaches for modeling and monitoring will be developed in WY2008. The text in lines 1020-1031 will be revised to more accurately state the staff's intent.

Comment #29 (Burkholder): *Lines 985–989 – another factor that should be considered here is increased regeneration from bottom sediments because of the hypoxic/ anoxic conditions. Are data being taken to resolve the role of low DO in higher P release?*

Response #29: With regard to the question about P release, our response is the same as what we gave to a similar question last year: We have not examined the effect of oxygen sags on phosphorus release from river sediment. Compared to the amount of phosphorus transported downstream from sources throughout the basin, we believe the amount of phosphorus released from river channel sediment should be relatively minor, if not insignificant. However, this is only speculation. For the upcoming evaluation of Phase II/III of the restoration project, staff is discussing proposals to study phosphorus assimilation and release as wetlands are restored in the Pool D floodplain and flow is diverted to remnant channels. A statement to this effect will be added to the end of the Phosphorus section in Chapter 11.

Comment #30 (Ward): *In lines 957–964 (page 11-29), an explanation is provided for the TP concentrations being higher today than during the restoration construction activities, being higher than pre-channelization conditions – from former pastures and flood plain transitions from terrestrial to wetland vegetation. Would you not expect spikes in TP concentration from restoration construction activities also? At times it would seem the construction activities would be a major source of TP.*

Response #30: We did see a couple of brief spikes in TP during the early part of Phase I restoration construction. These data were documented in a published paper (Colangelo and Jones, 2005). However, adjustments were soon made in Pool C water levels that reduced channel erosion and the construction contractor modified the backfilling method to isolate the activity from the flow of the river. Since then, construction has had no significant affect on TP concentrations. We expect that future phases of construction, employing a similar technique, will not affect water quality, either, but we will continue monitoring for any potential impacts.

*Colangelo, D.J., and B.L. Jones. 2005. Phase I of the Kissimmee River restoration project, Florida, USA: impacts of construction on water quality. Environmental Monitoring and Assessment 102:139-158.

[WS] Comment #31 (Ward): *Is the water quality monitoring conducted in the Kissimmee River region coordinated, in any way, with the water quality monitoring conducted in the Everglades Protection Area and reported on in Chapter 3?*

Response #31: Phosphorus loading from the Kissimmee River is included in the loading to Lake Okeechobee reported in Chapter 10, but otherwise there is no coordination of monitoring between the Kissimmee River and the Everglades Protection Area.

MERCURY

Comment #32 (Burger): *Lines 460–467: Since the Kissimmee is considered separately from some of the other chapters, what are the problems with mercury? While lines 460-467 discuss*

mercury, no details are given. What fish are impaired, at what levels? are there mercury advisories?

Response #32: Fish consumption advisories have been issued for a variety of fish in the Kissimmee River and several lakes in the Kissimmee Chain of Lakes. Specific advisories, including fish species and eating guidelines, are summarized for each water body in a publication issued by the Florida Department of Health*.

The FWC has just provided the District with raw data from fish collected from 1987 to 2007. In the Kissimmee River, concentrations of total mercury in fish tissue of several species ranged from 0.046 to 1.10 ug/g (ppm) wet weight. Concentrations in fish caught from the Chain of Lakes ranged from zero to 2.31 ug/g. We will summarize these data by waterbody and fish species, and look for trends.

We will include the above information in the chapter's mercury discussion.

*Florida Department of Health. 2006. Your Guide to Eating Fish in Florida. Florida Department of Health, Tallahassee. 24 pp. Available at:

http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/Fish_consumption_guide.pdf

[WS] Comment #33 (Burkholder): *How is the District tracking mercury bioaccumulation and impacts in the basin, considering that it is not involved in monitoring mercury in the basin? Will the mercury information for the Kissimmee system be included in the overall evaluation of mercury in the Everglades?*

Response #33: These questions refer to Lines 460-467 in the chapter. Concerns about mercury in ecosystems of south Florida are shared by the FDEP, Florida Department of Health, FWC, and SFWMD. The SFWMD's role is to assess potential changes in mercury mobilization resulting from works constructed as part of the Everglades Construction Project, which includes stormwater treatment areas, hydropattern restorations, water diversions, and other improvements. Restoration of the Kissimmee River is not part of this Project.

The research plan for the KRR evaluation included a mercury study that was intended to assess the impact of flooding drained lands in the Kissimmee River floodplain and headwater lakes. Some samples of water, plankton, small fish, and bass were collected and analyzed for baseline concentrations of mercury. Soil sampling was also planned. The study had two objectives: (1) collect baseline data in an attempt to foresee if significant amounts of methylmercury would be produced once the lands were flooded, and (2) compare these baseline data with data collected several years later after the lands had been inundated. However, as staff consulted with the FDEP and other experts, they concluded that monitoring of mercury in the water or soils has little practical use because several environmental factors determine how much of this mercury is converted to methylmercury and accumulated up the food chain. The time, effort, and resources required to collect these data were substantial, and there was a high level of uncertainty as to whether the study would ever be able to determine if the restoration project had caused detrimental effects due to mercury mobilization. Consequently, the staff terminated the study and has no plans to resume mercury studies in the Kissimmee Basin.

For tracking of the mercury problem in the Kissimmee Basin, the District will rely on the FWC's periodic analyses of mercury in fish tissue.

In conclusion, we cannot hope to predict or assess potential increases in mercury methylation and bioaccumulation without undue expenditures of time and funds. Even then, there is a high likelihood that the results we obtain from this large and diverse ecosystem will be inconclusive. Therefore, staff has taken the approach of monitoring mercury concentrations where it counts the most – in fish tissue. Experts we have consulted agree that this approach will give us the most useful information at the lowest cost.

[WS] Comment #34 (Burkholder): *Will the mercury information for the Kissimmee system be included in the overall evaluation of mercury in the Everglades?*

Response #34: As discussed in one of the responses above, the purpose of the District's mercury program in the Everglades is to assess potential changes in mercury mobilization resulting from works constructed as part of the Everglades Construction Project (ECP). Restoration of the Kissimmee River is not part of that Project and no plans currently exist to expand the ECP mercury program into the Kissimmee Basin.

[WS] Comment #35 (van Donk): *More clarification is still needed how management activities in the Kissimmee are integrated with management for the rest of the Everglades system. Clarification should include explanation of how the phosphorus and mercury information will be included as part of the overall Everglades evaluation of mercury contamination.*

Response #35: Mercury in largemouth bass (*Micropterus salmoides*) in the KB is being monitored by the FWC, but more extensive efforts to address mercury in the Kissimmee Basin are not planned for reasons given in the response above.

Comment #36 (Burkholder): *Is the District involved in, or planning to initiate, studies on impacts of mercury on the Kissimmee ecosystem?*

Response #36: As discussed above, the District does not monitor mercury in the Kissimmee Basin and has no plans to initiate monitoring. The FDEP and FWC monitors periodically for mercury, and the District is using fish tissue data collected by the FWC to assess trends in the Kissimmee Chain of Lakes and Kissimmee River.

BIRDS

Comment #37 (Burger): *Line 690: How many snail kite nests are usual?*

Response #37: The number of snail kite nests in the Kissimmee Chain of Lakes (Kissimmee, East Lake Toho, and Toho) varied between 0 and approximately 60 nests between 1992 and 2003 (Martin et al. 2003). In 2003, there were 17 nests on Lake Toho, 12 nests on Lake Kissimmee, and one nest on East Lake Toho. We will add this information to the chapter. Because of the low water conditions throughout south Florida in Water Year 2007, almost all of the successful nesting occurred in the Kissimmee upper basin, although the U.S. Fish and Wildilfe Service has not released final numbers for the year.

*Martin, J., W. Kitchens, and M. Speirs. 2003. Snail kite demography annual report 2003. U.S. Fish and Wildlife Service, Vero Beach, Florida.

Comment #38 (Burger): *Lines 796–797: Are these areas only used for foraging, or for nesting also. What happened to wading bird nesting in the region?*

Response #38: We will add the word "foraging" before wading birds on line 796. Wading bird nesting in the region is described in the "*Wading Bird Nesting Colony*" section.

Comment #39 (Burger): *Line 1188: abandoned because of lack of foraging sites because of the drought?*

Response #39: Yes – the question was answered at the end of the paragraph in lines 1195–1197. We will move that sentence to line 1189.

[WS] Comment #40 (Burger): *Table 11-3: One might expect with increasing environmental quality, the wading birds would move back. Are there any data on prey availability or density?*

Response #40: Only one of the nesting colonies described in Table 11-3 is in the KR floodplain and none are in the restored Phase I area (Table 1 below). Therefore, the numbers reported in the table are unlikely to be directly related to Phase I restoration. The table will be revised to clarify.

There are no pre-channelization records of large (> 1000 birds) wading bird nesting colonies within the area of Phase I based on Audubon Society game warden data (1936–1959). We will clarify in the chapter.

Only the New Chandler Slough colony (see Table above) (which is in Pool D, slated for restoration in Phase II/III) can be considered to be in the vicinity of a large colony that was confirmed to have occurred *within* the entire Kissimmee River floodplain prior to channelization; smaller colonies may have been found throughout by the Audubon surveys, but exact locations are not clear.

We have not collected data on prey availability (i.e. throw trapping) on the floodplain since 1999. We will start collecting this data again for Phase II/III this year.

The additional details shown in the table below will be added to Table 11-3.

Table 1. Peak numbers of wading bird nesting colonies inside or within 3 km of the Kissimmee River 100 yr flood line between the S65 and S65-D structures. Surveys were conducted Mar-Jun, 2004; Mar-Jun, 2005; Feb-Jun, 2006; and May-Jul 2007.

Lat.	Long.	Colony Name (Location)	Year	ANHI	CAEG	GBHE	GREG	TRHE	Colony Total
81 13.219	27 42.946	42W (4.5 km west of Pool A floodplain)	2004	-	-	-	-	-	-
			2005	-	-	-	-	-	-
			2006	-	-	-	8	-	**8**
			2007	-	-	-	-	-	-
81 04.466	27 22.853	C38 Caracara Run (east bank of C-38 canal in Pool D)	2004	-	-	-	-	-	-
			2005	-	-	-	-	-	-
			2006	-	500	-	-	-	**500**
			2007	-	226	-	-	1	**227**
81 16.527	27 32.088	Cypress West (5.2 km west of Pool B floodplain)	2004	-	-	-	-	-	-
			2005	-	-	-	21	-	**21**
			2006	-	-	-	25		**25**
			2007	-	-	-	-	-	-
81 00.380	27 22.620	New Chandler Slough (Chandler Slough near U.S. 98, in Pool D floodplain)	2004	-	-	-	-	-	-
			2005	-	-	-	-	-	-
			2006	-	-	-	40	-	**40**
			2007	-	-	-	-	-	-
81 04.649	27 21.076	Orange Grove (1.9 km southwest of Pool D floodplain)	2004	-	-	-	-	-	-
			2005	30	-	5	60	-	**95**
			2006	20	-	4	60		**84**
			2007	-	-	-	-	-	-
81 06.442	27 37.791	Pine Island Slough (1.6 km east of Pool B floodplain)	2004	-	-	-	-	-	-
			2005	-	400	-	-	-	**400**
			2006	-	-	-	-	-	-
			2007	-	-	-	-	-	-
Total Nests			**2004**	**0**	**0**	**0**	**0**	**0**	**0**
			2005	**30**	**400**	**5**	**81**	**0**	**516**
			2006	**20**	**500**	**4**	**133**	**0**	**657**
			2007	-	**226**	-	-	**1**	**227**

Comment #41 (Burger): Lines 1240–on: it says most foraging areas were dry; there are no other associated foraging areas in the region?

Response #41: The surveys are conducted on the KR floodplain to determine use of the floodplain. There are other foraging areas in the region (lakes, other wetlands) where wading birds are likely foraging.

Comment #42 (Burger): *Fig.11-17: Since many of the years were dry, the big decrease is unexpected. I assume this is foraging birds. Need to give the region of survey.*

Response #42: The figure will be redrawn to show that baseline and post-restoration sampling were conducted during the dry season (December–May) within the Phase I project area. This will be clarified in the revised chapter figure.

Comment #43 (Burkholder): *Is it possible to estimate how many nesting colonies, roughly, would have been expected historically within a rich floodplain such as the natural floodplain of the Kissimmee River?*

Response #43: See comment above answering Dr. Burger regarding pre-channelization wading bird nesting effort along the river. In pre-channelization surveys, large colonies were not observed within the floodplain itself. These were near the Chain of Lakes, Lake O, and in sloughs, isolated wetlands, and hammocks surrounding – but not in – the floodplain. We determined it was not reasonable to develop an expectation based on limited historical data regarding colony locations and sizes which did not indicate nesting in the project floodplain area historically.

Comment #44 (Burkholder): *Is progress planned to assess whether there are abundant habitats/locations available for nesting sites?*

Response #44: We can assess the abundance of potential nesting sites for wading birds at a gross level periodically using the abundance of shrub and tree stands as determined from the vegetation mapping program. We expect that restoration of an approximation of pre-channelization plant communities will restore potential wading bird nesting areas to pre-channelization conditions.

Comment #45 (Burkholder): *(Project Updates Section) Wading birds – Use of wading birds is a sound approach because they integrate ecological conditions. Unfortunately, only 1 nesting colony was found in severe drought WY2007, and it was unsuccessful (abandoned in mid-season); moreover, nearly all wading birds cattle egrets (exotic species). Even in 2006, however, there were only 5 nesting colonies within the Kissimmee River floodplain. This seems very low for such an historically rich area.*

Response #45: See comments above. To our knowledge, with the exception of the colony occurring in Chandler Slough prior to channelization, wading birds did not use the floodplain significantly for nesting prior to channelization.

Comment #46 (Burkholder): *The legend for Figure 11-17 should include more information (e.g. "n" values and what they mean).*

Response #46: We will refine Fig 11-17.

UPPER BASIN

Comment #47 (Burger): *Lines 1312–1318: More details are needed on the [KBMOS] outreach component: what does it consist of, how often, what happens to their input?*

Response #47: A public outreach component is incorporated into the KBMOS to encourage stakeholder participation in the performance measure and alternative plan development. Communication and information gathering is facilitated through email, interagency workshops, and public meetings.

The public outreach component for the KBMOS consists primarily of public workshops intended to educate the public on the study and how to get involved and to solicit input on desirable water level conditions. The primary public input period will initiate with the development of alternative plans. A glossy brochure entitled "Guide to the Computer-Aided Participation Process" was produced to define key terminology and to introduce the template that will be used to collect stakeholder preferred criteria for evaluation. A performance indicator type has been developed to capture stakeholder requirements not addressed under the flood control, natural resource, water supply, and aquatic plant management measures and indicators developed by the partner agencies. These stakeholder performance indicators will be used to report how well a given alternative plan performed relative to the stakeholder defined criteria.

The public outreach component of the KBMOS is part of a larger public outreach program associated with the Kissimmee Chain of Lakes Long-Term Management Plan. Under the KCOL LTMP local stakeholder groups including Homeowner Associations, the local chapter of the

Audubon Society and the Osceola County Lakes Management Advisory Board are being consulted to define management objectives and priorities for the water bodies within the KCOL.

Comment #48 (Ward): *Lines 1321–1338, page 11-40, discuss development of the Kissimmee Chain of Lakes Long-Term Management Plan. The plan will include measures of ecosystem health along with tools to assist in management decision making. Is this effort being coordinated with RECOVER, discussed in Chapter 7, and the water quality monitoring re-engineering discussed in Chapter 1B? If so, describing the coordination would be helpful. If not, there are opportunities to coordinate the production of management oriented water quality and ecosystem information, across South Florida, that could greatly facilitate decision making at all levels of water management, including communication with the public.*

Response #48: The monitoring and assessment component of the KCOL LTMP should eventually be coordinated with RECOVER. Coordination is underway with CERP through the Northern Everglades Technical Plan (NETP). Evaluation performance measures developed to describe the water levels and flows needed to sustain fish and wildlife resources in the KCOL are being used in the development of the NETP and assessment of whether implemented measures provide desired results will be required. The primary intent of the KCOL LTMP monitoring and assessment program is to report on conditions relative to the management objectives and priorities identified for each of the water bodies in the KCOL. That reporting needs to address monitoring for determining health of the system as well as monitoring to reduce uncertainty in the systems response to management measures.

Comment #49 (Burkholder): *What actions/future projects are planned to combat hydrilla, now that it apparently has acquired resistance to the herbicide fluridone? How serious of a problem was hydrilla in WY2007, and what are evolving expectations about its role, and the role of other exotic species in the KRRP?*

Response #50: The Florida Department of Environmental Protection (FDEP) is the lead agency dealing with hydrilla (*Hydrilla verticillata*) management in the state of Florida. The District works closely with FDEP to coordinate hydrilla management activities in the KCOL. Hydrilla is a serious problem in Florida and the state is actively pursuing new control technologies. New systemic herbicides are under development that may be available to replace fluridone in the next few years. Small areas were treated with a contact herbicide (fluridone is systemic) in some of the upper basin lakes in the last year. Another area under investigation is biological control agents (such as grass carp *Ctenopharyngodon idella*). However, it may be that we will have to accept some level of hydrilla in infested lakes in the future.

*Netherland, M. D., M. V. Hoyer, M. S. Allen, and D. Canfield. 2005. A summary of future management recommendations from the December 2004 Hydrilla Summit in Florida. Aquatics 27:4,6,8-10.

SAV IN KCOL LAKES

[WS] ***Comment #51 (Burkholder):*** *What are the District's plans to assess the causative factors for the apparent increase in seed germination and growth of native SAV in the littoral zones of several monitored lakes in the Upper Basin?*

Response #51: The increase in native SAV was an anecdotal observation made by staff from another agency. We felt this observation was worth documenting, and offered two possible explanations (increased light as a result of low water levels, and discontinued hydrilla treatment). Because of staff limitations and other priorities, the District currently is not planning a study specifically to follow this response, although detailed monitoring of vegetation in KCOL lakes including Lake Toho is planned to start in 2008. A similar response by native SAV was observed in Lake Istokpoga following an extreme drawdown project and hydrilla treatment (**2001)** (anecdotal observation from FWC summarized in Anderson 2007). While not experimental

evidence for Lake Toho, this observation from Lake Istokpoga suggests that light limitation may be more important.

*Anderson, D.H. 2007. Assessment of Ecological Impacts on Lake Istokpoga of a Proposed Deviation to the Regulation Schedule. Internal report. South Florida Water Management District, West Palm Beach, FL. April 18, 2007.

Comment #52 (Burkholder): *SAV in lake littoral zones (Toho, Kissimmee, Hatchineha, Cypress; lines 699–709) – Native SAV (Valisneria, Potamogeton illinoiensis) apparently increased seed germination and growth in the littoral zones of several monitored lakes in the Upper Basin – perhaps in response to prolonged low water levels (and increased light?), or to discontinued herbicide treatments for hydrilla. Explanation should be added about the District's plans to assess the causative factors for the apparent increase in seed germination and growth of native SAV in the littoral zones of several monitored lakes in the Upper Basin.*

Response #52: See Response to question above.

Comment #53 (van Donk): *Is the increased seed germination and growth of SAV in the littoral zones of several monitored lakes in the Upper Basin a response to prolonged low water levels (and increased light) as in Lake Okeechobee, or to discontinued herbicide treatments?*

Response #54: See Response to question above.

RESTORATION PROGRAM, GENERAL CHAPTER SUGGESTIONS, VEGETATION

Comment #55 (Burkholder): *Much of the Kissimmee River restoration depends upon planned replacement of Zone B releases with releases under the Headwaters Revitalization Project proceeding on schedule for completion in 2011 under KRHRP?*

Response #55: We may require clarification of this question. It is true that Zone B releases will be replaced with the new Headwaters Schedule, and that full restoration is dependent on the new schedule, which will more closely simulate pre-channelization quantities and timing of releases to the river. However, the exact year of implementation is not crucial.

Comment #56 (Burkholder): *What was the source of the spoil material that has been used and is planned for use in backfilling efforts (e.g. lines 298–299)? This question is an example of a broader concern about how the methodology used in restoration impacts the system.*

Response #56: The spoil material used for backfilling is the same material that was dredged during construction of the canal. During construction of C-38, this material was deposited in large mounds adjacent to the canal. It is composed primarily of sand and course shell.

Comment #57 (Burkholder): *How are benthic fauna, an important component of lotic systems, being considered by the District in river restoration?*

Response #57: Benthic invertebrates (and others) have been identified as key biological indicators of the restored river, and expectations (performance measures) are in place for the restoration project. Following completion of Phase I construction and restoration of continuous flow, replicate monthly benthic samples were collected between January 2002 and December 2004 from river channels in the Control area (Pool A) and the Phase I project area. Continuous flow since Phase I has flushed accumulated organic matter. The exposed, original river channel substrate within the Phase I project area is composed primarily of shifting sand with small amounts of organic matter (< 1 cm). Analyses are currently underway to determine shifts in benthic invertebrate community structure related to restoration of flow and physical habitat structure.

[WS] Comment #58 (Burkholder): *In efforts to restore the pre-channelization floodplain vegetation, what steps are being taken by the District to encourage broadleaf marsh plants to re-establish in the river floodplain, while discouraging growth of wetland shrub species?*

Response #58: We expect that restoration of pre-channelization hydroperiods ultimately will restore marsh communities approximately to pre-restoration distributions. Similarly, we expect that the areas of wetland shrub communities will approximate pre-channelization extents. However, in 1952 approximately 7% of the floodplain was wetland shrub. This had decreased to about 3% in 1974 two years after following channelization, and in 2003 (two years following Phase I construction), wetland shrub communities occupied about 20% of the Phase I floodplain. Most of this coverage is due to willow, buttonbush, and primrosewillow communities. No effort is being made currently to discourage wetland shrub communities, although upcoming monitoring of a planned controlled burning program in the Phase IVA floodplain and a restored marsh in Pool A is expected to provide data that will be useful in adaptive management of floodplain succession of vegetation.

Comment #59 (Burkholder): *It is important for the Introduction and Background section, or the Kissimmee River Restoration Project and Associated Initiatives section (i.e. near the beginning of the chapter), to include a table that clearly, briefly describes the KRREP, KRRP (including description/ timelines of Phases I-IV, KRHRP, KBMOS, KCOL LTMP, and LOPP, and their inter-relationships.*

Response #59: We will add a table describing the various phases and projects

Comment #60 (Burkholder): *The addition of . . . clarifying information is much needed. As presently written, for example, readers are left to wonder, through much of the document, what the four phases are and what they are supposed to accomplish (readers are later informed that they all involve backfilling), and why Phase I (completed in 2001) is followed by Phase IVA (which has not been explained, except "for logical reasons"). Readers first logically but wrongfully believe that "a second phase of backfilling, initiated in June 2006 (lines 48-49) is Phase II – they later are informed that this "second phase" is really Phase IVA (lines 290-305).*

Response #60: The naming of construction phases has a long history starting in the 1990s. The phases originally were named roughly in the order of expected completion. The sequence has been changed over the years for logistical reasons (budgetary considerations, coordination with land acquisition, ease of access). We will clarify in the revised chapter.

Comment #61 (Burkholder): *Floodplain vegetation responses –In Figure 11-14, it would be helpful to add a wetland shrubs panel.*

Response #61: Will add values for the wetland shrub vegetation type to Fig. 11-14.

[WS] Comment #62 (Burkholder): *Missing from the writing . . . is explanation as to how the accountability of KRRP will actually be evaluated as restoration efforts continue.*

Response #62: Evaluation of the success of the Kissimmee River Restoration Project is a requirement of the District's cost-share agreement with the USACE. The project is being evaluated using 25 restoration expectations (performance measures) to evaluate the success of the restoration in meeting the project's ecological integrity goal (Anderson et al., 2005; Bousquin et al., 2005). These performance measures have undergone an external peer-review process. Status of the performance measures is reported in several ways, including peer-reviewed publications, conference presentations, and annual SFER chapters, although final evaluation of project success will not take place until project completion and responses have stabilized.

*Anderson, D.H., S.G. Bousquin, G.E. Williams and D.J. Colangelo, eds. 2005. Defining Success: Expectations for Restoration of the Kissimmee River. South Florida Water Management District, West Palm Beach, FL. Technical Publication ERA #433.

*Bousquin, S.G., D.H. Anderson, G.E. Williams, and D.J. Colangelo, eds.. 2005. Introduction to Baseline Studies of the Channelized Kissimmee River. Chapter 1 in: *Establishing a Baseline: Pre-restoration Studies of the Channelized Kissimmee River.* South Florida Water Management District, West Palm Beach, FL. Technical Publication ERA #432.

Comment #63 (Burkholder): *The chapter helpfully, if briefly on some issues, explains how management of the Kissimmee relates to/coordinates with management of the rest of the Everglades system. One area that is missing in integration is how the Kissimmee restoration plans will be integrated with management of exotic species.*

Response #63: Exotic, invasive vegetation is actively managed throughout the KRR project area in an effort to meet goals in addition to restoration success. Kissimmee Division and Vegetation Management Division staff coordinate vegetation management efforts with field sampling, work to achieve consistent efforts from year to year, and follow guidelines to avoid inordinate impacts on native plant species. This program has been in place since 1988. The goal of vegetation management in the Kissimmee River ecosystem is to achieve "maintenance control" rather than complete elimination of exotics. Maintenance control is an effort to achieve tolerable, low levels of invasive species efficiently.

Comment #64 (van Donk): *I miss in the Introduction a table that describes all abbreviations used in this chapter, like: KRREP, KRRP, KRHRP, KBMOS, KCOL LTMP, LOPP etc.*

Response #64: Will add a glossary of acronyms, or we will add our acronyms to the Volume I glossary.

DISSOLVED OXYGEN AND THE 2007 FISH KILL

Dissolved Oxygen [WS DISCUSSION TOPIC]

Comment #65 (Burkholder): *Dissolved oxygen (lines 56–57, 641–666, 718–725) – Standard errors or standard deviations and "n" values should be included where mean DO concentrations are reported.*

Response #65: Figure caption or text will be clarified to indicate that for mean daily values, n is based on 15 minute readings or 4 X 24 = 96 measurements/day. In WY2007, the standard error for the mean daily values ranged from < 0.01 to 0.29. We will report the range of SEs for each number separately after each value in the chapter revision (e.g., 3.35 mg/L (SE x-y), < 1 mg/L (SE x-y), and 1 mg/L (SE x-y))

Comment #66 (Burkholder): *The authors should clarify lines 718-719 (31 October 2006 was the end of the critical period for low DO?).*

Response #66: Water temperatures begin to cool off by the end of October. This is stated in lines 720 and 721. We will clarify in our revision.

Comment #67 (Burkholder): *Here [718–719] readers first learn that data are available for bottom-water DO.*

Response #67: In anticipation of extremely low or zero flows, additional DO sensors were deployed near the channel bottom at two stations and maintained until DO increased. We will explain this in the chapter revision.

Comment #68 (Burkholder): *Writing needs to be added to explain how the benthic fauna are being considered in restoration.*

Response #68: We will explain in the revised chapter

Comment #69 (Burkholder): *DO figures for minima (depth 0-1 m, and depth ~2 m) should be added.*

Response #69: We only have data for about a month or so which is why figures were not included. These data can be presented in the revised chapter.

Comment #70 (Burkholder): *For Figure 11-7 – Bankfill stage should be defined in the legend or where it first appears in the text.*

Response #70: Bankfull stage is the elevation at which water begins to overflow the river channel onto the floodplain. (This definition has been added to the text of the chapter at the first location used, which is in reference to Figure 11-7).

Comment #71 (Burkholder): *Pp. 11-24 to 11-27 – As in comments on the 2006 SFER's coverage of the Kissimmee watershed, a major concern remains about the use of mean DO as a restoration performance measure (PM). It is well established that in aquatic ecosystems, the worst DO "sags" occur before dawn, yet mean daily DO was selected as the PMs (lines 853-860).*

Response #71: We do not have a PM that uses daily minimum DO as a metric because we have no reference data on which to base a minimum acceptable threshold. Additionally, we know that DO sags (and fish kills) occur naturally in South Florida streams, which further complicates development of a minimum acceptable DO concentration. That said, we do collect data at our continuous DO monitoring stations that tell us when a DO sag is occurring. These data are one of the tools that we use to help make decisions about regulation of stage and flow through the river on a weekly basis.

[WS] Comment #72 (Burkholder): *Two of the eight streams from which "reference conditions" were derived are also suspect. The PMs also seem questionable: It is doubtful that the pre-channelization Kissimmee River typically had < 2 mg/L, or 2-4 mg DO/L at depths < 1 m (PMs 1-3).*

Response #72: Reference streams were chosen based on availability of data as well as on their similarities and proximity to the Kissimmee River. Data from these streams show that DO concentrations during the wet season (June – October) were 3 - 6 mg/L. Therefore, we used this range as a target for wet season DO concentrations in the Kissimmee River. The reviewer is confusing the baseline or "pre-channelization" concentrations (< 2 mg/L during the wet season and 2–4 mg/L during the dry season) with reference conditions. We will add text to clarify how baseline and reference data are presented. This expectation has been through external and internal peer review.

Comment #73 (Burkholder): *The PM for DO concentrations at depths from 1-2 m (bottom) considers severe hypoxia bordering on anoxia (~1 mg/L) as acceptable, although it is well known that many benthic organisms in lotic ecosystems require 4 mg/L or more for healthy growth and low physiological stress.*

Response #73: We do not consider DO concentrations below 2 mg/L to be acceptable. The performance measure was developed to acknowledge that low DO events occur naturally, but should not persist for long periods of time. The performance measure would fail if DO near the channel bottom was less that 1 mg/L for more than 50% of the time. This threshold is based on data collected in the channelized system that show DO < 1 mg/L nearly all of the time. No reference data exist for bottom-water DO. This PM has gone through external and internal peer review and was deemed acceptable.

(JK) Phase II/III baseline studies will better integrate DO concentrations near the river bottom with benthic invertebrate community structure.

Comment #74 (Burkholder): *Relatively few DO stations are included thus far along the Kissimmee River and the Pools (lines 833-838), and only two of 9 stations provide continuous data; the rest have a monthly frequency of data collection. Are there plans for the District to add more stations, including more with continuous data collection?*

Response #74: At least four new stations will be added as part of Phase II/III studies.

Comment #75 (Burkholder): *(Project updates section) – other information River metabolism – This study was completed some time ago (1998-2003), and the information became available this year in the peer-reviewed literature. For the chapter text, at least brief technical detail is needed (number of stations sampled, number of replicates, description of the variability in GPP). Figure 11-13 should include error bars and "n" values. The data were interpreted to suggest that the connection between the river and its floodplain has been partially restored. Additional data will be needed to assess whether this is the case.*

Response #76: More detail will be added, including why the data presented are sufficient. Project will be repeated and improved in Phase II/III

[WS] 2007 FISH KILL [WS DISCUSSION TOPIC]

[WS] Comment #77 (Burger): *Lines 647-on: What was the food web effect of the fish kill: could some number be put on the fish kill (and relative to others in the region)?*

Response #77: For comparison, in a 1988 fish kill, 25,003 fish perished in the lower seven miles of Pool B of the C-38 canal (Toth et al. 1990). We do not believe that the 2006 fish kill affected the food web significantly.

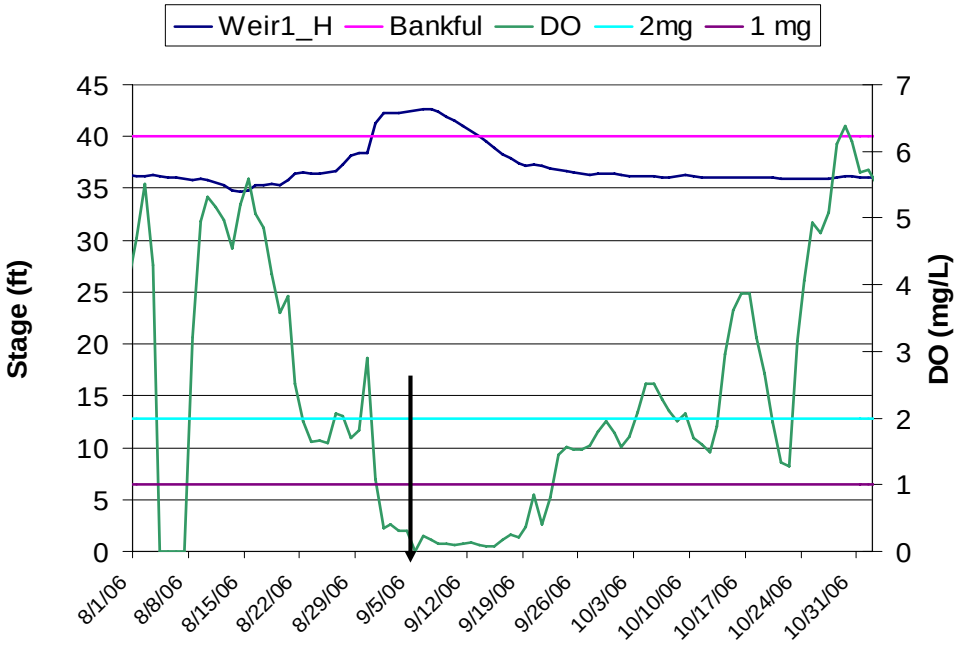
*Toth, L.A., S.J. Miller, and M.K. Loftin. 1990. September 1988 Kissimmee River fish kill. *In* M.K. Loftin, L.A. Toth, and J.T.B. Obeysekera, eds. Proceedings, Kissimmee River Restoration Symposium. South Florida Water Management District, West Palm Beach, FL.

[WS] Comment #78 (van Donk): *On page 11-19 is written that on Sept. 6, 2006 approximately two thousand dead fish were found in both the restored reach of the Kissimmee River and in the downstream reach of the C-38 canal remaining in Pool C. My question is: what were the consequences of this for the rest of the food web. Did you see an increase in transparency??*

Response #78: See other responses to other questions on the fish kill. We do not have data to assess a change in transparency (BJ). We assume that the question about increased transparency refers to the possibility that the fish kill initiated a trophic cascade that cleared phytoplankton from the water column. Such an effect is unlikely because the fish that died belonged to different trophic levels. Since the river was flowing at the time (flow was not ended until November 2006), it is unlikely that phytoplankton would have been present, so it seems unlikely that we would have detected a change even if we had been monitoring transparency.

Comment #79 (Burkholder): *Mean DO prior to tropical storm Ernesto was at a level that adversely affects fish health (3.35 mg/L). Post-storm levels were at < 1 mg/L (1 Sept. 2006) , 0.1 mg/L on 7 Sept., $\leq$ 1 mg/L for the next two weeks, and only 2 mg/L by early October. Predictably, the already-severely stressed fish (all species, even low-oxygen-tolerant catfish) under hypoxic conditions pre-storm (depth ~0-1m: 3 mg/L on 11 July [lines 723-725], 3.35 mg/L pre-Ernesto) died when the "restored" (more accurately, so far, backfilled) reach of the Kissimmee River and Pool C went anoxic (< 1 mg DO/L).*

Response #80: Fish were not observed showing signs of stress (breathing at the surface) until after TS Ernesto passed over (the observation was made on Sept. 5-see black arrow in Figure below) and the DO had crashed (see figure below). Dead fish were observed in large numbers the day after they began showing stress. There was no indication that the fish were under stress prior to Sept. 5, although they had intermittently since April experienced DO concentrations well below 5 mg/L and experienced approximately two weeks of concentrations below 3.35 mg/L before the fish kill.



There appears to be an assumption in the review comments that at 3.35 mg/L fish health is adversely affected. Evidence to the contrary:

1. Similarly low DO occurs frequently in the Kissimmee River without fish kills or observations of stress. Since Feb. 2001, DO concentrations at KRBN were less than 5 mg/L 53% of the days and less than 2 mg/L 17% of the days. This represents a significant amount of time that DO was low, yet we had very few instances of fish kills or stressed fish. The full frequency distribution for KRBR is below.

DO mg/L	*Frequency*	*Cumulative %*
1	170	8.72%
2	162	17.03%
3	202	27.38%
4	208	38.05%
5	286	52.72%
6	312	68.72%
7	287	83.44%
8	173	92.31%
9	94	97.13%
10	43	99.33%
More	13	100.00%

2. Blackwater rivers of the southeastern United states have naturally occurring low dissolved oxygen concentrations during the summer months due to natural loading of organic matter from

floodplain swamps. Dissolved oxygen concentrations lower than 5 mg/L are common during the summer (Meter, 1992).

3. Belanger et al. (1985) recommended the FDEP conduct a review of the 5 mg/L standard for dissolved oxygen because they found that in south Florida many water bodies stained with humic substances naturally have oxygen concentrations that fall below 5 mg/L for extended periods of time. Their study included two tributaries to the Kissimmee River.

4. The study concludes that a water quality standard for DO in humic colored waters should be lower than the present 5 mg/L standard for class III waters. Data in the study show DO concentrations well below 2 mg/L in Florida Class III waters especially during the summer months. [D. Colangelo] Meyer, 1992, also documents low (< 5 mg/L) DO concentrations in the Ogeechee and Satilla rivers in GA. These are relatively undisturbed rivers.

5. In shock tests where DO was lowered rapidly, bluegill and largemouth bass survived at concentrations as low as 0.75 mg/L at 25 degrees C (Moss and Scott 1961). When DO was lowered more gradually these fish were able to survive at 0.70 mg/L. These species seem to have acclimated to low DO concentrations.

6. FDEP is reconsidering DO standards for Everglades marshes (and other systems) because the current standard for class three waters (5 mg/)L is too high (although this refers to Everglades marsh and may not be suitable), They are developing a Site Specific Alternative Criterion (SSAC). Weaver (2004) noted that "The overall average dissolved oxygen concentrations for grabsamples collected at 56 monitoring sites between 1994 and 1999 was well below 5.0 mg/L state standard (3.19 $\pm$2.21 mg/L, mean $\pm$ standard deviation)with 81% of the measurements dropping below 5 mg/L. the mean dissolved oxygen concentrations at individual monitoring sites ranged from 1.07 to 7.43 mg/L with between 15.8% and 98.1% of the values not meeting the current standard (Table 2)." Note that these sites include impacted areas in the WCAs.

7. I checked with DEP and the program has been suspended for now.

8. Furse et al. (1996) state that for largemouth bass that "We further define DO between 1.0 and 2.0 ppm as stressful and DO < 1.0 ppm as lethal based on observations of Whitmore et al. (1960), Moss and Scott (1961), and Petit (1973)." These are point measurements at locations where bass occur and not mean daily values.

8. Furse et al. (1996) used telemetry to track the movements of largemouth bass in the Kissimmee River and found that bass frequently occurred in locations where the dissolved oxygen concentration was between 1 mg/L and 2 mg/L during the summer when oxygen concentrations were low. They also noted bass occasionally were found at locations where the concentrations had fallen to $\leq$ 1 mg/L left areas but the fish usually left these areas or died.

*Belanger, T.V., F.E. Dierberg, and J. Roberts. 1985. Dissolved oxygen concentrations in humic –colored waters and water quality standard implications. Florida Scientist 48:107–119.

*Furse, J.B., L.J. Davis, and L.A. Bull. 1996. Habitat use and movements in largemouth bass associated with changes in dissolved oxygen and hydrology in Kissimmee River, Florida. Proc. Annu. Conf. Southeast Assoc. Fish and Wildl. Agencies 50:12-25.

*Meyer, J.L. 1992. Seasonal patterns of water quality in blackwater rivers of the coastal plain, southeastern United State. In, Becker, C.D. and D. A. Neitzel (ed.) 1992. Water quality in North American river systems. Battelle Press, Columbus, OH.

*Moss, D.D. and D.C. Scott. 1961. Dissolved oxygen requirements for three species of fish. Transactions of the American Fisheries Society 90:377-393.

*Weaver, K. 2004. Everglades marsh dissolved oxygen site specific alternative criterion technical support document. Water Quality Standards and Special Projects program Division of Water Resource Management, Florida Department of Environmental Protection, Tallahassee, FL

Comment #81 (Burkholder): *The writing describes this as a "small" fish kill, yet very likely all of the fish present died. Various authorities in fish kill evaluation (e.g. the American Fisheries Society) define a major fish kill as ≥ 1,000 fish affected, and ~2,000 dead fish were reported.*

Response #81: The statement that "very likely all of the fish present died" appears to be based on the assumption that the lethal threshold is higher than 1 mg/L (see response to previous question) and ignores the potential for fish to find refugia in other parts of the system.

While we can debate the meanings of small and major, we described the fish kill as "small" because we felt that it 1) did not affect a large area, 2) was not prolonged, 3) did not kill all of the fish, and 4) had limited effect on the food web. We have records of a much larger fish kill in 1988 when 25,003 fish perished along a seven mile stretch of the C-38 canal (Pool B of the channelized system). We also have records of smaller fish kills (250-300 fish in the C-38 and Pool C boat ramp in August 2004.

We have examined both editions of the AFS Fish Kill Evaluation manual (AFS 1992) and cannot find reference to thresholds defining small and larger fish kills.

*American Fisheries Society. 1992. Investigation and Valuation of Fish Kills. AFS Special Publication 24. Bethesda, Maryland.

(LG) Additional information about the fish kill:

- It occurred mainly in three isolated locations with an approximate average of 320 dead fish collected per location (n = 271, 307, 386). Fish were collected on a single day using a transect method. The total estimate (~ 2000 fishes) includes accounting for potential fishes located in inaccessible areas within each sample site, for non-floating fishes, and for a few non-sampled areas containing greatly reduced densities of dead fished compared to the three high-impact areas.
- Food web – not greatly affected because the kill affected all trophic levels and in a fairly uniform fashion so that no single trophic level was eliminated from the food web.
- Standing crop estimates from baseline-period block net studies indicated an average of 350 fish (of roughly the same species as represented in the kill) per 50 m x 50 m area of river channel, so numbers are low when the total length of river channel in the restored area is accounted for.
- (SGB) A rough estimate based on this survey from the baseline period indicates densities of fish of 0.14 fish/m^2 prior to restoration, likely a conservative estimate since it is for non-flowing conditions. Extrapolated over the area of the Phase I restored river channel (~100,000 m^2), this gives an estimated total population size of 14,000 fish. By this estimate, the 2006 event killed approximately 14% of the population in the restored channel. We acknowledge that this is a significant proportion of the population and regret the use of the term "small" which implies a value judgement.

Comment #82 (Burkholder): *The fact that DO was already depressed, prior to the tropical storm, to a level that can severely stress fish health, and that DO then sank even lower to anoxia (down to 0.1 mg/L, technically below the technique/instrument level of detection – line 846), seems at odds with the statement in lines 662-666. These fish clearly were stressed at 3.5 mg/L; moreover, few fish species can physiologically adapt to anoxia. Lines 641-666 should be rewritten accordingly.*

Response #82: We disagree with the reviewer's comments. Signs of stress were not observed until almost a week *after* TS Ernesto passed, the water levels rose, and DO crashed to < 1 mg/L. It is not clear to us what is inconsistent with lines 662–666. Line 666 actually states that the fish kill was associated with a rapid decrease in DO when fish had limited access to floodplain refugia.

MAP FIGURES

Comment #83 (Burkholder): *Maps – Figures 11-1 and 11-2, repeated from the previous SFER, are generally excellent, but there is need to show additional features (likely on an additional map or two) that are discussed in the text without providing readers with information on where the features are located. These features include Weir #1 (p.11-19); the Phase I floodplain (is shown in Figure 11-15 but out of context with the rest of the basin; would be very helpful to show in Figure 11-1); PC62 (p.11-21); C-37 canal (p.11-23); the SFWMD water quality monitoring sites (p.11-13) in lakes (Lakes Kissimmee, Cypress, Hatchineha, Tohopekaliga, East Tohopekeliga) and three main tributaries (Boggy Creek, Shingle Creek, Reedy Creek); Caracara Run and the Lanier Floodplain area of Pool D (p.11-40); and the Three Lakes Wildlife Management Area (p.11-44).*

Response #83: We will modify the chapter to include maps of additional features, including the weirs, restoration phase areas, small project locations, water quality monitoring sites in the upper and lower basins, more detail in Upper Basin (e.g., C-37), and planned Phase II/III sampling locations.

EDITORIAL CHANGES (Burkholder)

Response #84: Will be examined and addressed.

Figure 11-2 legend, 4th line – Revitalization…

Throughout document (e.g. p.11-9, lines 282-284) – consistency is needed in presentation of units; metric (English) format is recommended. Should check throughout (e.g. Figure 11-3, p.11-45).

Line 557 – change to: …150 cfs (Figure 11-5C).

Line 562-563 – should be omitted (already stated).

Figure 11-6 - would benefit by previous information to inform readers as to the location of Weir 1 (see "Maps" comments above). The legend for this figure should also explain to readers why the stage recorder was deactivated (explanation presently occurs later, on p.11-22 – because of backfilling).

Figure 11-7 – should be moved up to p.11-20. The bankfill line (Figure 11-7B) should be clarified (difficult to see). The legend for Figure 7C should be: (C) mean dissolved oxygen…

Line 791 - …the mean daily concentration…

Line 815 – monthly data are insufficient to show effects of extreme climatic events; this writing should be altered accordingly.

Line 837 - …on eight free-…

Figure 11-9 – change the colors to match those in Figure 11-8 (reduces confusion).

Figures 11-7C and Figure 11-10 – aren't these figures supposed to show the same data? (they differ slightly – and if they are showing the same data, then Figure 11-10 could be omitted.

Figure 11-15 – add 2003 to map at far right.

Line 1159 - …dominated by wetland shrub vegetation…

Line 1284 - …four headwater

Figure 11-17 – should be moved to p.11-41.

RESPONSES TO COMMENTS ON SFER – VOLUME I, CHAPTER 12

Richard Alleman and Chapter Authors

Subject: Chapter 12- Responses to Comments
Document posted as: 2008 SFER RTCs_Ch12_102207.doc
Originally Posted: 24 Oct 2007 04:53 PM

RESPONSES TO PEER-REVIEW PANEL COMMENTS ON THE FINAL 2007 SFER VOLUME I, CHAPTER 12

Dr. Armstrong

General Comments

Comment #1: *Chapter should be restructured for in-depth focus on one coastal system each year and consistent presentation template. Panel will need to check SFER 2008.*

Response #1: The 2008 chapter was restructured accordingly.

Comment #2: *Add overview, clarify management strategies and quantifiable targets, and consideration of work done elsewhere on Atlantic and Gulf Coasts. Authors are encouraged to cite literature in Chapter 12 that demonstrates familiarity with and use of estuarine research done elsewhere. Panel needs to check SFER 2008.*

Response 2: The 2008 chapter included linkage to a conceptual science plan and quantifiable targets where appropriate. The expanded discussion about Florida Bay should demonstrate familiarity with estuarine research in other geographic areas.

Comment #3: *Coordinate work in South Florida estuaries. Apparently will incorporate into future reports.*

Response #3: The authors intend to explain coordination in the highlighted water body section (Florida Bay) and in the future detailed science plans for each water body as they are developed.

Comment #4: *Develop common presentation template for each coastal ecosystem and other changes. Panel needs to check SFER 2008.*

Response 4: Chapter 12 was restructured for 2008 and followed the recommendations from 2007 by making each section more consistent, providing summaries for most water bodies while highlighting and giving detail about one water body (Florida Bay).

Comment #5: *Incorporate separate section on EACs and VECs and related material. Panel needs to check SFER 2008.*

Response 5: The 2008 chapter included a summary of the status of VEC models and a discussion of VECs for each water body.

Comment #6: *Incorporate summaries of main programs, entities, and integrative efforts. Panel will need to check SFER 2008.*

Response #6: The 2008 chapter kept a focus on results and research, and how the research is linked to long term objectives outlined in the Coastal Ecosystems Science Plan in Appendix 12-1.

Comment #7: *Strengthened water quality data collection at key or core stations. Panel will need to check SFER 2008.*

Response #7: Discussion of improved water quality data collection is included in the 2008 chapter as appropriate. For example, the text describes additional monitoring stations in the St. Lucie, Loxahatchee, Caloosahatchee Rivers and Biscayne Bay.

Comment #8: *Examine urbanized areas for history of eutrophication and toxic substance accumulations. Not clear what District plans to do.*

Response #8: The 2008 chapter focuses on the status of freshwater flows for the estuaries downstream of urbanized areas, but in the future, as these estuaries are highlighted, discussion will include eutrophication and toxicants as appropriate. The District has extensive involvement in examining urban impacts in areas such as Biscayne Bay, but the current focus for most of the urban estuaries is on minimum flows and levels and water reservations.

Comment #9: *Role of phosphorus in supporting cyanobacteria bloom in Biscayne/Florida Bays. Not clear how this will ultimately be pursued.*

Response #9: The 2008 chapter includes an explanation of the role of phosphorus in lower Biscayne Bay and Florida Bay.

Comment #10: *Describe exotic invasive species in coastal systems. Panel will need to check SFER 2008 and subsequent reports.*

Response #10: Exotic species management is a function of the District's Vegetation Management Division, however, Coastal Division provides input to other parts of the organization such as CERP about documenting exotic vegetation in coastal wetlands, and strategies to control or eliminate it. Exotic invasive animals such as the green mussel do not appear to be widespread in the District's estuaries. The 2008 chapter will explain where Eastern oysters are monitored and the results.

Comments about the Loxahatchee River Estuary

Comment #11: *How will District address "next steps"? Panel will need to check SFER 2008.*

Response #11: Chapter 11 of the *Restoration Plan for the Northwest Fork of the Loxahatchee River* identifies all the known "next steps" for the Northwest Fork. Chapter 12 of the 2008 SFER includes the status of several studies to further the development of information for the Loxahatchee River and estuary, the foundation of which is in Chapters 10 and 11 of the Restoration Plan document.

Comment #12: *Oyster monitoring sites. Panel unable to readily locate information in SFER 2007 and will need to examine SFER 2008.*

Response #12: The 2008 chapter includes a section describing oyster monitoring in the Loxahatchee River.

Comment #13: *Flow gauge coverage. Authors were responsive to query. Not clear if incorporated into SFER 2007.*

Response #13: The area covered by the flow gauges is about 70% of the watershed inflows. The remainder of the watershed consists of tidally influenced areas, and it is not feasible to measure flow in the tidal areas. Flow from these tidally influenced areas is modeled using the calibrated basin with gauges. The 2008 chapter will be revised to describe how flow is monitored. This is described more fully in the *Restoration Plan for the Northwest of the Loxahatchee River*, Chapter 6 page 6-15.

Comment #14: *Water quality monitoring seemed inadequate. Panel will check SFER 2008 for information on changes made.*

Response #14: The 2008 chapter describes the improved water quality monitoring in the Loxahatchee River.

Comment #15: *Freshwater effects on mangroves. Authors were responsive to query. Not clear if incorporated into SFER 2007.*

Response #15: The 2008 chapter will be revised to explain the reason for the establishment of only one vegetation transect in the mangrove community of the Northwest Fork at RM 6.

Comment #16: *Larval fish density and species composition. Authors were responsive to query. Not clear if incorporated into SFER 2007.*

Response #16: The 2008 chapter includes a description of the fish monitoring program in the Northwest Fork of the Loxahatchee River, which at the stage of data collection methodology development.

Comment #17: *Nutrients to be included in water quality sampling? Authors were responsive to query. Not clear if incorporated into SFER 2007.*

Response #17: In Chapter 10 of the *Restoration Plan for the Northwest Fork of the Loxahatchee River* there is a description of the water quality monitoring partnership that the SFWMD has with the Loxahatchee River District. Also, a table indicating all the parameters can also be found in Chapter 10. The SFWMD obtains water quality data through the partnership, which has been in place for a number of years.

Comment #18: *What are expectations for Digital Elevation Model to improve inundation estimates and alter conclusions about optimal flows? Authors were responsive to query. Not clear if incorporated into SFER 2007.*

Response #18: The model will provide more detailed information at the local level to evaluate the effects of restorative flows on the vegetation of the freshwater floodplain, when those flows occur. The District did not have the ability to provide the Northwest Fork of the Loxahatchee River with restorative flows in WY2007.

Comment #19: *How well will selected flow regime approach critical flow needed for oysters? Authors were responsive to query. Not clear if incorporated into SFER 2007.*

Response #19: The Preferred Restoration Flow Scenario is discussed and explained in detail in Chapter 7 of the Restoration Plan of the Northwest Fork of the Loxahatchee River. Restorative flows were not provided to the Northwest Fork in WY2008.

Comment #20: *Green mussel invasion and impacts on oysters not discussed in chapter or appendix. Authors were responsive to query. Panel will need to check SFER 2008 for progress.*

Response #20: Oyster monitoring is being conducted in several of the estuaries. No green mussels have been found in the Loxahatchee River. The 2008 chapter will be revised to include information about the occurrence of green mussels if they are observed during monitoring activities.

Comments about Other Estuaries

Comment #21: *Role of phosphorus in supporting cyanobacteria bloom in Biscayne/Florida Bays. Not clear how this will ultimately be pursued.*

Response #21: The 2008 chapter includes detailed information about the role of phosphorus in the cyanobacteria blooms in lower Biscayne Bay and Florida Bay.

Comment #22: *Salinity recorder near seagrasses near mouth of (St. Lucie) Estuary? Authors were responsive to query. Panel will need to check SFER 2008 for progress.*

Response #22: The 2008 chapter describes an additional monitoring station that was added in the St. Lucie River Estuary to address this issue.

Comment #23: *How does modeling of salinity, nutrients, and other variables show interaction with seagrasses? Also, will Florida Keys be added to coastal ecosystems? Authors were responsive to query.*

Response #23: The 2008 chapter includes a description of the District's seagrass modeling approach as it applies to Florida Bay. The chapter will be revised to include information about the Florida Keys.

Comment #24: *Various questions about monitoring in the Caloosahatchee Estuary. Authors were responsive to query.*

Response #24: The 2008 chapter includes an update of monitoring and results in the Caloosahatchee River Estuary.

Joann Burkholder

Comment #25: *The panel recommended major revisions on this chapter, mostly, however, for designing Chapter 12 of the 2008 SFER. Thus, the panel's major recommendations for further restructuring mostly were not incorporated into the 2007 SFER. The panel hopes to see them in the 2008 SFER.*

Response #25: Chapter 12 was restructured for 2008 and followed the recommendations from 2007 by making each section more consistent, providing summaries for most water bodies while highlighting and giving detail about one water body (Florida Bay).

Comments about the Appendix 12-2 (Loxahatchee River)

Comment #26: *The panel was requested to evaluate this lengthy Appendix, although it was already in final published form. The quality of this Appendix (science, organization, writing) was excellent–it was a pleasure to read. The panel made six recommendations for future consideration, and hopes that they will be addressed in future updates of progress in restoring the Northwest Fork.*

Response #26: The "Restoration Plan for the Northwest Fork of the Loxahatchee River" was adopted by the SFWMD Governing Board in 2006. The Plan is scheduled to be updated every five years. Comments and suggestions will be noted and included during the plan update process. However, those recommendations related to improvements and additions in the NWFLR Science Plan, may be implemented when possible.

Jeffrey Jordan

Comment #27: *As this is a "work in progress" I appreciate the author's willingness to take our suggestions seriously. This is a hard and complex chapter and more work is needed. However, it is clear that the authors are making an effort to follow panel suggestions. I look forward to seeing the 2008 report.*

Response #27: Comment appreciated. The District looks forward to a more interactive workshop process this year.

RESPONSES TO COMMENTS ON THE DRAFT 2008 SFER – VOLUME I, CHAPTER 12

Dr. Armstrong

Comment #1: *As has been pointed out by the Panel in the past two SFER report reviews, there still appears to be little review, analysis, and incorporation into the District's coastal work, especially for the determination of and impacts of freshwater inflows, of research performed outside of Florida. An analysis (using the search engine in the Adobe Acrobat program) for example of the number of times that a Gulf coast or lower- or mid-Atlantic state's names appear in Chapter 12 (including the literature citations) is zero for Texas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina, and Virginia but 366 times for Florida. This is not surprising since Chapter 12 is all about the lower Florida estuaries within the District's boundaries. The same analysis for the Coastal Ecosystems Science Plan (Appendix 12-1) shows the numbers of times states are mentioned are: Florida – 122, North Carolina – 2, Texas – 1, and the rest zero. While the District has developed a strong approach to estuarine management, it could be stronger if experience gained in other states with freshwater inflow management was incorporated.*

Response #1: The District reviews all literature that may be useful to help form hypotheses, interpretation or conclusions about coastal systems. For example, a literature review has just been completed for Biscayne Bay where 57% of the literature is from other areas besides Florida. A wide variety of literature is typically not cited in Chapter 12 of the SFER.

Comment #2: *For each estuarine system, additional information should be provided routinely on an annual basis to get a sense of the "state of the bay", namely:*

a. Physical characteristics such as volume at mean tide, surface area at mean tide, average depth at mean tide, measures of tidal exchange such tidal prism, major currents, major geomorphic features;

b. Hydrologic characteristics such as annual average inflows by year for previous 20 years at least, annual average hydraulic residence times by year, average annual constituent residence times, fraction of freshwater;

c. Water quality characteristics such as annual average concentrations and temporal variations of key constituents (e.g., salinity, DO, organics, and nutrients) bay wide and spatially that conveys general information about water quality conditions throughout the estuary;

d. Biological data such as general concentrations (volumetric, areal, etc. as appropriate) of primary producers (e.g., phytoplankton, submerged aquatic vegetation) and secondary producers (e.g., zooplankton, benthic organisms, key species/VECs), and associated organisms.

Response #2: We concur that where data are available it would improve the chapter by including information characterizing each of the estuaries. We will consider including this type of information in future versions of the SFER for highlighted water bodies.

Comment #3: *Table 12-1 gives the status of Coastal Ecosystems Science Plan modeling products for each estuary, but the chapter could benefit from adding a short section (i.e., no more than half a page each) for each estuary describing the mathematical models that have been prepared and their status. This additional information would balance the descriptions provided of sampling programs for water quality and biota and other material provided. Any efforts to develop and apply simplified models (e.g., CSTR, plug flow, dispersive flow) and intermediate models (e.g., finite segment models in one-, two-, or three dimensions) should be described as well.*

Response #3: Concur. This type of information will be included in the individual estuary science plans as they are developed. As the science plans are completed, the information will be summarized in future versions of the SFER.

Comment #4: *For each estuarine system, accountability needs to be addressed via a statement as to how the hydrologic and water quality modeling, water quality data, and biological data are being used to manage this estuary at the present time, how water management in the watershed upstream relates to that management, and how well water quality goals have been met during the year.*

Response #4: We concur that where water quality objectives have been adopted, future versions of the SFER may include the results compared to water quality goals, and how results have been used to determine strategies especially in the highlight water body.

Comment #5a: *Southern Indian River Lagoon and St. Lucie River and Estuary–Water quality monitoring should include a measure of organic materials such as Volatile Suspended Solids or Total Organic Carbon.*

Response #5a: Concur. The two water quality sampling programs in this area address the tributary inflows and the receiving water body. These programs are being revisited as part of the Northern Everglades Protection Plan and will consider adding Volatile Suspended Solids (VSS)

to the analysis of Total Suspended Solids (TSS) presently determined. Additionally, future efforts to calibrate the sediment module of the CH3D water quality model will include intensive measurements of VSS and TSS.

Comment #5b: *Loxahatchee River Estuary – Flow and salinity are used as primary indicators now; what about using nutrients and nutrient cycling?*

Response #5b: Long-term water quality monitoring has been conducted by the Loxahatchee River District. The SFWMD has partnered with the Loxahatchee River District to improve the monitoring program so that water quality data are collected every month at some sites instead of every other month. Analysis of these data confirm that tidal influence and lack of adequate freshwater flows in the dry season are the main contributors to problems experienced in the Northwest Fork of the Loxahatchee River.

It is recognized that the analysis of water quality data is important to develop a more complete understanding of the Loxahatchee River and Estuary system. A water quality model is planned but not in the short term. The text will be revised to explain the position on using nutrients as primary indicators.

Comment #5c: *Lake Worth Lagoon – concern about sedimentation and turbidity was raised but not explained in this section; was shallowing of the Lagoon due to sediment deposition measured and was it considered as a cause for water volume decrease and hence salinity decrease?*

Response #5c: Water quality issues such as sedimentation and turbidity in Lake Worth Lagoon may be discussed in future SFER reports when strategies to improve the water quality are implemented by the District. Muck up to a foot in depth has been observed in the central part of the lagoon, but models have not been used to test the hypothesis that shallowing is affecting salinity. It is unlikely that this modeling scenario will be addressed in 2008 since the emphasis will be on the northern estuaries, but the question can be added to the Lake Worth science plan.

Comment #5d: *Biscayne Bay – Formatting is needed to make this section equivalent to the others; there are a number of questions remaining about salinity distribution in the Bay.*

Response #5d: Concur. The formatting will be changed.

Comment #5e: *Florida Bay – A considerable part of this chapter (54 pages) is devoted to Florida Bay as was planned, but there appears to be too much data presentation and too little analysis and synthesis of the meaning and relevance to management; there are a number of federal and state agencies involved in Florida Bay but little specific mention is given of their work and contribution to the understanding of the structure and function of the Bay; change the units of TP in Figures 12-28, 12-29, and 12-30 from µM to µg/L so that units are comparable to presentations in other parts of the chapter and SFER report; the update on the algal bloom in eastern Florida Bay and southern Biscayne Bay leads to the conclusion that this explanation for the bloom is still not resolved; in the section on key resources (p. 12-86) the use of "Fish and Crustaceans" is a very broad group compared to "Pink Shrimp", "Seagrass (SAV)", "Wading Birds", and the others which are much more specific – how will this group be defined and will Mollusks be added so that oysters will be considered a key resource?*

Response #5e: Synthesis. We concur that a goal of the chapter is synthesis with consideration of relevance to management, that the report is indeed data-rich and would be improved by more analysis. However, this document is but one of a series of annual SFER reports and this year is accompanied by the Everglades Division's Strategic Science Plan. This plan provides a strategy for synthesis and management relevance. As information is compiled for management applications, syntheses and reporting to management are provided. A recent example was a major synthesis for Florida Bay Minimum Flows and Levels Technical Report, which was summarized

in the 2006 SFER. The next major synthesis is expected to be for CERP's Florida Bay and Florida Keys Feasibility Study.

Interagency contributions. This report is intended to provide findings derived from District efforts and funding. Reporting on the results of all other agencies scientific findings would require excessive time and would be redundant with existing reporting by interagency committees and RECOVER (see Florida Bay interagency report edited by Hunt and Nuttle (eds), 2007, which is cited in Chapter 12 for extensive detail).

Units. The use of micromolar units is standard for estuarine research and there is no inconsistency within other parts of Chapter 12 because no nutrient concentrations were cited elsewhere in the chapter. We recognize that consistency within the SFER as a whole is desirable and can provide weight based units in future reports if there is consensus for this recommendation.

Resolution of bloom cause. We indeed are cautions in attributing cause to complex ecological phenomena, such as algal blooms. We do make clear that the weight of evidence points to multiple causes of bloom initiation (road construction and storm disturbance) and bloom sustenance (road construction and SAV die-off). We depend upon empirical information to provide inference, but recognize that such evidence neither provides proof nor an ability to precisely apportion the strength of influence among multiple factors.

Restoration Indicators. Development of a set of indicators for reporting to Congress and other interested parties is a work in progress, organized by the Restoration Task Force Science Coordination Group. District scientists have played a major role in developing indices for SAV and algal blooms, but not the other indicators. We have little knowledge of the fish and invertebrate indicator, and there is no oyster indicator for Florida Bay because oysters are not common in the bay and are not a restoration target.

Comment #5.f: *Naples Bay – the management plan for this estuary is at the beginning stage – what is the time frame for developing more components of the plan?*

Response #5.f: The timeframe for further developing more components of the Naples Bay plan is not clear at this time. In the short term, the focus for the District will be on the northern estuaries.

Comment #5.g: *Estero Bay - the management plan for this estuary is at the beginning stage although tributary flow regimens have been specified for maintaining eastern oyster adults– what is the timeframe for developing more components of the plan?*

Response #5.g: The timeframe for further developing more components of the Estero Bay plan is not clear at this time. In the short term, the focus for the District will be on the northern estuaries.

Comment #5.h: *Caloosahatchee River Estuary and Charlotte Harbor - what is the timeframe for developing more components of the management plan of this estuary?*

Response #5.h: The timetable for finishing the Watershed and River Protection Plan is due to the Florida Legislature in January 2009.

Comments about Logic and Consistency

Comment #6: *Yes, the chapter has much the same format as previous versions of the report, but the content needs to be more focused on accountability with the basic information listed above provided each year so the reader has a better sense of the "state of the bay" so to speak of each estuarine system. The format/outline is reasonable, and the content could be changed in the ways described above. The Biscayne Bay heading (line 417) needs to be elevated so it comparable to the other estuarine system headings.*

Response #6: We agree that some way to succinctly convey the state of each of the estuaries would be a good addition to Chapter 12, however, we have not yet developed an approach that can effectively do this each year. For example, spatially comprehensive SAV or oyster data are collected infrequently in most of the estuaries so annual comparisons are not possible. This year we reported on the status of freshwater inflow and salinity, but we will consider how to use some of the data such as water quality that are available in a way that gives readers a sense of the state of the estuaries in future versions. We will include a cross reference to appropriate sections I Chapter 7B that includes some of that information.

Comments about Linkage to Management Goals and Objectives

Comment #7: *As noted above, for each estuarine system, accountability needs to be addressed via a statement for each estuarine system as to how the hydrologic and water quality modeling, water quality data, and biological data are being used to manage this estuary at the present time, how water management in the watershed upstream relates to that management, and how water quality goals are being met. There is some reference to management objectives and management plan implementation, but the information does not lend itself to a determination of whether management objectives are being met.*

Response #7: The status of achieving MFL criteria, primary management objectives of the District, was described. We intend to indicate linkages of science strategies to management objectives in individual estuary science plans as they are developed, while reporting on the status and results of science projects in the Chapter. We will include cross-references to Chapter 7B, where the results are compared to performance measures developed for CERP or RECOVER.

Comments about Large Program Cross Linkages

Comment #8: *The Coastal Ecosystems Science Plan is the main large scale program linked clearly to the chapter. Other programs like CERP, Acceler8, and RECOVER are mentioned but the linkage could be made stronger.*

Response #8: Concur. We will provide more information and cross reference to other programs in future versions of the SFER.

Comments about Consistency and Thoroughness of Cross References

Comment #9: *The linkage of the Coastal Ecosystems Science Plan to each estuary could be stronger. While the Plan's products relative to modeling are contained in Table 12-1, there is no similar linkage for flows, water quality, and biota to a level of detail that indicates how well the Plan is being achieved. Also, linking to the water management system (Chapter 2) would be highly desirable so one can determine if estuarine management goals are being met while hydrology goals are being met as well.*

Response #9: Each water body section will be revised to indicate the science projects proposed, however, most of the activity will be focused on the northern estuaries in 2008. Future versions of the SFER may include a status of the science plan activities for each estuary.

Joann Burkholder

General Comments

Comment #10: *The authors describe vegetation monitoring of 10 transects. A continued concern from critique of the Restoration Plan for the Northwest Fork of the Loxahatchee is that, of the 10 transects and 138 plots included in the study, about half of the plots are in the Riverine reach, 37% in the Upper Tidal, and 14% in the lower tidal; moreover, only 1 transect is lower tidal (2007 SFER, Appendix 12-2). What is being done or planned to address the paucity of information in the tidal areas?*

Response #10: The transect locations were chosen to address the loss of cypress and the condition of freshwater floodplain vegetation in terms of variety in upper tidal and lower tidal floodplain vegetation due to salt water intrusion in the tidal reach and inadequate hydroperiods in the riverine reach. The mangroves are the predominant vegetative species, almost to the exclusion of other vegetative species in the area of Transect 9-1 at RM 6.46 or lower tidal reach. Therefore, multiple transects in the tidal reach of the Northwest Fork were not identified and established.

Comment #11: *Detailed quantitative information on specific urban impacts is described as essential for sound management decisions. What specific urban impacts are of concern, and what studies are planned to target quantitative assessment of those impacts?*

Response #11: This statement made about the Biscayne Bay watershed is referring to existing water supply and flood control practices. For example, better hydrologic models are needed to describe with some certainty how withdrawals from wellfields affect flows into the bay, or how changing water stages may affect existing land uses. The text will be revised.

Comment #12: *The research needs for Biscayne Bay (p.12-32) include an effective technique or modeling tool to hindcast and more accurately describe aquatic communities in the bay prior to major human disturbance (pre-1900). Such an assessment would be of value for all of the coastal ecosystems. What efforts are being undertaken to address this need?*

Response #12: This approach is valid for the area of Biscayne Bay contained within Biscayne National Park and Florida Bay (Everglades National Park), because it may provide a benchmark for restoration objectives. In other areas, however, it may not provide much useful information. For example, northern Biscayne Bay is so altered it could never be restored to resemble the condition around the year 1900. When a more detailed science plan for Biscayne Bay is completed it will explain the rationale.

Comment #13: *How does the District plan to fill spatial critical gaps in salinity data for Biscayne Bay? What is being done or planned to address the uncertainty in precision of canal flow data (based on stage)? Are seagrass mapping efforts planned for expansion to address the lack of data in critical areas and, if so, when will these efforts be undertaken?*

Response #13: When a more detailed science plan for Biscayne Bay is completed it will include details about these items. Future SFER reports may also include the results from some of these projects. Salinity data were most needed in the southwestern nearshore region of the bay. A multi-agency partnership established many new monitoring sites managed by Biscayne National Park in 2004. A District project to develop more precise rating curves for estimating canal flow through the coastal water control structures is nearing completion. An effort to collect much needed additional seagrass data in the southwestern nearshore areas of the bay began in 2004, and is continuing to be partially addressed through a project funded by RECOVER.

Comment #14: *What is the historic basis for the statement (line 1763) that seagrasses and oysters in Naples Bay have been reduced by 80-90%, considering the authors' description of extremely sparse data available for environmental conditions in that ecosystem?*

Response #14: A 2006 chronological study (Schmid, Worley, Addison, Zimmerman and Eaton) documented changes to the shoreline and bottom of Naples Bay since before the 1950s using aerial photos and interviews. They estimated the percentage of available habitat has declined about 80 to 90 percent. This will be clarified in the text.

Comment #15: *Information on the aerial extent of oyster reefs in Estero Bay apparently was last obtained in WY2003 (summarized in the 2004 SFER). Are there plans to update this information (p.12-94)?*

Response #15: The District does not intend to update the extent of oyster reefs in Estero Bay in the short term. Resources will be concentrated primarily on the northern estuaries in 2008.

Comment #16: *Monitoring stations seem limited to one in the southernmost area of Florida Bay (Figure 12-21). Are there plans to add any stations in that area?*

Response #16: Not all existing monitoring stations were shown in Figure 12-21. We only showed stations from which we reported results. Our opinion is that the water quality monitoring network's spatial coverage in southern Florida Bay is adequate.

Comment #17: *Are there data on the role of nutrient regeneration in supporting phytoplankton blooms in central and eastern Florida Bay? Are studies planned to resolve the magnitude/composition of the nutrient source for this bloom from construction and soil/sediment disturbance along US 1?*

Response #17: Yes, data are available, although they are not fully satisfactory to assess the current bloom. We have considerable data on sediment-water nutrient regeneration from northeastern and north-central sites, but these data were collected many years ago. Much other data on nutrient cycling exists from studies over the past decade by other investigators. Some data on water column nutrient cycling contemporaneous with the current bloom also exist (collected by colleagues from Univ. Maryland and FWRI). We cite one major finding of this group (N limitation of the eastern bloom in the fall of 2006, but await publication of their report or journal article for further information. We do have other ongoing studies. We just funded a study to analyze the isotopic ratio of dissolved inorganic carbon in the bloom region over the past four years and plan a similar analysis of iron concentrations.

Comment #18: *The Florida Bay and Florida Keys Feasibility Study (FBFKFS) is mentioned in both chapter 12 and Appendix 6-1, yet the Florida Keys are not considered in either appendix. What are the District's plans (and how do they mesh with activities of other agencies) regarding the Florida Keys?*

Response #18: Most of our scientific effort focused on Everglades-Bay linkages (e.g. fresh water flow effects), and thus (especially given limited resources) we have minimal research on the southern and western boundary of Florida Bay, where the Everglades watershed influence is muted. Most science in support of environmental management in this region is organized and implemented by the Florida Keys National Marine Sanctuary (with NOAA and USEPA funding) in coordination with the District. The District does fund salinity, water quality, and SAV monitoring throughout the bay, including its southern boundary. Current research by the District is being done in the upper Keys (near Key Largo) as part of our algal bloom studies and we do have an ongoing pilot study of ground water exchange and associated nutrient flux in the northeastern bay, including adjacent to the Keys. Finally, the District is strongly supporting several local projects in the Keys, including storm-water improvement ($2,600,000 in FY08), water conservation, and environmental education.

Comment #19: *The FHAP's efforts for SAV sampling were expanded by the District in 2004, from 10 basins to 22 basins (30 sites per basin; p.12-63). Does the District plan to increase the sampling frequency from once per year a seasonal basis?*

Response #19: Unfortunately, no. We recognize the importance of seasonality, but funds are not sufficient to support such sampling.

Comment #20: *Are there plans to conduct additional mesocosm experiments to examine influences of nutrient enrichment on these seagrasses, salinity x nutrient interactions, and salinity x sulfide concentrations (p.12-81, lines 1648-1649)?*

Response #20: Yes. We have funded multifactor experiments (by Dr. M. Koch of Florida Atlantic University) with Thalassia and Halodule in the past and experiments on Ruppia are in the planning stage. This information will be added to the text.

Comments about Accountability

Comment #21: *The Summary should be strengthened – the 2007 SFER's chapter 12 is excellent in caliber; please alter it to do this chapter, and the considerable, generally excellent work represented within it, justice.*

Response #21: Concur. The chapter summary will be improved.

Comment #22: *The Introduction is clear and very helpful. It includes an excellent table (Table 12-1) on the status of Coastal Ecosystems Science Plan products for each estuary that provides a strong foundation for readers' understanding about where progress has been made versus where information is critically needed. This table can be updated for each future SFER, and is a great addition (note – suggest that Table 12-1 also include the status of MFLs in the coastal ecosystems). An area of additional improvement for this table is under VECs (p.12-6) – "some data available" should be further clarified with brief further details.*

Response #22: Concur. Table 1 will be changed accordingly for the VEC information. Reference will be made to the status of MFLs contained within Chapter 3 of Volume 3 as appropriate.

Comment #23: *It would also be helpful to add, as the first table in this chapter, the pertinent information from chapter 1's Table 1A-1, which has a nice general comparison of the eight coastal ecosystems including size (surface area), which has been given in chapter 12 for some systems but not others.*

Response #23: Concur. A new table will be created in Chapter 12 with information like Table 1A-1.

Comment #24: *For each of the coastal ecosystems, a table of ongoing projects in WSY2007 should be included. Each ecosystem section should also include (e.g. as for the Lake Worth Lagoon and Biscayne Bay ecosystems) summary information about planned efforts, referring to Appendix 12-1 for further information.*

Response #24: Concur. The text will be revised accordingly.

Comment #25: *Throughout chapter 12 – salinity should not have units. If units continue to be included, the chapter should be consistent (present draft includes both psu and ppt). In addition, consistency is needed on presentation of metric versus English units (including figures); please use the metric (English) format.*

Response #25: The current accepted practice among scientists in South Florida is to use practical salinity units (psu). The text will be changed accordingly. The use of English units for water flow rate and quantity such as cubic feet per second (CFS) and acre feet is also in widespread use throughout the scientific community in South Florida, probably because the data are reported as such. We will consider converting the units to metric or perhaps providing both types of units in future versions of the SFER.

Comments about Integration

Comment #26: *Clarification should be added in chapter 12 that strategic science plans have been developed for the coastal estuaries and can be found in Appendix 6-1 (Florida Bay) and Appendix 12-1. Clarification is also needed as to the status of plans and work regarding the Florida Keys.*

Response #26: Concur. The text will be revised accordingly.

Technical Comments about Florida Bay

Comment #27: *Evaluation of the adequacy of restoration efforts is the mandate of CERP's Florida Bay and Florida Keys Feasibility Study (FBFKFS). The Florida Bay section should mention the excellent Strategic Research Plan for Florida Bay that is included in Appendix 6-1; that plan is very helpful in explaining how the integrated modeling effort builds upon and integrates various datasets.*

Response #27: We will provide explicit reference to Appendix 6-1 to make the reader is aware of the role of data synthesis and integrated modeling.

Comment #28: *Figure 12-21 – Blackwater Sound (mentioned in the writing) should be added.*

Response #28: Concur. The figure will be revised.

Comment #29: *Figures 12-26 – The legend should add brief description of what these data represent (averages from n? samples per date; quadrat size?, add standard errors to the lower figure? etc.).*

Response #29: Concur. We will add information to the caption regarding and will add error bars in future reports when this addition does not excessively clutter the figure.

Comment #30: *Figure 12-27 – These are data, not trends; trends is a statistical term that seems misapplied here. Legend should include n values and indication of statistical significance.*

Response #30: We agree and will delete term "trends" from the caption header. We will add information on n, but hesitate to provide any statistical finding within the short space of the caption (we would need to explain assumptions of such analyses, for example regarding independence of points). More in-depth analysis will be provided in future reports (and hopefully a publication).

Comment #31: *P.12-48 – Does not seem to match the figures in some of the writing; please recheck.*

Response #31: After a re-check, all figure references seemed to be correct.

Comment #32: *Figures 12-28 - 12-30, 12-35 - Legend should add brief description of the data (averages from n? samples per date; add standard errors, indicate statistical significance).*

Response #32: We will provide more information in the caption regarding sampling, but addition of error bars would obscure the results and thus require completely new graphics with more panels. Statistical analyses would require more explanation of methods and assumptions within text. We will make an effort to display error bars and provide more complete statistical analysis of water quality changes in future reports.

Comment #33: *P.12-52 – It should be clarified that inter-annual variability of chlorophyll a concentrations vs. total freshwater discharge may not be a sufficiently sensitive approach to detect relationships; more in-depth analyses of periods (weeks or months) prior to bloom development, for example, would be instructive. It should also be mentioned that increased nutrient pollution does appear to be linked to supporting the (smaller) bloom in the eastern Bay.*

Response #33: We will make sure that we do not overstate inferences derived from annual mean approach, but past analyses have found this time-step to be more instructive than shorter-term (especially monthly) time-steps. We expect this is because of the physical complexity (and poor circulation) of Florida Bay. We will explicitly cite the likely role of nutrient enrichment (including canal discharge) in the eastern bloom's initiation.

Comment #34: *Figure 12-33 – The legend should clarify whether these are means; n values and standard errors should also be added.*

Response #34: We will add description of data as means with sample size, but will add standard errors in future reports (as described above).

Comment #35: *Lines 983-985 vs. Figure 12-35 – There seems to be no coherence between TOC and TN (?).*

Response #35: We state that there is much greater variability for TN, which obscures C:N and N:P relationships, but it is still a consistent increase for all three elements from the fall of 2005 – this is the basis of the statement regarding coherence. We will specify this time period for the N plot.

Comment #36: *Lines 1015–1016 – Supporting literature should be cited.*

Response #36: Concur. The citations will be added.

Comment #37: *Lines 1085–1086 – The modified Braun-Blanquet index categories need to be listed here.*

Response #37: Concur. The text will be added.

Comment #38: *Line 1086 – Clarify why this large difference in n values (4-12).*

Response #38: Concur. We will clarify that this n value is either 4 for small area coves along the northern Florida Bay coast or 12 for larger water bodies.

Comment #39: *P.12-65 – Description of the calcareous green macroalgae should be provided here (species, known nutritional ecology) – would help support the rationale presented in lines 1148-1150.*

Response #39: We will correct some sentences regarding green macroalgae (not all are calcareous), add list of genera, but we will not have sufficient time to gain more knowledge of nutritional literature to make stronger inferences regarding nutrient enrichment.

Comment #40: *P.12-72 - 12-73 – The authors' suggestions should be included as to why the benthic community in Lake Surprise continued to thrive during this major cyanobacteria bloom.*

Response #40: Concur. Text will be added to explain that the basin is shallow.

Comment #41: *Lines 1331-1332 – Meaning should be clarified (DOM is the dominant form of this nutrient import (?)).*

Response #41: Concur. An explanation will be added to the text.

Comment #42: *P.12-77 – Brief description of the mesocosm experimental design should be added.*

Response #42: Concur. A description will be added to the text.

Comment #43*: Line 1710 – Do "periphyton" include macroalgae here?*

Response #43: No, we erred in including this in the Florida Bay list. It refers to Everglades periphyton. We will edit the list.

Comment #44: *Editorial changes*

Throughout – change submerged to submersed (Wetzel, Limnology, 3rd edition, 2001).

Throughout – Taylor River and Taylor Creek are interchanged; should be consistent.

Line 552 – include the name of the pond (Argyle Hendrey Pond).

Line 923 - …during the summer/fall, and…

Line 1037 - …dry season (Figure 12-30). It…

Line 1117 - …No significant change is…

Line 1153 - …but rather suggest either decreasing

Response #44: Concur. The text will be changed.

Technical Comments about Southern Indian River Lagoon and St. Lucie Estuary

Comment #45*: Information should be added to inform readers that this estuary (along with the Caloosahatchee) has been targeted for major emphasis because of the recently passed Northern Everglades Protection Plan; and that modeling efforts for this estuary are relatively advanced (refer to Appendix 12-1).*

Response #45: Concur. The text will be revised accordingly.

Comment #46*: Line 123 – change to channelizing (instead of straightening [straitening])*

Response #46: Concur. The text will be revised accordingly.

Comment #47*: Line 127 and throughout – change submerged to submersed*

Response #47: Concur. The text will be revised accordingly.

Comment #48*: P.12-10 – the MFL rule does not seem very protective, probably because very little rationale is presented; brief explanation would help, considering both the North Fork of the St. Lucie and Lake Okeechobee.*

Response #48: Concur. The text will be revised accordingly.

Comment #49*: Line 141 - …inflows were not exceeded…*

Response #49: Concur. The text will be revised accordingly.

Comment #50*: Figure 12-3 – shouldn't the title be North Fork?*

Response #50: Yes. The figure will be revised accordingly.

Comment #51*: Lines 159-160 – why the change from biweekly to monthly sampling?*

Response #51: The monitoring program was reevaluated and a monthly frequency was found to be adequate. An explanation will be added to the text.

Comment #52*: Lines 167-168 – briefly state what the Ten Mile Creek facility is.*

Response #52: Concur. The text will be revised accordingly.

Technical Comments about Loxahatchee River Estuary

Comment #53*: Figure 12-6 – study area boundaries should be added.*

Response #53: Figure 12-6 is an aerial view of the Northwest Fork and its tributaries, and the Southwest Fork and North Forks of the Loxahatchee River, including the embayment and inlet. It does not represent the watershed, therefore the study area boundaries were not placed on this figure. This figure serves only as a location map.

Comment #54*: Figure 12-7 - should add information (river miles) to legend to indicate freshwater, upper tidal, and lower tidal areas.*

Response #54: Concur. The figure will be revised.

Comment #55*: Line 253 - please clarify parameters being monitored.*

Response #55: Concur. Information will be added to the text.

Comment #56*: Figure 12-8 - should also indicate the selected sites where the water quality monitoring network was strengthened (are these stations in green? If so, it would be helpful to add 1-2 stations for monthly monitoring in the upper watershed).*

Response #56: The caption for Figure 12-8 will be changed to indicate that the green sites are monitored once a month and the yellow sites are monitored every two months.

Comment #57*: Figure 12-9 – legend should clarify that this information is based on 2003 LRD data. Where are the live oyster locations within the squares? Why are there no live oysters indicated in the main embayment?*

Response #57: The title of the figure will be changed to: The Loxahatchee River District Oyster Sampling Areas (2003) in the Northwest and Southwest Forks of the Loxahatchee Estuary.

The focus of the *Restoration Plan for the Northwest Fork of the Loxahatchee River* was on the oysters in the Northwest Fork. Oyster beds within the Northwest Fork are delineated in Figure 12-10.

The main embayment of the Loxahatchee River lacks to the appropriate substrate and salinity regime to support dense, healthy populations of oysters. Before the Jupiter Inlet was constructed and maintained (1947), the embayment experienced a lower salinity regime favorable for oyster bed development. The text will be revised to explain this situation.

Comment #58*: Figure 12-10 – Are additional sites for oyster monitoring planned farther down-estuary? It seems that such sites would be important to add in helping to track restoration success.*

Response #58: The *Restoration Plan for the Northwest Fork of the Loxahatchee River* calls for the addition of cultch to areas near RM 4. An oyster bed restoration project is scheduled for FY08 in partnership with the Loxahatchee River District and with a portion of the funds being provided through state appropriations. When these new sites are established, they will be monitored for oyster colonization and growth. An explanation will be added to the text.

Comment #59*: P.12-21 - Please provide more rationale for use of the Hobe Sound site as a reference area.*

Response #59: The Hobe Sound site represents the same conditions as the Loxahatchee River Embayment Area but does not experience the large discharges of freshwater flows, which provides an important opportunity for comparison and the assessment of adverse impacts of large freshwater discharges. An explanation will be added to the text.

Comment #60*: Editorial changes*

Line 254 - …at selected sites…

Line 256 - …long-term trends in…

Line 317 – Loxahatchee River Central Embayment…

Response #60: Concur.

Technical Comments about Lake Worth Lagoon

Comment #61*: In WY2007 a new salinity monitoring program designed to evaluate a new CERP target (that should be briefly described) was established.*

Response #61: Concur. The text will be revised accordingly.

Comment #62*: Lines 374–375 – why have these important long-term sites for salinity monitoring been discontinued?*

Response #62: This was an error in the text. It will be revised accordingly.

Comment #63*: Figure 12-17 – legend should briefly explain the gap in data collection (1999-2001), and the paucity in data prior from 1994-1998 compared to 2002-2006.*

Response #63: Monitoring was conducted by the Palm Beach County Health Department, Palm Beach County Department of Environmental Resources Management and Florida Department of Environmental Protection over the years as funding was available. Frequency was improved from quarterly to monthly in 2002. The District is just reporting the results.

Comment #64*: Figure 12-18 – legend should explain the trend line (statistical basis, p value for apparent increase).*

Response #64: Concur. The line represents a linear regression of the data over the period. P values will be included on the charts.

Technical Comments about Biscayne Bay

Comment #65*: Figure 12-19 – should include the key stations for long-term salinity monitoring (data in Figure 12-20).*

Response #65: Concur. The figure will be revised.

Comment #66*: Figure 12-20 - legend should explain the trend lines (statistical basis, trend directions, p values).*

Response #66: Concur. The line represents a linear regression of the data over the period. P values will be included on the charts.

Comment #67*: Editorial changes:*

Line 431 - …Today, about half of… ; Line 449 - …listed in the…

Response #67: Concur. The text will be revised accordingly.

Technical Comments about Naples Bay

Comment #68*: Line 1763 – Briefly clarify the historical information underlying these losses of seagrasses and oysters.*

Response #68: Concur. The text will be revised accordingly.

Comment #69*: Lines 1790-1791 – Explain why monitoring ceased at the Golden Gate Canal after 2002.*

Response #69: Concur. The text will be revised accordingly.

Technical Comments about Estero Bay

Comment #70*: Lines 1849-1850 – clarify how this seagrass coverage compares to the total area of Estero Bay.*

Response #70: The seagrass plus attached algae coverage of 3,349.5 acres is about 7% of the total bottom area of Estero Bay. The text will be revised to include this information.

Technical Comments about Caloosahatchee River Estuary and Southern Charlotte Harbor

Comment #71*: Additional nutrient limitation studies are being considered to support the new Northern Everglades and TMDL initiatives; it should be clarified that major District emphasis is planned for this estuary (refer to Appendix 12-1).*

Response #71: Concur. The text will be revised accordingly.

Comment #72*: Line 1951 – Figure 12-5 shows only 5 continuous salinity sensors? (the Sanibel Causeway sensor was destroyed by a hurricane).*

Response #72: Figure 12-52 depicts all six continuous salinity sensor stations that are in place, as well as a seventh sensor to replace the Sanibel Causeway location, which is scheduled for reinstallation when the bridge construction is completed within the next 1-2 years. This information will be added to the text.

Comment #73*: Line 1957 – How long salinity at Shell Point was near 0?*

Response #73: During WY2007, salinity near the surface (at about 1 meter depth) approached 0 for only several days near the peak September 2006 flow event. This information will be added to the text.

Comment #74*: Lines 1980–1981, The writing should be altered: The sparse regrowth of Vallisneria, compared to its abundance prior to the WY2001–2002 drought, cannot be called recovery; it likely will take much longer than 2-3 years for the populations in the upper estuary to recover.*

Response #74: Concur. The text will be revised accordingly.

Comment #75*: Figure 12-53 – Y-axis 2 should be labeled Salinity.*

Response #75: Concur. The figure will be revised accordingly.

Comment #76*: Editorial changes*

Line 1905 – and Southern Charlotte Harbor

Line 1931 - …that were discharged…

Response #76: Concur. The text will be revised accordingly.

2008 SFER – Volume I
Authors' Responses to Comments

Part II:
Responses to Comments on Special Review Topics

This section includes authors' responses to comments in the 2008 SFER panel's WebBoard comments (Appendix 1A-3 and Appendix 1A-4) on draft appendices presented as special review topics in this year's SFER.

Volume I special review subjects include:

- Hydrologic Monitoring Network of the South Florida Water Management District
- Sulfur as a Regional Water Quality Concern in South Florida
- Environmental Responses to Water Management in the Everglades: A Strategic Research Plan for the Everglades Division
- Coastal Ecosystems Division Science Plan

RESPONSES TO COMMENTS ON APPENDIX 2-1

Chandra S. Pathak

Subject: Appendix2-1: Responses to Peer Review Comments
Document posted as: Appendix 2-1 All Special and Peer Review-Comments-and-Responses.pdf
Originally Posted: 27 Sep 2007 08:04 AM

[Editor's note: The author's original posted document included all peer-review reports. Those reports are not reproduced here, but can be found in Appendix 1A-3 and Appendix 1A-4 of this volume.]

General Response: *The authors of the Draft 2008 South Florida Environmental Report –Volume I, Appendix 2-1, are grateful to six peer-reviewers – Dr. Robert Ward, Dr. Neal Armstrong, Dr. JoAnn Burkholder, Prof. Rafael Bras, Prof. Daniel Loucks and Prof. Phillip Bedient for providing constructive review comments. We have reviewed comments and the following responses are offered.*

Hydrologic Monitoring

Response #1: Hydrologic variables such as rainfall, evapotranspiration (ET), surface water and ground water stages, and surface water and ground water flow, which are components of the hydrologic cycle, are multi-dimensional, continuous fluxes (very often assumed to be smooth functions – in reality that may not be the case) or fields — dynamic functions in space and also in time. These dynamic hydrologic variables are either mathematically estimated or directly measured at a specific point and for a discrete time segment. Subsequently, based on estimates or measurements at several points and various time segments for a given domain, an effort is expended to represent and characterize that continuous flux in space and time. In order to represent this continuous flux of a variable in a domain, space is discretized into mesh of geometric elements, mostly linear regular or irregular rectangular/triangular shape grids/cells (prism/solid). This representation in space leads to estimation of the variable at certain relevant locations along those geometric elements (for example at vertices or grid/cell-centroids) by using simple to complex interpolation schemes amongst the measured points or numerical models. When you have many points of measurement, more accurate values of that variable would be available for relatively better spatial representation of the flux. The interpolated estimation comes with certain estimation errors that are generally understood to increase in proportion with increasing distance amongst the point of measurements. Hence, more points of measurement would lead to superior representation and characterization of the continuous flux (assumed to be smooth functions) of a variable by reducing errors associated with interpolation. However, obtaining a large number of point measurements is not only expensive but also in many cases is not very practical.

Similarly, to represent variability of the variable on a time continuum, various frequencies of measurement (or sampling) at selected time intervals (from seconds to hours; and/or at discrete time steps when there is change in the state of variable detected) are performed. Once again, some interpolation is needed when the time intervals between measurements increase and the measurements are used to represent a variable along a certain time continuum. This necessitates the selection of a variable-based sampling frequency. Typically, the limitation on the frequency of measurement/sampling for hydrologic variables depends on the type of sensors and dataloggers used for their measurements.

The character of the continuous flux in space and time that is developed from the measurement differs significantly from variable to variable in a given domain based on spectral content. For

example, the character of rainfall flux is significantly different from the character of solar radiation flux. The understanding and knowledge gained from past datasets for the spatial and temporal characterization of variables can be very useful. This experience, in turn, would provide the information needed to design and or optimize the monitoring network for a given variable.

The analytical methods used for designing and or optimizing of the network are highly dependent on the variable-of-choice, and may not be interchangeable. Therefore, one should be very careful in generalizing the methods used to design and or optimize the monitoring network for each variable. For example, the methods used for designing a rain monitoring network would not be appropriate for designing a surface water stage monitoring network; similarly, the methods used for designing a wind monitoring network would not be appropriate for designing a solar radiation monitoring network. Therefore, the authors believe that the network for each variable should be designed independently first. However, prior to implementing the recommendations from network design, each network should be evaluated and assessed in an integrative fashion, as suggested by a peer reviewer, to further optimize the networks to take advantage of co-location of measuring sites, combining data transmission equipment and other infrastructure requirements with the intent of minimizing cost, improving efficiency and achieving economies of scale.

Traditional monitoring network design and or optimization studies are based on data collection purpose or use (or objective of monitoring) for which variables are measured. However, in our design and optimization studies, the District focused on obtaining the best possible data quality from the network for hydrologic variables that are financially affordable and most relevant for the District. It is to be noted that the present monitoring network has evolved and is currently meeting most of the requirements of the District mission and goals. In addition, the District's staff has been developing formal data accuracy requirements based on the data collection purpose.

Currently, in the absence of these formal requirements, it has become important for the design/optimization studies to develop relationships among the numbers of sensors, distribution of sensors and estimated errors in measurements. Based on this information, the District can make decisions about a set of number of sensors and their distribution needed for measurement of each variable and the measurement errors and related risks associated with that decision.

The current flow monitoring network is the most efficient network amongst others. This is due to its nature where flow data are derived at a water control structure by using dynamic data from upstream and downstream surface water stage sensors and gate/pump operation. Where possible, some stage sensor data could be shared between two water control structures for computing flow depending upon the relationship and accuracy of the measured and estimated stage data. This procedure needs to be performed on structure-by-structure basis that is time consuming, expensive and may not lead to improve efficiency any further.

The other current monitoring networks of the District require improvement in efficiencies. The network efficiencies need to be improved while continuing at the current maintenance costs level.

This would require maintaining the current total number of sensors, whenever possible. However, some increase in the current total number of the sensors may be scientifically necessary and would be considered and permitted by the District on a case-by-case basis. These cases would then require using some optimization scheme to improve the spatial distribution of sensors by removing certain dense clusters of sensors and at the same time, adding sensors in other areas where very few sensors are present and additional sensors are needed. Specifically, these sorts of sensor relocation would be considered for the rainfall network, meteorological network, and surface water stage network. It is to be noted that the network design would be (and were) performed not on a project-by-project basis but by using a regional approach that considered homogenous areas (polygons) with similar spatial characteristics of a variable for a selected time interval (daily or hourly) and season (dry or wet). However, in some cases, project requirements

(for some specific projects) would be considered in design and or implementation of the network when available.

The District is continuing to invest in the state-of-the-art monitoring technologies such as new field flow measurement instruments including Acoustic Doppler Current Profilers (ADCPs), Acoustic Doppler Flow Meters (ADFMs), Acoustic Doppler Veloci-meters (ADVs), (these instruments are based on the acoustic Doppler principle and provide much more detailed and accurate flow data than other traditional mechanical instruments); actual evapotranspiration measurements at a field-scale level are performed utilizing a set of Eddy correlation instrumentation that includes a single-axis sonic anemometer, a fine wire, chromelconstantan thermocouple, and a krypton hygrometer; radar (NEXRAD) based rainfall estimation and satellite based ET estimation.

In addition, the District has been expending efforts in developing methodologies/procedures in estimating uncertainties associated with various monitored variables including flow measurements for a specific set of instruments. A project is under consideration to develop procedures for classifying the data quality under categories such as excellent, good, fair and poor for the monitoring data that are collected from rainfall, ET, surface water stages, surface water flow and groundwater monitoring network.

In recent years, the District has made significant advances in improving maintenance cycles of sensors in the field that significantly reduces the frequencies of missing and poor quality data. Also, in the events, when it is discovered that certain sensors are not functioning or providing poor quality data, then the appropriate information is provided to field crew which takes quick action on that situation and this further reduces acquisition of missing or poor quality data from the sensors. Additionally, the District's electronic data transmission and acquisition network (hardware and software) have been improved to increase reliability of the data transmission, which reduces data loss between the field sensors and data acquisition system that is physically located at the District headquarters.

Comment #2: *Does the hydrologic monitoring network report provide necessary information on hydrologic monitoring networks of the District?*

Response #2: The intent of the Draft 2008 South Florida Environmental Report, Volume I, Appendix 2-1 is to provide a comprehensive overview of the hydrologic monitoring network of the South Florida Water Management District (District). The appendix includes a high level description of all the essential elements of the hydrologic monitoring that has evolved over the last five decades. The majority of the information presented herein is available at an exhaustive level of detail in over 50 District publications such as technical reports, notes, and papers that are referenced in this appendix. For relevant and detailed information on any subject presented in the report, the reviewers and readers are advised to acquire more detailed information on each required subject from these publications.

Several peer reviewers requested additional details on data QA/QC methods used, network optimization studies and others to be included in the report. This report provides summary level information on these subjects. Many stand alone District technical publications are available on these subjects. Authors believe, it not appropriate to repeat the information that is already available in the other District publications. The authors of this appendix will be happy to provide a copy of these documents, if requested.

Comment #3: *How can the existing hydrologic monitoring network be made more efficient and cost effective?*

Response #3: As mentioned above, the District has been continuing (and will continue) to perform design/optimization of the monitoring studies to improve the efficiency of these networks. In addition, in due course of time, the District staff will be investigating the possibility

of use of simulation and sensitivity analysis procedures by utilizing the regional hydrologic models that would integrate a set of monitored variables and hence, further improve efficiencies of monitoring networks, as recommended by the two peer reviewers.

Comment #4: *What additional information should be included in the hydrologic monitoring network report to improve the utility of work product?*

Response #4: The report will expand information on purpose of monitoring including how and why the District connects its hydrologic monitoring to water management decision making as requested by the peer reviewer.

The report will provide available information on accuracy of the measuring instruments for all the relevant variables. However, it should be clearly understood that the District has been developing information on estimates of uncertainties, estimates of measurement errors, and/or data quality associated with collected datasets. These efforts are currently underway but are not ready to be included at this time in the report as requested by the peer reviewer.

As requested by the peer reviewer, the report will add information on availability of time series data from other external agencies that are currently available in the District's corporate database – DBHYDRO.

Two peer reviewers requested to include information on water quality monitoring network, ecosystem parameter monitoring network and other monitoring network. The report will not include information on these networks as it is out of scope for this document.

Comment #5: *The report indicates that the longest consistent measurement record is from 1995 to 2005. How can past data be used with current data for longer-term trend analyses? What techniques are used to 'correct' past data to be compatible with values being generated currently? Should information be added about the equipment used in past measurements?*

Response #5: The District agrees with the peer reviewer that it is not appropriate to "correct" past data. However, whenever possible all the available additional information should be shared with the data users. One peer reviewer recommended District to research past equipment changes; learn the specifications of the old equipment; obtain any old-new comparison data from other agencies; compute bias that may be attributed to equipment changes; and develop a new long-term data record that account for the equipment changes. These are excellent recommendations. However, due to limitation of fiscal resources, the District would not be able to implement them at this time.

RESPONSES TO COMMENTS ON APPENDIX 3B-2

Mark Gabriel

Subject: Responses to reviewer comments
Document posted as: Inline text
Originally Posted: 27 Sep 2007 11:32 AM

All comments and questions by reviewers are appreciated. Their helpful insight will make this an even stronger and more informative document.

If all questions haven't directly been addressed it is because (1) many questions overlapped and were combined and/or (2) they will be addressed in the presentation

Burger

Comment #1: *"It is interesting that Florida is low with respect to atmospheric deposition of sulfur, given the high rate for mercury. Some comment could be made about this here. (lines 310-on)."*

Response #1: Possible reasons why we see differences in S deposition between S. Florida and other areas are (1) industry (2) farming practices (3) meteorological patterns (4) climate differences (specifically drier conditions)

Jordan

Comment #2: *"….does the District have the political support to undertake what may ….be an even more fundamental and more costly research track than the effort undertaken to understand the phosphorus issue?"*

Response #2: We are handling tasks one at a time with FDEP.

Comment #3: *"What has been the reaction from the agricultural community….that there is a link …to the levels of sulfur and historic and present agriculture practices"*

Response #3: This question is for an agricultural representative. A large majority of their exposure to the sulfur issue should have come through this document.

Comment #4: *"sulfate….shouldn't its control be the focus of water quality activities for the region as is alluded to in line 223 of the chapter?"*

Response #4: First we have to confirm sulfur is a problem for South Florida wetlands.

Burkholder

Comment #5: *"It would also be helpful to explain, that acid-volatile sulfide is potentially important in addition to porewater sulfide, and that few data are available for this parameter."*

Response #5: Will consider this and follow up with literature review.

Comment #6: *"An excellent point was made in lines 362-365, that the available data do not indicate whether the sulfate entering canals in the EAA is from recently applied agricultural sulfur or from historically applied sulfur that is slowly being released by soil oxidation. How will that important question be addressed?"*

Response #6: One simple approach is to compare what is applied through agriculture to amount removed from runoff and soil mineralization

Comment #7:*"Lines 51, 100 – Sulfur is an essential plant nutrient. Why is it described as a "secondary" nutrient? (please clarify in the writing)"*

Response #7: This is a traditional way of addressing sulfur in agriculture. Sulfur may have adopted the "secondary nutrient" status since it follows several others (N,P,K) in nutritional value.

Stein

Comment #8: *"Pg 6, 145-146 This statement does not make sense to me and seems to be in conflict with the argument about SRB raising pH discussed above."*

Response #8: H_2S0_4 dissociation in water releases H+: H+ will initiate a "chemical weathering" process, liberating PO43- as HP042- or H2P041-

Comment #9**:** "there is little additional benefit to be gained by further refinement of the sources of sulfur to the Everglades: the data collected to date is quite convincing that the predominate source is from EAA runoff. Perhaps the only unanswered question is whether more of the sulfur load is from current or historical anthropomorphic (e.g. agricultural) sources…the need now is to explore ways to limit additional sulfur loading"

Response #9: Agreed, however since results of this work can have significant implications for Florida environmental conservation and management it is worth several agencies working in cooperation to define a comprehensive and current S budget as a first phase of evaluating the issue. Efforts to define a budget have only been performed once and further investigation may not require large amount resources to complete. The secondary phase will be to define important processes such as relevance of new and legacy sulfur application and soil sulfur oxidation, all possibly requiring more funding and time.

Comment #10**:** "111–112 why does 500/acre translate to 70 lbs/acre?"

Response #10: This translation is based on a calculation that accounted for the likely percentage of soils above a pH of 6.6 and application over the entire surface area of the EAA. From "Schueneman, T.J. 2001. Characterization of Sulfur Sources in the EAA. Soil Crop Science Society Florida Proceedings. Volume 60. 49 -52."

Comment #11**:** "by using the word "pristine" is there an implication that this means areas with sulfate concentrations within and/or below the optimal sulfate range for mercury methylation?"

Response #11: Pristine as it relates to background levels of sulfate.

RESPONSES TO COMMENTS ON APPENDIX 6-1

Everglades Division

Subject: Responses to Panel Comments, Appendix 6-1
Document posted as: 2008 SFER_RTCs_App6-1_fs.doc
Originally Posted: 19 Oct 2007 10:31 AM

Joanna Burger

Comment #1: *This chapter is an excellent overview of water management strategies, and provides an excellent overview of organization, problems, and possible solutions. The inclusion of a table of contents makes it easier for the reader to find subjects. The introduction and background clearly lays out the objectives, priorities, and implementation plans. As such, it is a clear statement with finite and do-able objectives. The organizational chart listed on the first page, however, is confusing; it is unclear how this relates to anything else in the document. It would also help the organization if a paragraph were added to the end of the introduction that briefly summarizes the organization of the rest of the chapter.*

Response #1: The organization chart was designed to illustrate the business structure of the Everglades Division and the names of all the staff who are responsible to writing and implementing the Strategic research Plan. The need for a paragraph at the end of the Introduction makes sense and the following will be added:

"The leading scientists for this research plan were the Senior Supervising Scientists as shown on the cover page of this Appendix. They were responsible for selecting the projects that would be in their individual units. Staff within each unit were responsible for formulating the details of each project. The Chief Scientist was responsible to integrating the package and making sure that projects that cross units and divisions within the District were realistic and linked to District mandates. The following four sections were meant to be an orderly progression of science from the population level to the landscape scale. Each section was meant to build upon the last. Each section can have between 2 and 5 projects. Projects tend to be multi-dimensional and multi-disciplinary. They can have numerous nested experiments and/or surveys to meet the management and restoration objectives that are described for each project. Every project within a section was also designed to focus upon a set of CERP hypothesis. CERP created these hypotheses to guide, direct and implement both monitoring and research, and as such they are written as declarative statements, leaving room for the development of testable hypotheses associated with individual experiments."

Comment #2: *Table 6A-1 is extremely important as a basis for understanding the overall Everglades research plan in relation to clear goals and objectives. The authors are to be congratulated on making the research objectives clear.*

This is an opportunity for the program to add areas that clearly need addressing, and should be placed within the water management area. Invasive species is one such area that seems to be missing from this chapter, and in the invasive species chapter, several of the species seemed to be partly dependent on water level regimes. For example, are there any plans to determine whether invasive fish are having an effect on fish communities such that prey are less available to wading birds? In this same line, it would be useful to make sure that tribal interests are included in the synthesis area.

Response #2: Invasive species are being surveyed and studied by a variety of State and Federal agency. The Everglades Division does not have the resources to manage a large scale program

such as this. However, small scale studies of the effects of invasive vegetation are planned and include 1) surveys of *Lygodium* on tree islands, 2) *Lygodium* physiology, and 3) community responses to Accelerated Recovery. Small-scale exotic fish studies, not mentioned in the Plan but associated with the wading bird studies, include; 1) an FAU collaboration to determine current exotic fish distributions in the ridge & slough landscape, and 2) a USGS collaboration to assess the physiological tolerance of selected species.

Comment #3: *There should be a clear connection between the hypotheses and the individual studies being described (I'm sure there is, but it isn't clear). That is, it should be easy to see which hypothesis an individual study is addressing. While these are explained in Table 6A-1, it should also be under each study. Perhaps these could be placed under management and restoration objectives, making the chapter more reader friendly.*

Response #3: This is an excellent recommendation and we will comply.

Comment #4: *The overall organization of each section, and the consistency between sections, makes this an extremely useful document, and one deserving considerable discussion. This chapter would be improved with the*

Response #4: All of Sue Newman's literature has been cited.

Comment #5: *addition of literature citations to work mentioned. It might also help to have references in Table 6A-1 that tell the reader where to go for details about the specific studies. This could also go into the individual studies mentioned. In other words, there has to be a place for the reader to find more details on each of the study components that make up the overall research plan.*

Response #5: We feel that Table 6A-1 is busy enough. However, individual studies will include more background references.

Comment #6: *The hypotheses as written are not really hypotheses, but are statements. Usually a hypothesis is worded in such a way that it could be tested (e.g. for hypothesis 1 it would be - Wading bird nesting colony location, size and timing are related to changes in water levels [or whatever]). A hypothesis usually gives the reader some indication of a causal relationship, and these are mainly declarative statements.*

Response #6: Some testable hypotheses will be added to the Objectives section of each project.

Comment #7: *Finally, at the end of the hypotheses for each section, and before the description of the studies it would be useful to have a paragraph that lays out how each of the studies in the section relate to one another. In other words, lay out the rationale for how they were selected.*

Response #6: A final paragraph will be added to each section. Some form of the following will be added to the Food-web introduction:

The food web component encompasses studies at multiple trophic levels over various spatial and temporal scales. We do not have the capacity to focus on all components of the food web so we are concentrating on the core trophic elements: a top level vertebrate predator, the main fish and invertebrate prey of many predator species, and periphyton, the essential base of the food web. The individual studies are not linked directly to one another but instead address important questions that ……

Most of the comments above relate to all the sections, and below I give only comments specific to each section.

EXAMINING THE FOOD WEB

Comment #8: *The problem of mercury and its effects on the food web, and the methylation of mercury in the periphyton should be included. Similarly, the effects of invasive species should be integrated in some way, as these species will have a drastic effect on foods webs.*

Response #8: Mercury does indeed have important consequences for the food web but this is being investigated by scientists at Florida universities and other institutions. The same applies to the problem of exotic animals, particularly exotic fish species, which are currently attracting research attention from a number of quarters. The district is involved with a number of research studies on exotic fishes but theses are not include in the strategic plan because they are not a major component of our research. The first of these studies, in collaboration with Florida Atlantic University, will determine the current distribution of all exotic fish species throughout the Everglades ridge and slough system using data collected from a current CERP MAP project, the Aquatic Faunal Seasonal Concentration study. These data are provided free to the District and will help determine the distribution and relative abundance for each exotic fish species in the Everglades during the dry season over a three-year period. The results will be valuable for characterizing pre-CERP populations of exotic fish species. The second component will assess the physiological tolerance (temperature, DO, salinity) of selected species in collaboration with the USGS Florida Integrated Science Center (FISC), Aquatic Research Laboratory. These data will provide a better understanding of the abiotic factors that limit the invasion and spread of exotic species. Results from these studies can be used to adaptively manage ecosystem resources and guide restoration efforts with respect to exotic fish species.

We believe that mercury is a great environmental concern for the Everglades. We know that mercury is impacted by sulfur, nitrogen and phosphorus cycles, and we are aware of the role that mercury can play in the analyses of periphyton food-webs and wading bird foraging and nesting. The studies needed to elucidate these pathways are being investigated by other agencies (USGS, FDEP, the ERA Department of the SFWMD, and by the University of Florida) that are better staffed and equipped to deal with the complexities of mercury. When there is a possibility that mercury has an impact on the ecological processes that we study, we contact these experts for assistance and this information is reported every year in Chapter 3 of the SFER. -FHS

This is one of those moments…is mercury an important aspect of the Everglades? Yes. Should we study it? I don't think so. Why? First, we are stretched too thin. Second, I don't have the expertise to do it. It raises the point that we can't do everything but it is important to recognize that it is an issue that, hopefully, someone else is working on. SEH

MANAGING FOR ACCELERATED RECOVERY

Comment #9: *What attention has been given to other methods for accelerated recovery except herbicides and burning for this project. It would be useful to have a sentence or two about alternatives that are, or have been considered. LTP 1 is very useful because it can be tested.*

Response #9: Rewrite lines 485 to …Several management actions were considered, including binding of soil P via chemical amendments, moving the nutrient enriched soils by scraping, vegetation elimination by harvesting, herbicide application, cutting, prescribed burns, shading, crushing, and combinations of one or more techniques. Each approach was evaluated in terms of the ecological benefits that would be provided, financial cost and environmental risks.

Comment #10: *Have models been used to predict recovery times, both for natural recovery and for accelerated recovery. Do the models predict differences as a function of herbicides vs fire? What about fire intervals as a factor? Although modeling will be conducted for scaling up, it is not clear that modeling has been used to predict behavior of the system itself under different conditions.*

Response #10: Currently, models have not been used to predict ecosystem dynamics and recovery times for either natural recovery or for various accelerated recovery options. To our knowledge, there are no models available that could realistically compare differences in accelerated recovery dynamics as a function of management options such as herbicide application vs. fire.

Fire intervals are not included as an experimental factor in the Fire Project design for a number of reasons. (1) The intention is to use repeated fires to stress and weaken the cattail, which might then leave room for native, fire tolerant species to move back in. So, the idea is not to give the cattail plants enough time to fully recuperate before burning them again. This means that the repeated prescribed fires will occur at the smallest possible interval. (2) Due to the large-scale whole ecosystem approach used by the Fire Project, including fire frequencies as a main experimental factor was not feasible. (3) When the model is completed, parameterized, calibrated and validated, we intend to use model simulations to look at ecosystem response to, among other things, various potential fire intervals.

The reason it is not clear that the model has been used to predict the behavior of the system under different conditions is because there currently is no model that can realistically do this. However, we are in the process of developing a model to deal with these objectives including: predicting ecosystem response under various different conditions and management options, including fire interval, area burned and seasonal timing of the fire. We have changed the text to include all of the modeling objectives, instead of only the scaling-up objective.

Comment #11: *It would be useful to have a little more information about natural and accelerated recovery: time frames, differences among microhabitats, effects on wildlife and plant communities, effects on invasive plant spread.*

Response #11: We agree, it would be useful to have more information about the time frames of natural and accelerated recovery as well as the effects on wildlife and plant communities. We believe that with Fire project moving forward, particularly the model study, there would be more information in this regard. Currently there is little more that speculation about either natural or accelerated recovery processes. Along with investigating the effects of repeated prescribed fires for accelerating the recovery of nutrient enriched areas of WCA-2A, the Fire Project is simultaneously investigating the natural recovery process for appropriate comparison of options. That is why examining the natural recovery process is also one of the main objectives of this modeling initiative.

UNDERSTANDING ECOSYSTEM PROCESSES

Comment #12: *While the two main questions addressed under this section are indeed quite important, I wonder whether other similar questions should be addressed, such as the relationship of Okeechobee to the Everglades proper and the relationship of the more northern modules with the Everglades proper? These same functional linkages need to be explored at some time. Similarly, are there other overview questions besides microbial and soil processes that are needed to understand ecosystem processes. While they may not be addressed at this time, they should be mentioned. One such question that comes to mind is the relationship between reptile invasives, native reptiles, and food web interactions. Many of the hypotheses listed for the relationship between the Everglades and Florida Bay would be of interest for the linkages between other components of the system.*

Response #12: Excellent point. In fact, our day-to-day interactions with other District scientists and operations staff are designed to discuss these hydrologic linkages. We often have to deal with limited water resources and as such we have to understand the implications of giving water to one region at the expense of another. These tradeoff are the very basis for our studies on the "Environmental Responses to Water Management."

Comment #13: *The conceptual models for ecosystem functions is very useful, and the study of the effect of sea levels rise is critical to the system. Many of the models being developed will be useful throughout the Everglades. I wonder, however, about the definitions of stability in the system, given the externals of potential changes in sea level? Further, do the models also examine interactions with the bay with respect to compartments (e.g. open water, mangroves and so on).*

Response #13: For coastal wetlands, stability relative to sea level rise reflects a "dynamic equilibrium" where land elevation keeps pace with sea level. We do intend to apply the soil model to consider accretion and subsidence in the mangrove ecotones of the Everglades and Florida Bay and consider long-term responses to sea level rise. We will make this explicit in the plan. At this time, the models will not examine interactions (at least directly) with the bay or other areas because the models are not spatially explicit. After development of unit models, incorporation into spatial models and analysis of interactions would be highly desirable.

Comment #14: *The Florida Bay Everglades Linkage study is extremely important, and it good the SFWMD had turned to understand these interactions. This is the first place that stewardship has appeared as a long term goal, and this is an important aspect of the overall research and restoration plan. Are there any historical data on inputs into Florida Bay that might indicate what restoration goals might look like (do the data indicate anything about temporal and spatial patterns?). This would extend not only to direct measures of nutrient input, but the effect in terms of algal blooms (which might be surrogate problem for which there are data). Presentation of the models (Fig. 6A-4) is useful because it shows the complexities of the interactions, and makes the text more understandable.*

Response #14: There is a wealth of information on the character of Florida Bay prior to Everglades drainage and construction of the Overseas railway across the Florida Keys, which occluded passes between the Bay and Atlantic, by Herny Flagler around 1912. Much of this information was collected by USGS and University of Miami investigators in the mid- to late-1990s with District funding. These investigators have a set of sediment cores with geochronology estimated by multiple isotopes and profiles of multiple ecological indicators/proxies to hindcast past salinity, nutrient status, and the extent of seagrass cover. Coral cores provided a complementary data set regarding salinity history. Salinity estimates have been a basis (but not sole basis) for RECOVER and Florida Bay and Florida Keys Feasibility Study restoration targets. Patterns of temporal variability could only be resolved on a scale of 1 year from corals and to 3-5 years from sediments. Neither nutrient and algal bloom history nor estimates of historic nutrient inputs have beem successfully characterized by this approach. Spatial information is coarse because few cores were successfully dated and analysis is very time consuming, but we have been able to contrast eastern, north-central, and southern Florida Bay conditions. See the Ecosystems History chapter by Wingard et al. in Hunt and Nuttle (2007; Florida Bay Science Program: A Synthesis of Research on Florida Bay. FWRI Technical Report TR11. Florida Fish and Wildlife Conservation Commission. 148 pp) and Journal of Coastal Research special issue 26 (1998) for details.

ANALYZING LANDSCAPE STRUCTURE AND FUNCTION

Comment #15: *The examination and study of the Everglades system on a landscape scale is a necessary part of restoration, although perhaps the most difficult. In this section was the mention of a 100 year time frame, and perhaps this concept needs to be expanded so that it is clear when specific goals are to be met throughout the report. The holistic approach taken in this section is optimal for an overview of the Everglades restoration. The use of 100 years makes it clear that a series of interim goals and assessment measures need to be developed.*

Response #15: Corps and District engineers want regulation schedules and operational guidelines that will not require constant requests for deviations. This may not be realistic, so yes…it will be necessary to develop a series of interim goals and assessment measures. The next phase of this Research Plan will be to assess the timeframe of the expected scientific results and to link these to the CERP hypotheses in a way that also helps CERP to evaluate interim restoration goals.

Comment #16: *The mapping being proposed is also important for the overall Everglades work, both for managers and scientists, but for the greater public, including public policy makers. The issue of ground-truthing needs to be considered, as well as adding some details about the scale of*

the data. It is not clear from the description how the historical information (as well as the peat cores) are going to be integrated into the current vegetation mapping. Who is responsible for comparing historical vegetation mapping with the current products? This comparison should prove particularly useful in the restoration process, and for the public to understand the nature and extent of ecosystem disruption.

Response #16: This comment is correct. All our technical and scientific publications on this topic stress the importance and procedure for effective ground-truthing. CERP requires a 90% or better accuracy. This and details of the scaling will be added to the Plan. The person who will compare historic to current maps will be Dr. Martha Nungesser as part of the "Ridge and Slough Pattern Analysis" program.

Comment #17: *The experiments to understand flow effects on plant community interactions are very important to overall restoration goals, and more details need to be provided on how the experiment will contribute to understanding in the greater Everglades area. It is a matter of scaling up the effects observed. The meta-scale transport processes study should go a ways toward understanding the scaling up. The ridge and slough pattern is critical to Everglades restoration, and any studies aimed at understanding how to maintain existing ones should be vigorously pursued. The management and restoration objectives for the ridge and slough pattern analysis and modeling project are well-stated and important.*

Response #17: Details of this LILA experiment were discussed in Chapter 6. This below will be added to the appropriate section of the Appendix:

In order compare the effects of water depth and flow rate and to examine sedimentation, soil-building and nutrient dynamics, strips of vegetation composed of blocks of three keystone Everglades wetland species have been planted in 2 x 2 m patches (Figure 6A-xx). These strips were planted at 2 depths and 2 flow rates in the sloughs of each cell, as well as on the interior and edge of a ridge in each cell. In each cell, an upstream portion of one ridge is built out in to the adjacent shallow slough to constrict flow and thus increase water velocity in this area of the shallow slough, while the constructed tree islands constrict flow in the deep slough. This built-in variation in flow will be utilized to provide a within-cell flow velocity treatment. Additionally, two of the cells will have slow flow, while two will have higher flow, giving a between-cell difference in flow rate.

As depicted on Figure 6A-xx, the three species planted are sawgrass (*Cladium jamaicense*), spikerush (*Eleocharis cellulosa*), and water lily (*Nymphaea odorata*). These three species have very different growth forms that could affect local flow rates and sedimentation very differently. Intermixing plantings of sawgrass, spikerush, and water lily under different flow rates and water depths, then monitoring sedimentation and soil accretion, as well as growth of each species, will help to understand how these species affect the landscape (i.e., function as "ecosystem engineers") and to determine whether morphology of the different species results in local differences in flow rate and soil-building processes. The hypothesis is that species morphology alone can create ridge, slough, and wet prairie topographies through effects on sedimentation, given sufficient flow, but that the water depth-flow rate interaction determines a species' ability to grow. Additionally, comparison of direction of expansion of the plantings on the edge of the ridges to plants in the interior, as well as rates and direction of expansion around blocks of plants in the sloughs, allows us to examine species expansion versus contraction under different flow rates within a cell.

This planting configuration will allow monitoring of growth and sedimentation in a hydrologic environment that is already channelized and where each species grows in an isolated patch. Each species was just recently planted at initial densities of 1 plant/0.25 m2. Growth will be monitored by counting number of stems in six permanent 0.25 m2 quadrats in each block, one on each of the four edges and two in the interior. Leaf length and number of leaves per plant will be determined

for each of these quadrats. There will be no leaves in these edge quadrats initially, but these are expected to fill in over time. This design allows us to determine whether the growth into these areas is related to direction of flow, water depth, and/or flow rate. Sediment traps will be set out upstream, downstream, and inside of vegetation blocks to document rates of sedimentation. Local velocity measurements around each block will be collected in conjunction with sediment trap collections. The data will be analyzed for the effects of flow rate, water depth, and their interaction on growth and productivity of each species and results will be compared among species.

Comment #18: *Tree island formation and maintenance are clearly integral to the restoration efforts in the Everglades, and play a key role in ecosystem dynamics. To what degree have the effects of potential sea level rise been factored into the thinking, models and research plans.*

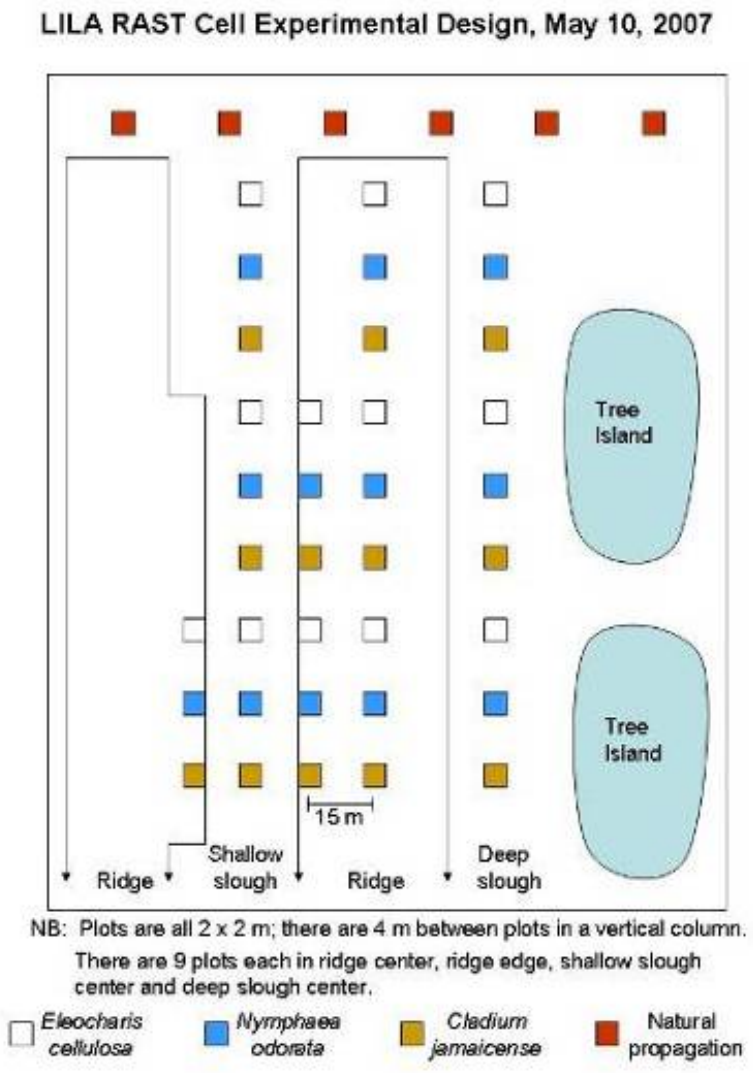


Figure 6-14. Plan view of a single cell with proposed plantings of sawgrass (*Cladium jamaicense*), spikerush (*Eleocharis cellulosa*), and water lily (*Nymphaea odorata*). P = plots for monitoring natural propagation. Species are planted in 2 x 2 m blocks of a single species, separated by 3 m.

Response #18: Completed in Document. In general, all work in the coastal regions of Fl Bay consider impacts associated with water management as it relates to sea level rise.

Comment #19: *For this project, it might be useful to relate the management and restoration objectives to the larger picture. That is, how will understanding litterfall help with restoration of tree islands. Are there any plans to actually build new tree islands to experimentally determine if this is feasible or even possible?*

Response #19: The belowground processes, such as root production, turnover, and decomposition along with soil accretion measurements are an integral part of on-going research in mangrove forests that has a main objective to determine the response of forested wetlands (i.e. mangrove forests and tree islands) to increasing sea level rise. So far, we have estimated that mangrove forests subjected to long hydroperiods are not keeping pace with current sea level rise estimates (2-4 mm per year).

Litterfall measurements along with other aboveground processes, such as tree growth and seedling and sapling recruitment, are directly linked to woody tree species responses to changes in hydrology and to determine tree island health under current conditions.

There are not current plans to build new tree islands in the Everglades; however, CERP is considering using levee material along the Miami Canal as tree island habitat and current experiments that are carried out at LILA can give a better answer to determine whether building new tree islands is feasible or not.

Comment #20: *Since the water regime is expected to change in the future as a function of water management, what thought has been given to selecting tree island sites that most mimic the future water level regimes to predict future effects? If not, then some preliminary water regimes should be tested to examine these effects. At the very least, the flooding tolerances data to be collected are extremely important to answering some of these questions.*

Response #20: Tree islands were specifically selected to determine how they will respond to future water regimes. We have been working on tree islands located in areas that are under long hydroperiod (WCA-3A) and short hydroperiod regimes (WCA-3B). The water level regimes of these areas will be modified under CERP; therefore, we will be able to predict how the plant biology and ecology on tree islands will respond to future water level regimes.

Tree islands under study were selected to determine how plant responses will response to future water regimes. For instance, we have been working on tree islands located in areas that are under long hydroperiod (WCA-3A) and short hydroperiod regimes (WCA-3B). The water level regimes of these areas will be modified under CERP; therefore, we will be able to predict how the plant community distributed on tree islands will respond to future water level regimes.

Comment #21: *The role of exotics in tree island formation is another critical question. This is one of the few places in this chapter where invasives are seriously considered, yet they should be integrated into as many of the research projects as possible as they will become even more important in the future of the Everglades. Monitoring is extremely important, and every effort should be made to encourage monitoring of the program at Loxahatchee with respect to exotic invasive plants.*

Finally, Mangrove structure and function has been an area that has received little attention, but which has great potential for affecting the Florida Bay system. Since this system serves as a buffer for the Everglades from storms, as well as to coastal communities, it deserves some careful studies. Are there historical data that would allow for an understanding of the spatial and temporal changes in the location and extent of the mangrove system? Are any data available from the 1940s, 50s or later?

Response #21: Most of the historical of the spatial and temporal change in the extent of mangrove forest is available for the Southeast Everglades (the MSTZ). However, the southwest

coast from Cape Sable to Lostman's region has change very little. Except for some forest destruction due to hurricanes, in the west coast the mangrove forest has not changed significantly over the last 50 years. I am sure I can find some references to back up this statement if we need them.

The hurricanes that caused a major destruction in that region occurred in 1929 (whitewater bay region) and 1948 (ten thousand island region). In this region and the Florida Bay (MSTZ) region as well, the rate of sea level rise appears to have been critical in determining whether shoreline has moved landwards (transgressive) or seawards (regressive). Thus, from the geology point of view, this region is transgressive (mid-holocene) and has been largely regressive during the late Holocene (Spackman et al., 1969). In short, the MSTZ region mangrove forests are moving landward (due not only to increase in sea level but also to the reduction in freshwater input). In contrast, in the Southwest region, mangrove forests have been moving seaward but little research (i.e. maps) has been done to record seaward mangrove expansion.

SYNTHESIS

Comment #22: *Ecological evaluation is a critical part of ecosystem management, and is usually done with a goods and services approach. Both ecological economics and ecological services approaches usually examine the value of ecosystems from an extractive and services viewpoint. Yet, many subsistence and American tribal peoples view ecosystem values in a more holistic and larger context. Every attempt should be made to go beyond the goods and services approach when evaluating ecosystems.*

Response #22: We completely agree.

Joanna Burger

ENVIRONMENTAL RESPONSES TO WATER MANAGEMENT

Comment #23: *The organizational chart listed on the first page, however, is confusing; it is unclear how this relates to anything else in the document.*

Response #23: DONE

Comment #24: *Line 72: might mention restoration goals here (not just the ecological trajectory).*

Response #24: DONE

Comment #25: *Line 77: Do you want to also add that support fish consumption?*

Response #25: No, I think that is covered under 'the dynamics of wading birds'.

Comment #26: *Line 116: How many workshops - might be useful to have a table of workshops with their objectives.*

Response #26: There were 3 workshops.

Comment #27: *Line 151: Under food webs, I wonder if there should be an invasive animal component, particularly where the invasive is disrupting the whole system (such as the pythons or feral hogs).*

Response #27: See the response above.

Comment #28: *Line 164: Are wading birds higher in numbers than alligators (which are also top predators)?*

Response #28: Yes, there are many more wading birds than alligators.

Comment #29: *Lines 191-205: How do these individual hypotheses relate to the projects listed thereafter? This information is in table 6A- 1, but it requires going back and forth, and it should be in each section.*

Response #29: As stated in the introduction, these hypotheses are more restoration expectations than strict scientific hypotheses per se and as such do not necessarily relate directly to each study.

Comment #30: *Lines 247-258: Give citations for the specific studies mentioned.*

Response #30: I will cite the wading bird report and the final report of the SRF contract.

Comment #31: *Line 281-309: Are there any plans to determine the effect invasive fish have on prey availability?*

Response #31: Yes, the mapping study mentioned above will relate the prevalence of non-native fish to densities of natural prey during the dry season, when prey is available to wading birds.

Comment #32: *Line 328: Should the problem on methylation of mercury be included.*

Response #32: See earlier reply.

Comment #33: *Line 411: What datasets?*

Response #33: "Long-term Audubon of Florida field datasets…"

Comment #34: *Lines 459-462: The management and restoration objectives do not seem as tied to restoration as the others are.*

Response #35: I can say that it is very important for restoration managers to understand the pre-drainage distribution of wading bird colonies. The current idea is that pre-drainage nesting occurred primarily in the southern estuaries. Today, most nests are found in the WCAs and the restoration strategy is to improve conditions in ENP so that those birds move back down south. However, while we know that large colonies were present in the pre-drainage southern estuaries, we do not know whether they were present or not in the northern everglades. Understanding the temporal distribution of colonies has important implications for deciding what water management strategies need to be applied to the various regions of the system.

Comment #36: *Line 503: Need to state removal of what.*

Response #36: Done.

Comment #37: *Line 505: Need to include the options (These should stand alone).*

Response #37: Done.

Comment #38: *Line 542: Might say what kind of community structure.*

Response #38: Done. Change text to Corollary 1: Removal of densely vegetated community structure can affect food-dynamics.

Comment #39: *Line 562-578: Are cattails the only vegetation that is so dense?*

Response #39: No, sawgrass communities are also dense in overdrained areas of the ecosystem.

Comment #40: *Line 586: Are there any predictions for time to natural recovery.*

Response #40: Not yet.

Comment #41: *Line 663: I found this line a little condescending - it should be softened.*

Response #41: Done.

Comment #42: *Line 667: Might add a sentence about the historical fire interval in the Everglades.*

Response #42: Done.

Comment #43: *Line 672: When initiated*?

Response #43: Done.

Comment #44: *Line 688: Do you have a criterion for how to determine success? In order to have natural recovery you need to know the time frames of that recovery.*

Response #44: Done.

Comment #45: *Lines 800+: The two questions are very different in approaches and scope. One deals with the whole system, and the other deals with how parts of the system interact or are linked. This needs to be addressed.*

Response #45: This will be addressed in the rewrite.

Comment #46: *Line 841: Again this is a statement rather than a hypothesis.*

Response #46: We want to be consistent with CERP.

Comment #47: *Lines 847-895: I would like to see all of these framed as testable hypotheses (I think this would make it easier for the reader also).*

Response #47: These will be added to objectives.

Comment #48: *Line 960 on: To what degree will sea level rise affect these models and peat accretion?Table 6A-3 is extremely useful.*

Response #48: See new text below.

Comment #49: *Line 1031: I agree it will be useful, but it would be helpful to have some examples of potential applications.*

Response #49: Lines 960 to 1034 from the original draft are modified (below) to address the above comments (for line 960 and 1031). Mainly, this involved adding additional text and a separate paragraph in the final section "Application of Results". However, small editorial changes were made throughout.

Specific Management and Restoration Objectives: The integrative empirical and modeling approach described here will provide a tool for understanding how Everglades plant communities and soils will respond to hydrologic restoration measures over time periods that are relevant to ecosystem restoration. The goal of this work is to generate a quantitative framework for understanding Everglades ecosystem responses to altered hydrology, including (1) the effects of past climate variability and water management on system stability and (2) effects of future hydrologic changes (e.g., restoration effects and natural climate variability) on system stability. Specific objectives of this work are

• To quantify the extent to which peat accretion in tree islands (and long-term stability) is affected by changes in water depths, water flow and sediment transport

• To quantify the extent to which peat accretion in ridges and sloughs, and the consequential effects on their microtopographic differences, is affected by changes in water depths, water flow and sediment transport

• To identify the ecosystem processes (for example: plant productivity-hydrology relationships, litter quality effects on decomposition, soil oxidation/compaction rates) that are most sensitive to hydrologic drivers and can be used to provide an understanding of the long-term accretion and stability of Everglades wetlands

Methods and Procedures: This 1-D accretion model structure and assumptions draw on previous examples from other wetland systems (e.g., Morris and Bowden, 1986; Callaway, 1994; Rybczyk et al., 1998; Day et al., 1999; Nungesser et al., 2003; Saunders, 2003). Main components of this model includes above and belowground production of competing plant species, litter quality and abiotic (including hydrologic) controls of soil organic matter (SOM) decomposition, sediment deposition/erosion, soil compaction, fluctuating hydrology (mainly water depths), and the interrelationships among these processes. This model will be designed to simulate accretion rates, elevation changes and soil profile changes in organic matter and mineral matter, along with paleoecological proxies specific to Everglades systems (Saunders et al., 2006; Chmura et al., 2006) over decades to centuries.

This research integrates a variety of data used for calibration, validation, and system drivers (**Figure 6A-3**). System driving variables, mainly hydrologic variables governing water depth and water flow, comprise the DRIVERS data set. The PROCESS data set includes the results of field and mesocosm/greenhouse studies and data from the published literature quantifying key ecosystem processes (e.g., plant productivity, litter decomposition, seed production and relationships with abiotic covariates). These data are used mainly for calibration purposes. The PALEO data set includes results from the analysis of soil profiles related to organic constituents

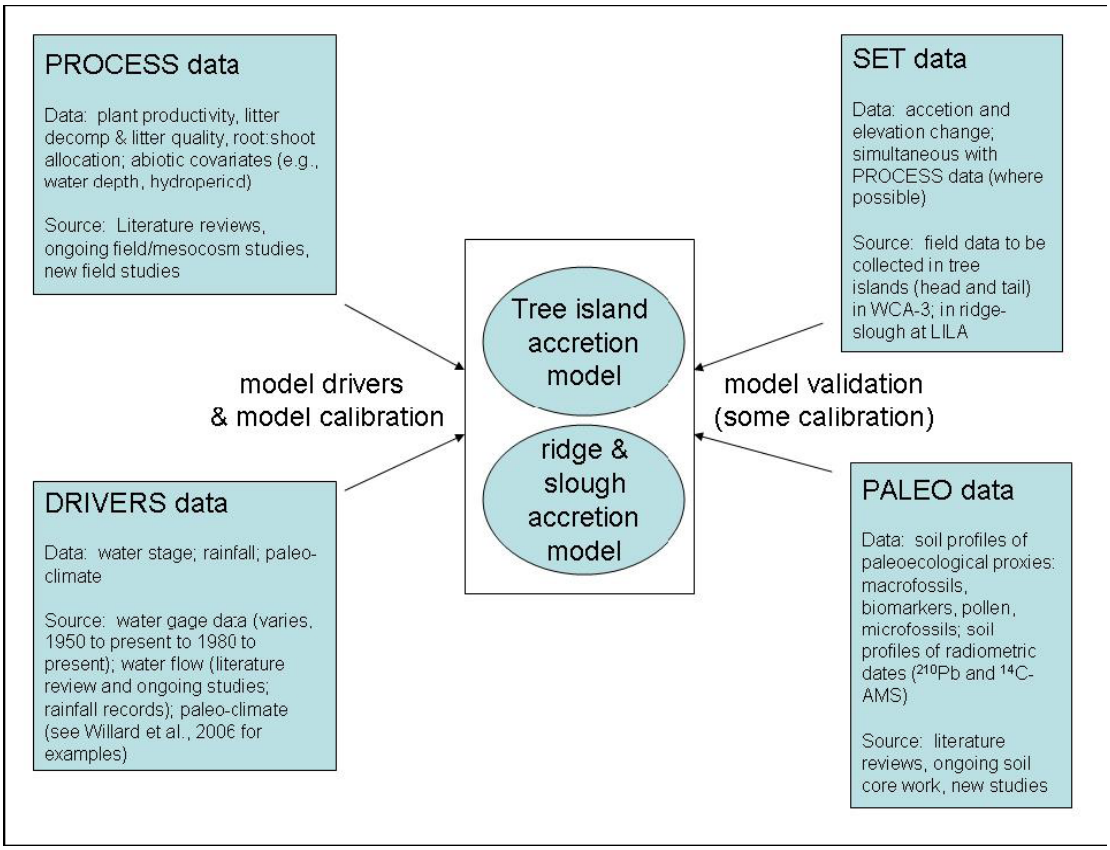


Figure 6A-3. A summary of the four data sets integrated with accretion

(e.g., labile/solubles fractions and more recalcitrant cellulosic material and lignins), inorganic constituents (e.g., nutrients and CaCO3 content, total ash-dry weight), radiometric soil dates (e.g., ^{210}Pb and ^{14}C dates), and paleoecological proxies such as fossil seeds and biomarkers. PALEO data are used for both calibration (especially for parameters that cannot be directly measured) and for validation (testing model predictions of soil accumulation and accretion from soil constituents and radiometric dates and vegetation dynamics from macrofossil and biomarker profiles).

SET data include repeated measurements of sediment elevation and accretion using a Sediment Erosion Table (SET) developed by Boumans and Day (1993) and Cahoon et al. (2002a,b). These data will be used to test model simulations of elevation and accretion over shorter time-scales (several months to several years). Forthcoming SET research will include in situ measurements in tree island and ridge-and-slough communities and measurements at the Loxahatchee Impoundment Landscape Assessment (LILA) experimental site. LILA will provide a unique setting for applying an experimental approach to refine model assumptions and equations governing accretion and elevation and refine their relations to ecosystem processes (e.g., water flow, water depths, primary production, floc transport, decomposition).

Application of Results: These objectives will quantify the thresholds in water depths/hydroperiods and water flow that promote or reduce the stability of tree islands, ridge and slough vegetation (relative to historic levels), and ridge-and-slough microtopography (relative to historic microtopography). For instance, one application of the model may be to evaluate the degree to which floc transport and deposition observed from short-term (days to months) adaptive management experiments (e.g., DECOMP Physical Model and LILA experiments, Figures 6A-6 and 6A-7) result in more or less system stability when simulated over years to decades. In

addition, model sensitivity analyses will help identify ecosystem processes that regulate those thresholds and which of these processes should be research priorities aimed at assessing restoration success.

The soil accretion model developed here is a general ecosystem process model that can also be applied to other areas and issues in the Everglades. While our initial focus is on freshwater habitats, a forthcoming collaborative project (funded externally through CESI/DOI) involving researchers at SFWMD, the Florida Coastal Everglades LTER, FIU and ENP will begin applying this framework for understanding coastal wetlands responses to hydrologic restoration and rising sea levels. Necessary modifications to the conceptual model in Figure 6A-2 include relationships by which salinity and flooding regimes alter primary production (in sawgrass, mangrove and open water habitats), and decomposition, with consequent changes in soil accretion and accretion-mediated feedbacks. Despite these modifications, the framework will continue utilizing the same four principal data sets (Figure 6A-3) which are available from published literature (e.g., PALEO data in Willard et al., 2001; DRIVERS data from sea-level records and paleo-reconstructions of sea level) and ongoing studies (e.g., PROCESS and SET data through FCE LTER and SFWMD research programs). An anticipated application of this work will be to quantify the pace and magnitude of ecotone changes in sawgrass, mangrove, and/or open water habitats and the degree to which accretion/erosion responses reinforce or buffer those changes.

Comment #50: *Line 1099: Any field evidence for this?*

Response #50: Yes. Add (Hagerthey et al. In Prep) to the end of the sentence.

Comment #51: *Line 1113: In the laboratory or the field?*

Response #51: Please see lines 1114–1119.

Comment #52: *Line 1148 on: The use of stewardship is important, but should be defined.*

Response #52: We did not mean to use this term. It will be replaced by "preservation".

Comment #53: *Line 1210–on: Are there any data for historical inputs to Florida Bay from the Everglades?*

Response #53: See detailed reply to Florida Bay historical information question above.

Comment #54: *Line 1247: I do not normally think of bioavailability as being decomposition rate (surely, there is some percentage thereof?). This needs more explanation.*

Response #54: We will edit the text to be sure that we are concerned with both the quantity of organic matter that can be readily decomposed (i.e. is "bioavailable" on a time scale relevant to bay productivity) and the rate of decomposition. Typically, focus is on the percent of total organic matter that is bioavailable, but the rate of decomposition is very important because of the long residence time of Florida Bay. Our modeling estimates both the pool size of bioavailable and refractory organic matter and mineralization rates.

Comment #55: *Line 1264: Are there any data showing the extent of increases in algal blooms as a function of 30 years, 20 years or 10 year timeframes. What are the data?*

Response #55: The earliest chlorophyll a data were collected in 1989 and have been collected monthly (by Florida International University scientists with District funding) since 1991. Anecdotal evidence indicates that phytoplankton were negligible in Florida Bay in much of the 1970s and all of the 1980s – water was so clear that scientists (specifically Jay Zieman of University of Virginia) did not collect samples. It is likely that this clear water was an anomalous condition associated with seagrass (Thalassia) expansion.

Comment #56: *Line 1270–1272: Are there data on relative public concerns. Not just a few comments, but has there been any research to actually assess perceptions and attitudes about the Bay?*

Response #56: Public opinion surveys have been done by NOAA Sea Grant, but am not familiar with the details or results.

Comment #57: *Line 1307: Up to this point, there has been little mention of the mangrove system (is this covered elsewhere?).*

Response #57: There is a section on mangrove system structure and function on pages 57-59. While this work is in the Landscape portion of the Plan because of its emphasis on structure and zonation, it is also an important component of our Everglades-Florida Bay linkage plans.

Comment #58: *Line 1354: Does it also look at percent salinity?*

Response #58: The model receives information on salinity conditions at specific points in the bay, either from data input files or from predictive output from other models such as FATHOM or EFCD. The seagrass model applies an averaging scheme that smoothes the salinity input to a mean value per day. This is the value that is "sensed" by the plants in the model.

Comment #59: *Fig 6A-4: The abbreviations along the left-hand side are not always obvious, and should be in the legend. The same with other abbreviations in the model.*

Response #60: Figure 6A-4. Conceptual model showing major components and interactions of the Florida Bay SAV community model. Forcing functions are to the left of the diagram are represented by circles and include PARis photosynthetically active radiation, DIN, DIP are dissolved forms of nitrogen and phosphorus respectively, OM is organic matter; state variables for which mass is conserved in the model are represented by rectangles. Those variables above the horizontal line represent entities on or above ground and in the water column. Those below the line represent entities below ground and within the sediments.

Comment #61: *Line 1408. This sentence seems incomplete - and stable what?*

Response #61: Revise to: The model is calibrated for a 1996-2001 baseline period and stable.

Comment #62: *Line 1429: What was the time period of the canal digging?*

Response #62: The first canals were completed in 1906 and we have been building them ever since (see the very first SFER in 1998).

Comment #63: *Lines 1458-1464: Again, change to testable hypotheses.*

Response #63: Yes.

Comment #64: *Line 1495:Who is developing the interim goals, and is anyone developing assessment measures?*

Response #64: RECOVER is the answer to both questions.

Comment #65: *Line 1515: Need to define LiDar*

Response #65: Light Detection and Ranging (LiDAR) is a remote sensing technology used to measure vertical profiles of natural and man made objects. Primarily used in topographic mapping applications, LiDAR has also been used successfully to map wetland and forest vegetation vertical profiles and structural properties.

Comment #66: *Lines 1526-1530: What is the timing of the mapping? When will the initial draft be done?*

Response #66: Updated in document.

Comment #67: *Line 1535: I think that the Tribal interests should be mentioned here.*

Response #67: Updated in document.

Comment #68: *Line 1539-40: What ground-truthing will there be for the mapping.*

Response #68: Updated in document.

Comment #69: *Line 1572: Did the aerial photography in the 1940s cover the whole Everglades?*

Response #69: A third type is available through aerial photography that began in 1940 and followed generally each decade thereafter that provide images of the changing landscape (Nungesser et al., submitted). The 1940 aerial photographs cover most of the Everglades, though some of the images are missing. Subsequent aerial photographs from the 1950s, 1970s, 1980s, 1990s, and 2000s also cover similar or broader areas.

Added citation:

Nungesser, M.K., C. McVoy, Y. Wu and N. Wang. Landscape Patterns of the Everglades Ridge and Slough Peatland. Submitted to Wetlands.

Comment #70: *Fig 6A-5: This is difficult to read because it is not clear.*

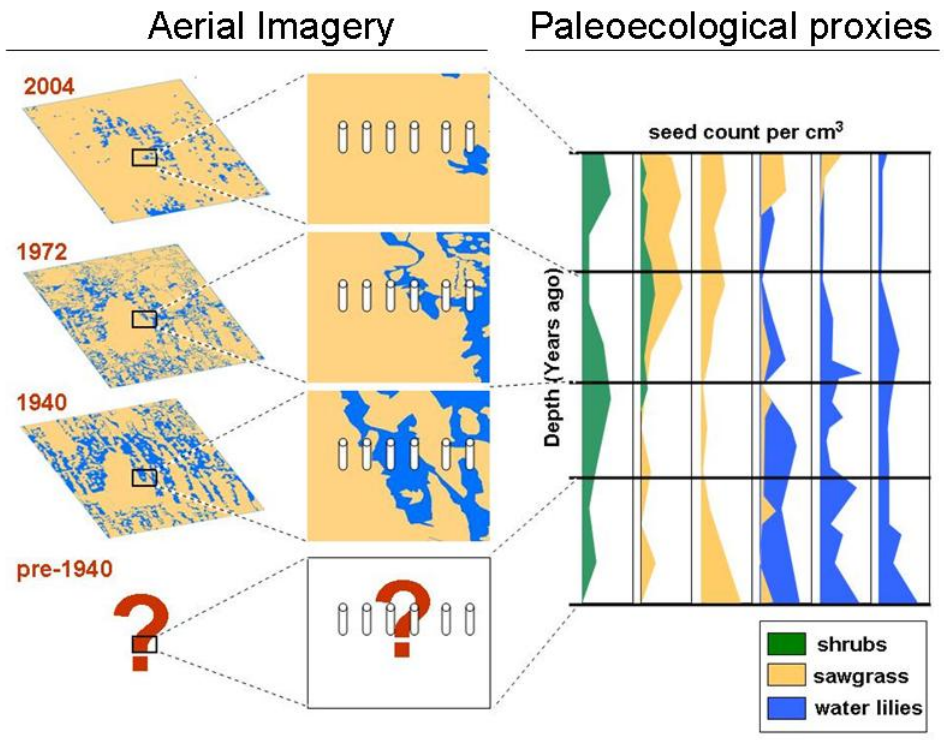
Response #70: FIXED.

Comment #71: *Line 1602: How will these sample areas be selected; will only one of each type be used?*

Response #71: Lines 1592 to 1611 from the original draft are modified (below) to address the above comments for Fig 6A-5 and Line 1602: note Fig 6A-5 is replaced with a larger, simpler figure; note the figure legend has changed also; much of the methods text has also changed) . PER CJS 9/19/07

Methodological Approach—Paleoecological Analyses. Paleoecological data from Everglades soils can provide information about past vegetation, soil accumulation, fire frequency, and hydrologic conditions over time periods ranging from decades to centuries (Winkler et al., 2001; Saunders et al., 2006; Willard et al., 2006). Changes in Everglades habitats have been linked to millennial scale changes in the Florida climate (Winkler et al., 2001; Willard et al., 2006), but more investigations are needed to resolve the effects of 20th century water management activities (Willard et al., 2006). Paleoecological analyses of Everglades soils have been used to demonstrate changes in ridge and slough boundaries at the resolution of 30 meters (Bernhardt et al., 2004) or less (Saunders et al., 2006 and 2007), thereby enabling researchers to use both paleoecological and aerial imagery approaches to quantify and understand changes in ridge/slough boundaries. The research described here will integrate paleoecology with analyses of historic records and aerial imagery to provide fine-scale data on vegetation, soil, and hydrologic changes from pre-drainage to modern periods (Figure 6A-5).

Specific paleoecological investigations will focus on four key subregions, including: (1) an historically drained area; (2) an impounded area; (3) a "stable" area (ridge-and-slough patterning relatively unchanged); and (4) an area to be hydrologically affected by the DECOMP Physical Model experiment. Subregions will be selected based on aerial imagery analyses (per M. Nungesser) of fifteen landscape quadrants (4 km by 6 km) in WCA-3 (see Ridge and Slough Pattern Analysis and Modeling, Figure 6A-8). At each of the four subregions, 6-8 cores will be collected along a 100-meter ridge/slough transect (total of 4 transects, 24-32 cores total) that is located in the approximate center of the 4 km by 6 km landscape quadrant. Cores will be analyzed for ^{210}Pb and ^{14}C to establish soil dates for each core. Paleoecological proxies, including macrofossils (mainly seeds), pollen and biomarkers, will be used to quantify changes in ridge/slough boundaries, including pre-drainage and early drainage conditions (before 1940) and after 1940, when water management began occurred in earnest.



08/30/07 App. 6-1-42 DRAFT

Figure 6A-5. Research plan overview, integrating paleoecological reconstruction with image analyses. Soil profiles of paleoecological proxies (exemplified here as fossil seeds) from cores collected along ridge/slough transitions will validate aerial images from 1940 to 2004 and quantify pre-1940 vegetation, peat accretion and hydrology.

Comment #72: *Fig 6A-6. The date of construction should be in the figure legend.*

Response #72: Will do.

Comment #73: *Line 1723: How will pre-drainage flow be determined?*

Response #73: It will be calculated from measured flow rates in the current system, corrected quantitatively for differences between current and pre-drainage conditions.

Comment #74: *Line 1774-1781: Are there good data on all the drainage and water flow changes that mirror the aerial photography?*

Response #74: There are dates for construction and completion of the structures, and there are data on precipitation that can be used in conjunction with the pattern changes. However, there are no stage/depth data prior to with which to compare the pattern responses, but proposed work will attempt to reconstruct (Hindcast) stages to 1973.

Comment #75: *Line 1789: Can intermediate times also be determined? What did the pattern look like in 1950, for example?*

Response #75: Yes, intermediate patterning will be determined for each of the six years (1954, 1972, 1980, 1995, and 2004). These intermediate times will be used to aid in trajectory analysis forward from 1940 and backwards from 2004 to help reconstruct earlier, pre-drainage patterns.

Comment #76: *Line 1793: It is not clear what "these pattern changes" refer to. Some of these need to be more clearly stated.*

Response #76: "these pattern changes" refers to the previous bullet: pattern changes in the Ridge and Slough and tree islands in WCA-3.

Comment #77: *Fig. 6A-8: Need to give the location of this quadrant pattern.*

Response #77: These quadrants are located in Water Conservation Areas 3A and 3B and follow flow lines that are expected to result from restoration of more natural flow through the Everglades.

Comment #78: *Line 1852: Need to list the predictions that can be rapidly tested, and in what timeframe?*

Response #78: We anticipate that the model will be most useful for suggesting how degradation of microtopography, altered slope, increased density of vegetation, and availability of water quantity and seasonality will affect pattern rejuvenation and maintenance resulting from restoration of natural flows. It may also suggest how removal of flow blockages will affect both upstream and downstream patterns. Because it is a simple, rule-based model, the processes are implied in the rules, and they need to be tested with real life experiments. Integration with the RSM model is possible for more realistic hydrologic testing.

Comment #79: *Lines 1864-on: It might be useful to give some basic statistics on the relative degree of tree island loss (these are presented elsewhere, but would be useful here.*

Response #79: Completed in document.

Comment #80: *Line 1903: Is the 61% decline typical of the Everglades overall?*

Response #80: Original line 1902 and 1903:

Water stress and decline in forest structure. Aerial photographs of WCA 3 were used to document a 61% decline of tree island area between 1945 and 1995 (Sklar and Van der Valk, 2002).

Revised line 1902 and 1903:

Water stress and decline in forest structure. Loss of tree islands in both number and size have been documented throughout the Everglades landscape over the last half of the 20th Century, including a 61% and 87% decline of tree island area in WCA3 and WCA2, respectively (Sklar and Van der Valk, 2002) and a decline in tree island number and size in impounded areas of WCA1 (Brandt et al., 2000).

Note: this revision includes a new reference:

Brandt, L. A., K. M. Portier, and W. M. Kitchens. 2000. Patterns of change in tree islands in Arthur R. Marshall Loxahatchee National Wildlife Refuge from 1950 to 1991. Wetlands 20:1-14.

Comment #81: *Line 1924: What is the pattern of formation of new tree islands? Are there many? Have they been studied well? Are they being followed? How stable are tree islands, and do they have a lifespan?*

Response #81: Completed in Document.

Comment #82: *Line 1960 and on: It might be useful to state how each of the objectives will help understand tree islands and their restoration.*

Response #82: Revised Lines 1958 to 1967**.** Management and Restoration Objectives: The first set of objectives of this research includes (1) determining the spatial pattern and variability of litterfall; (2) defining the effects of water level variability on long-term patterns of litterfall production, phosphorus sequestration and nitrogen cycling; and (3) determining soil/peat accretion rates in relation to current water management practices and future predicted hydrologic restoration goals. Objectives 1 - 3 will provide a means to assess the ecological processes linked to tree island health and soil formation. Similarly these objectives will help to define where tree

islands are more (or less) vulnerable to drowning and loss due to reduced productivity, lower rates of accretion, or greater sensitivity to water level variability. The second set of objectives utilize a paleoecological approach to (4) quantify vegetation changes in tree islands over the past 100-200 years and (5) determine the hydrological conditions conducive to tree island formation, development, and maintenance. Objectives 4 and 5 will provide the pre-drainage variation in community types and soil development, essentially restoration targets for tree island health. These objectives complement the first three by providing a longer-term data set documenting tree island responses to hydrologic variation that occurred over several decades to centuries. Combined, accomplishing these objectives will provide Water Management District with ecological and hydrological information that is suitable to maintaining or promoting tree island communities under different hydrological conditions.

Comment #83: *Line 1775: What paleontological data will be used? peat cores?*

Response #83: The impression that from the text "track surface pattern changes" that this meant we were tracking surface patterns physically was incorrect. We have done this by image analyses using aerial photography.

This section addresses patterning changes that are visually determined from the imagery. We plan to use paleontological data to address questions that predate information available from the imagery.

Comment #84: *Line 2005–2009: Are the water tolerant species invasives, nonindigenous, or just native species that are outcompeting more preferred species?*

Response #84: Completed in Document.

Comment #85: *Line 2036–2045: The objectives are not parallel; some are statements, others are effects of...*

Response #85: The paragraph will be replaced by this: The LILA experimental component includes four main objectives; (1) assess the flooding tolerances of trees, (2) evaluate competitive interactions and the spacing tolerance of tree species as a function of hydroperiod, (3) determine the role of sheetflow and water velocity on tree island development, and (4) explore the role of the ground water – surface water interactions on tree physiology and island geomorphology. Tree islands studies at LILA are designed to provide restoration managers with reliable and cost effective methods for tree island restoration and creation, as well as a better understanding of how tree island habitat is influenced by hydrology. One hypothesis regarding tree island development states that when woody shrubs become established during dry conditions, they create a root system that elevates the land. The subsequent increased growth of plants and accumulation of organic soil, in turns, elevates the wetland further, increasing the size of the tree island habitat until some dynamic equilibrium is reached between soil oxidation and peat decomposition.

Comment #86: *Line 2114: Is there any chance of getting this program to include a monitoring component and appropriate controls?*

Response #86: I think so, since this is what is being proposed by this section. Line 2118 reads … Monitoring is needed to quantify the response of the native species abundance and diversity. Development of "appropriate controls" (read – when can spraying be done or not done) is dependent upon results from the proposed research. Since we do not have the knowledge, a priori, to develop a protocol yet, specifying "appropriate controls" at this time is premature. I am inclined to think seasonal biologically critical phenological life stage relationships need to be identified to help identify important components of appropriate controls. The investigations proposed to Vegetation Management should incorporate these ideas as a fundamental objective of the research.

Comment #87: *Line 2176: It would be useful to add more details of the predicted changes as a result of sea level rise.*

Response #87: Providing such a prediction is a goal of our research and future work will evaluate recent and modeled rates of sea level rise in relation to measured and modeled rates of soil elevation change. With information currently available and large uncertainties, we hesitate to provide such a prediction in this document.

JoAnne Burkholder

Comment #88: *I was asked to review this document in addition to my other responsibilities, partly in response to a request from the District to ensure that a member of the panel who reviews Chapter 12 (Coastal Ecosystems, including the most detail to date within a SFER on Florida Bay) also assesses the Science Plan for future Florida Bay work, contained in this appendix.*

The 5-year Plan is written as an outline and general approach to Everglades restoration, conservation biology, and resource management needs of the District. It focuses on understanding four general sets of Everglades components or functions affected by water management activities, including (1) Food webs, (2) Areas impacted by phosphorus enrichment, and management to accelerate recovery; (3) Ecosystem processes related to soil dynamics and functional linkages between the Everglades and Florida Bay; and (4) The structure and function of major landscape features.

The Plan also projects ahead over the next decade by identifying three priority needs and directives for District programs, as (1) Implementation of the Long-Term Plan with options for accelerated recovery; (2) Restoration of more natural flows and levels in the Everglades, and concomitantly, restoration of natural ecological functions; and (3) Development of technical criteria for minimum flow levels in the coastal watersheds.

The planned projects logically focus on key components and uncertainties identified by conceptual ecological models. Within each section, four elements of each project are clearly presented, including overview and background – with generally excellent, very helpful explanations; management and restoration objectives; methodological approaches; and importance/application of the findings. The Plan acknowledges that, while present Everglades restoration efforts strongly emphasize hydrologic restoration (water quantity, timing and distribution), it is important to continuously consider potential trade-offs with water quality (lines 1109-1111).

Does the research plan represent a good strategy for addressing key scientific and management-relevant questions related to hydrology, water quality, habitat, wildlife, and ecosystem management?

Yes: Overall, this appendix presents an excellent strategic research plan. I found the writing extremely helpful in understanding some of the underlying logic for various SFER chapters.

2. *Given that the Everglades Division does research across a very broad landscape, at multiple scales, what is the best way to integrate the spatial and temporal dynamics of these projects?*

The basic strength of this plan lies in the increasingly well-developed modeling approaches that continue to be built and refined based upon empirical datasets that are strengthening over time. Modeling specialists in ecological endeavors typically are frustrated because they are often consulted after research and monitoring studies are designed – often, after such projects are finished. Here, in contrast and as an ongoing effort, the District is focusing on conceptual, hydrologic, and mechanistic models to identify the most important information that should be obtained in order to evaluate progress in restoration efforts. The District should continue to emphasize and to increase emphasis on the use of these carefully constructed, constantly improved-upon models to integrate the spatial and temporal dynamics of its Everglades projects.

3. *Is the research strategy a logical progression from previous studies and will it provide projects that are relevant to management decisions?*

Yes: This Plan clearly builds from previous work, and clearly conveys why the planned projects are highly relevant to its management decisions in efforts to restore the Everglades.

4. *What important ecological and management issues are not addressed in this Strategic Research Plan?*

In the Florida Bay algal blooms component, sampling, research and modeling efforts should go beyond chlorophyll a to consider the responses of dominant bloom species and functional groups of phytoplankton, and the responses of known noxious macroalgal species.

Response #88:

- Other agencies (FWRI) document algal bloom taxonomic composition. The recent eastern blooms have been present since Fall 2005. Central area blooms have been coming and going since 1992 (see Chapter 12).
- As part of seagrass monitoring (District funded), bay bottom cover (an index) by macroalgal species or major taxonomic groups is recorded.
- For algal bloom mapping, Everglades Division scientists (led by Dr. Madden) are now adding fluorometric probes for phycoerythrin and phycocyanin for cyanobacteria ("blue-green algae") to the Dataflow system, which already has a chlorophyll a fluorometric probe.
- Functional group dynamics to be modeled (within the SAV model) in collaboration with P. Glibert & C. Heil, who measure growth and grazing.

Comment #89: *There is also a critical need to include consideration of exotic species in the Food Web and Florida Bay-Everglades Linkages Sections.*

Response #89: Invasive species are being surveyed and studied by a variety of State and Federal agency. The Everglades Division does not have the resources to manage a large scale program such as this. However, small scale studies of the effects of invasive vegetation are planned and include (1) surveys of *Lygodium* on tree islands, (2) *lygodium* physiology, and (3) community responses to Accelerated Recovery. Small-scale exotic fish studies, not mentioned in the Plan but associated with the wading bird studies, include; (1) an FAU collaboration to determine current exotic fish distributions in the ridge & slough landscape, and (2) a USGS collaboration to assess the physiological tolerance of selected species.

Comment #90: *It is astonishing that ecosystem valuation techniques have never been applied to the Everglades (lines 2304-2305). The Ecological Valuation section of the Plan is not mandated or listed as a restoration need, but the District deserves major credit for including it – this is an exciting section, and the work that it describes is critical, very much needed as part of the process to guide restoration efforts and to help the general citizenry understand them.*

Response #90: It will take many years of research to evaluate the techniques that are most applicable to the District's triumvirate of masters (Water Supply, Flood Control and Environ. Restoration)

Comment #91: *Integration. The Plan explains that research project linkages with each other are not shown in a conceptual diagram because it would "look like spaghetti"…Nevertheless, it acknowledges that such a diagram would be useful in revealing strong linkages, dependencies, and critical paths (line 139). A nice example of an integrative diagram is shown in Figure 6A-3; it would be helpful to include such diagrams for the other sections.*

The Florida Bay effort also provides a strong illustration of project integration, planned through several levels of numerical analysis including calculations of improved nutrient budgets, statistical analyses/models of monitoring/Dataflow data, mass balance modeling, and dynamic water quality modeling. In the seagrass component, the approach to understand interactions of freshwater flow, salinity, water quality, and seagrass dynamics is planned to integrate modeling, fieldwork and laboratory research including a strong set of mesocosm studies to measure nutrient uptake and kinetic parameters of seagrasses under different inter-specific competition treatments, strengthened by field verification studies to "ground-truth" the data.

Impediments to progress in managing the South Florida water supply network in a holistic, integrative manner are very nicely explained, as are strategies for surmounting these impediments (lines 1436-1455). The Plan recognizes the need for projects that examine not only direct effects of management actions, but indirect effects, feedback loops, and habitat stability (lines 2269-2270).

The value of Table 6A-1 cannot be overstated – this table provides an excellent overview of the Plan, including linkages of each project with scientific needs of CERP and with State and Federal regulations and policies. The Plan is organized, in part, around a set of clearly defined hypotheses that guides the research of each major section. The Application of Results sections are also well conceived and clearly presented.

Technical Review. This document was, in general, a pleasure to read – it clearly explained the logic underlying the various projects presented in Chapter 6, the hypotheses, and even provided clear definitions (e.g. "secretive" marsh birds, lines 231-233).

The methodological approaches generally were also clearly presented and combined both traditional/ foundational and innovative new techniques (e.g. for wading birds, compiled nesting data, systematic reconnaissance flights, and development of a bioacoustics library and network – lines 247-258).

Florida Bay and Bay-Everglades Linkages – overall, this component of the Strategic Plan is excellent and well-conceived. Planned monitoring, research and modeling efforts should also include consideration of dominant bloom-forming algal species (microalgal and macroalgal), as well as exotic species.

Response #91: See Above.

Comment #92: *Rationale and application – Performance measures (CERP RECOVER) have targeted the spatial expansion of the valued ecosystem component (VEC), "transition zone" SAV (e.g. Ruppia maritima, Halodule wrightii, with concomitant reduction in Thalassia testudinum), in the northern third Florida Bay. Yet, little is actually known about the forage and refuge functions of transition zone plants as a habitat mosaic for fish and other fauna. Planned projects are designed to fill this knowledge gap, and to assess whether the transition zone SAV habitat has unique benefits for fish that cannot be provided by mangrove prop roots – an important question since SAV has declined while mangrove cover has increased.*

Methodological approach – An appropriate multi-phase approach involving analysis of long-term field data (10-15 yr thus far) and targeted experiments is planned to examine underlying mechanisms for forage fish distribution and habitat structure in dominant vegetation types of the transition zone.

The Ecosystem Processes section describes integration of monitoring, research, and modeling to improve understanding about functional linkages between the Everglades watershed and Florida *Bay. Two sets of hypotheses, #11 (Florida Bay water quality hypotheses) and #12 (Florida Bay submersed aquatic vegetation). Of these, hypothesis #12c would be helped by further explanation.*

Response #92: The hypothesis is verbatim from the RECOVER Monitoring and Assessment Plan. We will slightly edit/add to the hypothesis to improve the clarity of this turbidity hypothesis…

Numerical modeling, largely through CERP's Florida Bay and Florida Keys Feasibility Study (FBFKFS), is being used as a tool for information synthesis and forecasting responses of Florida Bay to water management activities, especially focusing on (1) salinity magnitude, spatial and temporal variability; (2) estuarine hydrodynamics, especially water residence time; (3) nutrient loadings and other pollutants; (4) structure and productivity of SAV habitat and associated fauna, especially fish. The modeling efforts are impressive continue to strengthen. This effort includes development of a suite of large-scale dynamic numerical models to guide restoration of more natural and historical flows to the bay. An identified key constraint is that the changes in hydrology imposed by restoration must not further degrade water quality in the bay or the Keys coral reef areas. The suite of models being integrated includes:

- *Watershed models* – USGS' TIME, Tides and Inflows in the Mangrove Ecotone; a wetland hydrologic model to estimate freshwater flows; and mangrove zone models to estimate nutrient inputs to the bay);
- *Ocean boundary hydrodynamic model* (HYCOM – Hybrid Coordinate Ocean Model, to provide ocean boundary conditions);
- *Bay integrated hydrodynamic and water quality models* (the EFDC – Environmental Fluid Dynamics Code, central to the entire modeling effort; includes consideration of biogeochemical

processes such as nutrient uptake and transformation, nutrient sequestration, and primary production); and

 Bay biological models – for example, the evolving Florida Bay seagrass community module developed by the District is to be incorporated into an EFDC model. Also planned for integration into the EFDC model are a phytoplankton simulation module and higher trophic level models for critical species (e.g. pink shrimp).

This ongoing and planned effort aims to synthesize the knowledge base and datasets on the Florida Bay ecosystem to enable assessment of the effects of hydrologic changes from management practices.

Florida Bay Algal Blooms. The Plan frankly acknowledges widespread public concerns about water management effects on Florida Bay water quality that need to be clearly addressed through project modification to improve water quality and prevent degradation, and/or through providing quantitative analyses that provide strong scientific basis to refute the concerns. One major concern and critical uncertainty identified in the Plan is that increased freshwater flows to the bay will concomitantly increase nutrient loadings (especially N and P species), stimulating undesirable algal blooms. The overall objective of planned projects is to quantify the status and trends of nutrient inputs to the bay, and general water quality conditions in the bay, targeting performance measures as nutrient loading and chlorophyll *a* concentrations (indicator of phytoplankton biomass). Projects to address this objective will involve a combination of long-term monitoring (in place planned for strengthening?), research, and quantitative synthesis through modeling. The monitoring and research is planned to include (1) nutrient loading to the southern wetlands from canals, (2) N and P transformation, retention and transport through the southern marshes to the bay, as influenced by hydrologic changes, and (3) nutrient cycling within the bay. An important targeted area for emphasis is nutrient retention/transport studies in Whitewater Bay, which is expected to receive much more freshwater flow through hydrologic management. Research on phytoplankton dynamics and light extinction will also include landscape-scale analysis of water quality monitoring network data, and experiments about research processes that influence both phytoplankton and benthic algal production/ productivity (e.g. the role of various forms of dissolved organic matter).

Seagrass and Ecosystem Studies. The Florida Bay seagrass community is the central, keystone component of the ecosystem, and the central performance measure under CERP. Innovative fine-scale mapping and geostatistical analyses of seagrass meadows are planned including use of Dataflow, with emphasis on mapping gradients from the mangrove transition zone. Hydroacoustic or side-scan sonar methods for continuous seagrass mapping will also be examined. Mesocosm studies will be conducted to assess seagrass nutritional ecology and competitive species interactions. An evolving mechanistic, process-based simulation model (calibrated for a baseline period of 1996-2001) is being developed to predict seagrass dynamics (*Thalassia testudinum, Halodule wrightii; Ruppia maritima* to be added within 10 yr) in response to management-imposed hydrologic and salinity changes in the northern and central bay.

Response #92a: [text above] Updated in document.

Comment(s) #93 (Editorial):

Lines 286-288 – omit; stated below.

Line 364…how specific…

Line 462…were known to…

Line 479…of Typha domingensis…

Line 493…The Fire Project focuses…

Line 543…rapid way to…

Lines 579-580 …in Newman et al. (2006).

Line 584 - …intensive restoration

Line 601 - …Approach: CHIP will…

Lines 616-626 – The same hypothesis is addressed for Objectives 1-2; these should be combined.

Line 660 - …The Fire Project

Line 883 - …(e.g., denitrification…

Line 890 - …will be influenced by…

Line 895 – correctly states "submersed" for SAV – should be changed from submerged to submersed throughout the document.

Line 1077 – Is there an improved method since White et al. (1979)?

Lines 1084-1085 – Additional explanation would help here; as is, seems somewhat "far-fetched".

Line 1144 - …is leading this ambitious

Line 1172-1173 - …effects from other…

Line 1233 - …transects include…

Line 1241 - …Bay is also…

Line 1245 - …where groundwater nutrient

Line 1319 - Implications of…

Line 1342 - …capability so that we

Line 1353 - T. testudinum and…

Line 2112 -…but little progress…

Line 2137-…species have often…

Robert C. Ward ('B' Review)

Comment #94: "*Given that the District is a water management agency, does the research plan represent a good strategy for addressing key scientific and management-relevant questions related to hydrology, water quality, habitat, wildlife, and ecosystem management?"*

The research plan provides a good roadmap for research. However, given management needs for new knowledge, the plan should provide more insight into how it will integrate research products with future management decision making. The organization chart for the Everglades Division is appreciated, as it is difficult to grasp exactly who, from where, are producing the SFER documents. Having also reviewed Chapter 12 and scanned Appendix 12-1, I would also like to see the organization chart above the Everglades Division. I do not understand how the research divisions are connected to the larger SFWMD. Given the nature of this special review question, I need to have a better feel for how research is, organizationally, placed among the key water management decision making groups.

Response #94: This will be politically and conceptually very difficult because:

- Not everyone will agree on who are the specific Decision Maker's
- Some projects (e.g., veg mapping) can have numerous Decision Maker's.
- The Decision Maker's process is difficult to track because it is so dynamic and variable.

We need more time to think about this recommendation. We would like to explore the development of a Decision Making Network Diagram as part of the introduction to the Strategic Plan. This would shows conceptually (and maybe idealistically) how science is part of the Decision Maker's process. A simple version of this was developed for CERP and RECOVER.

Comment #95: *Thus, I would like to see more detail in the science plan on how the researchers will connect research, in all its phases, with management decision making. As I noted in my review of Chapter 12, based on 14 years of directing a highly applied water research institute, I*

recommend that those who make water management decisions be engaged in all facets of the research, from planning, through conduct, to reporting, and, ultimately, to using the new knowledge to modify, if necessary, decision making procedures. Preparation of the science plan in Appendix 6-1 is an excellent first step in this process. Are the appropriate decision makers providing written reviews of the plan? Will decision makers serve on the research project staff in an active advisory manner? Will emerging science/research questions be examined by decision makers? Will decision makers be able to provide their own questions as the research unfolds? Positive answers to all the above questions sets the stage for decision makers to have comfort with the research findings and comfort with using the new knowledge in their work.

Response #95: A description of the process that uses science results for decision making was not a goal of this strategic plan. Our goal was to paint a broad set of projects that in the short-term and long-term can be used by water managers and the public to assess and evaluate the current and future status of the Everglades. This does not mean that our information will be used. We feel that the most appropriate place for this discussion is in the CERP chapter under the description of the Adaptive Mangement program. This 4-step program is best suited to address these important issues.

Comment #96: *However, I want to also throw in caution and think the best way to do this is to relate an experience I had several years ago at a meeting of the National Institutes for Water Resources in Washington, D.C. The Department of Interior's Assistant Secretary for Water and Science was addressing the group and noted that he accesses four categories of information, in equal amounts, as he prepares to make a management decision: (1) Science; (2), History behind the issue; (3) Applicable laws; and (4) The politics surrounding the issue. I would suggest that most high level decision makers work with some similar model in assembling information for making policy level decisions. As decision making moves down an organizational chart, I would agree more with the quote in lines 50-52 in Appendix 6-1: "Environmental science provides much of the basis for defining and deciding the nature of this balance and effectively improving management for each of these often competing missions."*

Thus, as an organization, such as the SFWMD, strives 'to get the water right' (line 69) many factors must be considered, one of which is 'what does the research say?' In order for science to be effective in its role in informing decision making at all levels of a water management district, the science plan must include much more insight into how science and management will be integrated to achieve the SFWMD mission, stated in lines 48-50. It would be helpful for the science plan to indicate it understands management decision making with more elaboration on guiding mandates, rules, and permits. These are mentioned, but they are not examined for detailed guidance.

After some mention of mandates (Table 6A-1), the science plan is rather silent on how research will interface with decision makers. [To be honest, the plan is brief on all details which helps with my review!] The subtitle selection under each project description is heavily science oriented. The subtitle 'Application of Results' is too general to fully explain the connection between decision makers and researchers. Given the importance of this connection, the connection needs to be better understood. For example, lines 266-268 state that the results 'will be used by' CERP to shape hydrologic targets. How will the results be used? Is there a reference that could be cited here? Will the researchers be involved in the shaping? Or will only their science be considered by the decision makers? What is the connection, at the point of use, between the researcher and decision maker?

One recommendation I would suggest that a new subtitle be added to each project description in the plan: "Decision Maker Involvement'. A first task in the section would be to identify relevant decision makers. Also, in this section connections/dialogue between researchers and decision makers, over the entire course of the research, will be defined - from the initial formulation of the research, through proposal writing and peer review, through the actual conduct of the research (where updates and emerging questions are addressed in, for example, monthly meetings), through presentation and use of the results.

Response #96: A description of the process that uses science results for decision making was not a goal of this strategic plan. Our goal was to paint a broad set of projects that in the short-term and long-term can be used by water managers and the public to assess and evaluate the current and future status of the Everglades. This does not mean that our information will be used. We feel

that the most appropriate place for this discussion is in the CERP chapter under the description of the Adaptive Mangement program. This 4-step program is best suited to address these important issues.

Comment #97: *A context for research/decision maker dialogue is provided in lines 68-72:*

Virtually all District projects regarding Everglades management strive to "get the water right" in terms of quantity, timing, distribution, and quality and this Plan describes how we intend to relate these hydrologic and water quality drivers (including their variability and their interactions) to the ecological condition and trajectory of the Everglades ecosystem."

The process of doing what the sentence says is not well defined in the plan.

I should point out that not all decision makers and ecosystem researchers are able to work closely together, in a collaborative and constructive manner, to speedily bring the results of research to application. In my work, generally, one third of researchers were equipped to work well with water managers. The others simply were too focused on the details of their research to be concerned about its application. I did not view this as a negative – these researchers often made the best discoveries. It does, however, put more pressure on the research and operations directors to pay close attention to who is asked to take on the critically important role of strongly connecting research and water operations.

Response #97: This will be politically and conceptually very difficult because:

- Not everyone will agree on who are the specific Decision Maker's
- Some projects (e.g., veg mapping) can have numerous Decision Maker's.
- The Decision Maker's process is difficult to track because it is so dynamic and variable.

We need more time to think about this recommendation. We would like to explore the development of a Decision Making Network Diagram as part of the introduction to the Strategic Plan. This would shows conceptually (and maybe idealistically) how science is part of the Decision Maker's process. A simple version of this was developed for CERP and RECOVER.

A description of the process that uses science results for decision making was not a goal of this strategic plan. Our goal was to paint a broad set of projects that in the short-term and long-term can be used by water managers and the public to assess and evaluate the current and future status of the Everglades. This does not mean that our information will be used. We feel that the most appropriate place for this discussion is in the CERP chapter under the description of the Adaptive Mangement program. This 4-step program is best suited to address these important issues.

Comment #98:*"Given that the Everglades Division does research across a very broad landscape, at multiple scales, what is the best way to integrate the spatial and temporal dynamics of these projects?"*

The issue raised by this question is addressed on lines 183-188 in the plan:

"The complexities of understanding wildlife ecology in an Everglades restoration context—multiple temporal and spatial scales, non-linear ecosystem attributes, numerous components—necessitates a transdisciplinary approach that encompasses studies at multiple levels of the food web over various spatial and temporal scales. The studies will variously utilize observational, experimental, and modeling approaches. A synthesis of this information will help guide restoration and operational decisions.

However, it is not clear how the synthesis will occur; nor, how it will interface with restoration and operational decisions taken by management.

The answer to the next special review question suggests that the previous-research review contained in each project description is too short to judge the progression of planned research from previous studies. Rather than add a research review to each project's description, an integrated review of past research at the beginning of the plan could assist readers in integrating

past and planned research across the landscape and over time, as well as across disciplines. Such an integrated overview of research status could also include connections with decisions mandated by the laws, permits, and rules. I believe similar types of Everglades research reviews have appeared in previous SFERs, thus an update for the plan should not be too difficult. The difficult part will be summarizing the research so it will be read (i.e. short and to the point) and adding meaningful and specific management connections.

Response #98: A review of past research is an excellent idea.

Comment #99: *Table 6A-1 lists an array of projects by title under major research themes. Mandates are associated with each project as are hypotheses. The project descriptions provide insight to scales, but the project-by-project comments make it difficult to see how the entire science plan integrates across the broad South Florida landscape.*

Response #99: The broad south FL landscape is not within the domain of the Everglades Division funding source and mandates. Our plan was only focused on the Greater Everglades landscape. However, we agree that this is a good idea because it would demonstrate the large-scale connectivity of the ecosystem services that we propose to examine.

Dr. Burger requested that this Plan be modified to show how each of the studies within a section are related to each other and the hypotheses This is very similar to what is being requested here and we hope that, without creating a complex conceptual model of all research attributes, we can address this issue by adding a paragraph to the introduction to each section..

Comment #100: *"Is the research strategy a logical progression from previous studies and will it provide projects that are relevant to management decisions?" Without a literature review of previous research, it is hard to answer this question. The project summaries are very brief and literature citations few. It is hard to context the research plan based on the plan itself. The reader would need to know, personally, more about past research than I do to provide an answer.*

Response #100: We have been writing this annual report for 10 years and the body of literature created and referenced is very extensive. We did not want to duplicate previous SFER information. However, if we want this Appendix to be a stand-alone document, then this is an important recommendation. Therefore, for now, we will make a concerted effort to add more citations. And, for future modifications to this document, we will add more background information.

Comment #101: *"What important ecological and management issues are not addressed in this Strategic Plan?" As noted in the answer to special review question number one, lack of strong connections to decision makers is a key issue that needs addressing in the science plan.*

The science plan talks about identifying flows that protect ecosystem health. How will the flows be expressed. If in the form of something like monthly averages, how do decision makers handle extreme hydrologic events, when flows to protect the ecosystem are presented as averages?Is there guidance regarding flows during extreme events that could be provided? This is an example of where dialogue among researchers and decision makers could work through the decisions to be made and develop a research plan to benefits operations in a direct manner.

Response #101: See answer above – plus it should be noted: The needs of the engineers are understood by the scientist and vice versa, at our weekly Operations Dialogue Meetings. To some degree, here is where the relevance of the science is tested and the need for new science is invented.

As other reviewers have noted, we have made the decision not to make mercury and exotics major components of our strategic plan.

Additional Comments and Questions:

Comment #102: *Lines 229-230 note that experts agree that causes for declines in avian population are related to hydrologic changes, but no references are cited. Is it just hydrologic*

changes that cause the decline? What about loss of land (habitat size) to human occupation? Has the loss of avian population caused by habitat loss been quantified?

Response #102: This request for more background information is reasonable and we will comply.

Comment #103: *What is the relationship of this science plan to the science plans associated with CERP and RECOVER. I note the use of CERP/RECOVER hypotheses in this plan, thus there is a strong connection. Lines 102-115 and lines 125-127 discuss CERP/RECOVER, but the exact nature of the connection is not explained. There is a concern of duplication that should be addressed somewhere in the plan.*

Response #103: There is no duplication because RECOVER is the funding element for much of what we have discussed in this strategic plan. The connection with RECOVER is through the development and understanding of Performance Measures.

Comment #104: *Lines 121-124 asked that the plan be reviewed as an outline. No reference is provided as to where one could go for more detail. Some research project descriptions provide references, but not all.*

Response #104: More References will be added.

Comment #105: *With the Coastal Ecosystems Division and the Everglades Division both developing science plans, is there a larger initiative in the SFWMD to develop a District-wide science plan? How do the individual science plans relate to one another?*

Response #105: Division scientists meet on a regular basis to discuss methodologies and they also review each other's manuscripts. Discussions of science needs are aired during our weekly Operations Dialogues.

Comment #106: *The ecological valuation project described at the end of the science plan may offer an opportunity to address many of the issues raised in this review. What type of water flow and level decisions have to be made under what conditions? Can these decisions be related to ecological value? A prorated scaling of decision options could be developed and used to formulate policy regarding the trade offs between human and ecosystem needs. This is an exciting new avenue of research, as is stated in the report.*

Response #106: Thanks.

Van Donk

General Comment: *This Appendix explains clearly the various projects presented in Chapter 6. It is good readable and also the methodological approaches are clearly presented and include innovative new techniques.*

Comment #107: *Line 1262- Are there data available how long algal blooms are already present in Florida Bay.*

Response #107: The recent eastern blooms have been present since Fall 2005. Central area blooms have been coming and going since 1992 (see Chapter 12).

Comment #108: *Line 1316- The planned mesocosm studies are not very clear described.*

Response #108: These mesocosm studies have not yet been fully designed.

Comment #109: *Line 2009: Are the water tolerant woody species in the tree islands non-indigenous species?*

Response #109: No, the water tolerant woody species are indigenous; however, due to the increase in hydro-period these water tolerant species have replaced the less water tolerant woody species; therefore, reducing the woody tree species diversity.

RESPONSES TO COMMENTS ON APPENDIX 12-1

Coastal Ecosystems Division

Subject: Response to Comments - DOERING
Document posted as: Appendix 12-1 Written responses to Comments.doc
Originally Posted: 02 Oct 2007 05:13 PM

Neal E. Armstrong

Comment #1*: The Panel was asked to address the questions posed for primarily Integrative, secondarily Technical, and three specific questions in its review of this Appendix.*

"Are large programs presented so that the overall goals are clear and linked systematically to descriptions across the Report?" As noted in the reviews of Chapters 2 and 12, hydrology and coastal systems are indeed linked, but there is little mention of the consequences of managerial decisions about releases of water to coastal systems in either chapter. This is a significant gap as the interrelationships between water management in the watershed and management of the coastal systems are strongly related.

"Is the chapter cross referenced in a thorough and consistent manner?" This appendix is cross referenced thoroughly in Chapter 12.

"Are the findings and conclusions supported by "best available information," or are there gaps or flaws in the information presented in the document?" The coastal system approach adopted by the District is limited in its scope and represents only partially estuarine management approaches that have been developed for estuaries elsewhere. This point is addressed in the text below.

Response #1: See responses below.

Comment #2: *"Are there other interpretations of the data and other available information that should be considered by the authors and presented to decision makers? If so, panel shall identify specific studies that should be addressed or available data to support alternative findings." The District's coastal system management approach is based primarily on freshwater inflow to the estuaries and salinity limits in those systems which are based on VECs (or key species). This approach does not include consideration of nutrients (organics, N, and P) carried with those inflows which are vital to the productivity of the systems. Specific estuarine management approaches that include nutrient loading and secondary productivity are presented in the text below.*

Response #2: Historically, as a water management agency, our work has centered on water quantity and salinity tolerances of estuarine organisms have been used to address this issue. The presentation of the Framework and the examples of its application reflect this past emphasis. We agree that the relationship between the flux of nutrients driven by freshwater inflow and estuarine primary and secondary production is not sufficiently emphasized and we will revise accordingly.

There are two sides to the nutrient loading issue in estuaries. Nutrients are undesirable pollutants that cause eutrophication and the many attendant ill-effects. This view contrasts with the agricultural paradigm or the notion that nutrients carried by freshwater sustains estuarine productivity and larger inflows of freshwater lead to higher yields of desirable species. In practice we need to understand the relationship between the nutrient loads required to meet TMDLs, loads required to maintain estuarine productivity and inflows required to meet salinity criteria.

Comment #3: *"Is the research strategy proposed by the Coastal Ecosystems Division scientifically sound and consistent with the state of the art in coastal science?" The Districts approach to estuarine management is partially consistent with the state of the art in coastal science for reasons noted above. It is anticipated that through adaptive management, the District will adopt more robust management approaches and utilize more fully the data being gathered through the studies being conducted in the estuaries. Again, see the text below for more detail.*

"Given that the District is a water management agency, is this a good strategy for addressing water quality, water quantity, and habitat problems that may be related to water management or are there better alternatives?" The basis approach is sound; it could just be improved with consideration of more aspects of the structure and function of estuarine systems.

"If this is a reasonable strategy, how could the strategy or its application be improved?"

As noted above, the District's coastal system management approach is based primarily on freshwater inflow to the estuaries and salinity limits in those systems which are based on VECs (or key species). This approach does not include consideration of nutrients (organics, N, and P) carried with those inflows which are vital to the productivity of the systems. Specific estuarine management approaches that include nutrient loading and secondary productivity are presented in the text below.

Response #3: See previous response.

Comment #4: *Note: Because of the strong relevance of this Appendix to Chapter 12: Management and Restoration of Coastal Ecosystems, the material presented below is also contained in the comments offered for Chapter 12.In developing the Coastal Ecosystems Division Science Plan, the Coastal Ecosystems Program (CEP) has constructed an approach for coastal ecosystem management that is basically sound as a solid starting point for managing the coastal ecosystems, the waters that flow to them, and their watersheds, but it is incomplete. While the Plan is not necessarily unique, for it embodies approaches taken by water regulatory agencies in other states since at least the 1950s in which water resources are often scarce and in which the coastal ecosystems support commercially important finfish and shellfish and their associated support structure, the Plan is a integration of science, engineering, and management within the District and perhaps most importantly it begins to elevate the value of freshwater inflows (and their needed spatial and temporal variability) to Florida's southern estuaries to a level commiserate with municipal, industrial, and agricultural water supply.*

One can quibble with Alber's (2002) overly simplistic conceptual model for freshwater inflow impacts on estuaries derived from her literature review (see Figure 2 of Appendix 12-1) or the classification of watershed, hydrologic, water quality, and ecological models presented in Table 1 of the same appendix. For example, Alber (2002) discusses in her article the transport and mass loading of organics and nutrients along with flows to estuaries, impacts of flow reduction such as salinity intrusion and alterations in circulation within and flushing from estuaries, alterations in geomorphology, impacts on species composition, abundance, and distribution due to tolerance limits, primary and secondary productivity supported by the flux of organics and nutrients to the estuaries, yet these important processes are not incorporated into her framework.

The District mentions many of these factors in its Plan and seems to recognize the importance of nutrient recycling of nutrients by adding "Processing of Material" to Alber's conceptual model diagram, but the implementation of the Plan in the coastal systems under its jurisdiction does not really deal with anything more than tolerance limits to salinity and the resulting effect on species distribution.

Response #4: This comment raises two important points. First, Alber's model is simple and could be revised to more explicitly include other variables such as nutrient loading, estuarine circulation and residence time, and impacts on species composition. These revisions would make it stronger scientifically. However, if the audience is largely non-scientific, its simplicity may be

regarded as one of its strengths. We may have to come up with two versions of this diagram, one for scientists and one for non-scientists.

The second point made is that implementation of the Plan in the coastal systems does not really deal with anything more than tolerance limits to salinity and the resulting effects on species distribution. Historically, as a water management agency, our work has centered on water quantity and salinity tolerances of estuarine organisms have been used to address this issue. As a Division, we have not done the same amount of work on nutrient loading, water quality and estuarine productivity. As District priorities stand now, these issues will be emphasized over the next few years.

While we are developing a water quality model for the St. Lucie, most of the work that we have done with water quality is statistical in nature. What may help in explaining the Framework is to include as an example an instance where we have used the linked model approach to address a nutrient issue. In the Caloosahatchee estuary, we have used a series of statistical relationships between chl *a* and light attenuation and chl *a* and nitrogen loading to estimate a nitrogen loading threshold and to set water quality chl *a* targets.

Comment #5: *With regard to Table 1, water quality modelers would include statistical models and simplified mass balance models in the simple models category. The steady state "box" model or continuously stirred reactor model as it is more commonly called, for example, would fit there, and Thomann's (1972) use of such a model for Hillsborough Bay in Tampa, FL illustrates their practical use. Finite segment, mass-balance, steady-state models would be classified as Intermediate models – they are not included in Table 1 but would be powerful tools useful in each one of the coastal systems the District manages. Thomann and Mueller (1987) describe their application to the Wicomico Estuary in Maryland (one dimensional), Boston Harbor (two dimensional), and Lake Erie (three dimensional).*

Response #5: Agreed. As a matter of fact, CED staff developed regression flow-salinity models using the simple steady state approach for long-term salinity prediction. This has been proved to be practical with applications in several of our estuaries. A similar attempt was made for TN and TP in the St. Lucie estuary based on annual loading rates. A cascade of CFSTRs (Continuous – Flow Stirred-Tank Reactors) model based on inflow concentration, residence time, and reaction rate, will be ideal for a river setting such as the Caloosahatchee River and the Northwest Fork of the Loxahatchee River. This approach will be extremely useful for long term simulations when the dominate water quality processes are understood.

Comment #6: *Likewise, the resource-based Valued Ecosystem Component approach is in fact the approach taken by state water regulatory agencies since the 1950's when commercially important finfish and shellfish were the focus of freshwater inflow management as "key species," expanded in the 1960s and 1970s to incorporate the food chains and habitats of these organisms and eventually nutrient cycling. The USEPA formalized it as the Valued Ecosystem Component approach in 1995 as part of the National Estuaries Program but adapted it from others who have originally proposed a similar name in the mid-1980s (from Alber 2002). Regardless of what name is applied to the concept, it is one that has been in play for half a century. But the point is that the District and its CEP has adopted the concept as part of its Integrated Modeling and Assessment Framework, and that is highly significant.*

As comprehensive as this Integrated Modeling and Assessment Framework is, the one concern with it is its strong focus on salinity as the primary indicator for management purposes of freshwater inflows on the estuaries within the District's boundaries. Yes, salinity is a strong indicator of the impact of freshwater inflows on estuaries and it is a major influence on the distribution of biota in estuaries due to their tolerance limits as noted above, but the flux of organic materials and nutrients to estuaries and their cycling within the estuaries governs system

productivity. For commercially important species, it is productivity or commercial yield from coastal systems that is most important.

What is largely missing from the Framework is the consideration of organics and nutrients.

Response #6: This issue has been addressed above.

Comment #7: *Armstrong (1982) developed relationships between the average fraction of freshwater in estuaries caused by freshwater inflows, nutrient areal loading rates, and secondary (key species of finfish and shellfish) productivity in Texas estuaries (see attached figure); these are relationships that could be and should be explored in the lower Florida estuaries.*

Response #7: Agreed.

Comment #8: *The heavy focus on salinity as the primary indicator of freshwater inflow and their influence on the distribution of VECs may have its roots in the outcome of the Estuarine Research Federation conference entitled "Freshwater Inflow: Science, policy, and management" held in St. Pete Beach, FL in November 2001. The Alber (2002) article was an outcome of that conference as was another article (Montagna, et al. 2002, which included a District co-author) which summarized the conference and spoke to the issues of estuarine management. They summarized the issue by saying that:*

An improved understanding of the functioning of estuarine systems has allowed for increased sophistication of freshwater inflow management techniques…These sophisticated biological and modeling approaches are very data intensive and a few simple principles may be sufficient for making water allocation decisions with competing demands are not extensive.

The nature of these decisions makes them amenable to using adaptive management, i.e., using the results of ongoing monitoring and assessment to modify and optimize the operating decisions. Because we are still learning about the properties of these systems, we must develop ways to improve out understanding on how the systems we manage function and about the process of adaptive management so that future capabilities can be improved.

The District's management objectives of (1) improving timing, volume, and delivery of fresh water, (2) improving operation of District infrastructure, (3) improving and protecting water quality, and (4) rehabilitating estuarine habitats as articulated in this Appendix are very good objectives, and it is presumed that over time the District will practice adaptive management and over time move beyond salinity as it primary indicator of the impacts of freshwater inflows to other indicators that are also water quality as well as biologically based such as food chains (phytoplankton and detrital), nutrient cycling, and primary and productivity.

References

Alber, Merryl. 2002. A conceptual model of estuarine freshwater inflow management. Estuaries 25:1246-1261.

Armstrong, Neal E. 1982. Responses of Texas Estuaries to Freshwater Inflows. In Estuarine Comparisons, Victor Kennedy (Ed.), 1982, Academic Press.

Montagna, Paul A., Merryl Alber, Peter Doering, and Michael S. Connor. 2002. Freshwater Inflow: Science, Policy, Management. Estuaries 25:1243-1245.

Thomann, Robert V. 1972. Systems Analysis and Water Quality Management. McGraw-Hill, New York.

Thomann, Robert V. and John A. Mueller. 1987. Principles of Surface Water Quality Modeling and Control. Harper & Row, Publishers, Inc.

Ward, George H. and Neal E. Armstrong. 1982. Matagorda Bay: A Management Plan. Submitted to National Coastal Ecosystem Team, Division of Biological Services, Fish and Wildlife Service, Slidell, LA, Contract No. 14-16-0009-78-066.

Figures

Influence of annual areal nutrient loading rates and average estuarine freshwater content (as influenced by freshwater inflow and tidal exchange) on average annual areal commercial catch yields of finfish and shellfish in Texas estuaries. The three figures are for carbon, nitrogen, and phosphorus, and within each figure lines connecting equal yield rates of finfish (solid lines) and shellfish (dashed lines) are drawn forming response surfaces. Each point in each figure represents one of the six major estuaries of Texas which lie in a freshwater inflow spectrum from very high inflow and small volume (Sabine estuary) to small inflow and large volume (Guadalupe estuary) and variations in between. With these figures one may estimate the change in yield (or secondary production) caused by changes in freshwater inflow and nutrient loading. Because freshwater inflow and nutrient loading are interrelated, one can examine combinations of flow change and nutrient concentration change on yield that occur to due changes in the watershed and/or changes in the estuarine system itself. In Ward and Armstrong (1982) several perturbations in Matagorda Bay, Texas were evaluated for their impacts on secondary productivity.

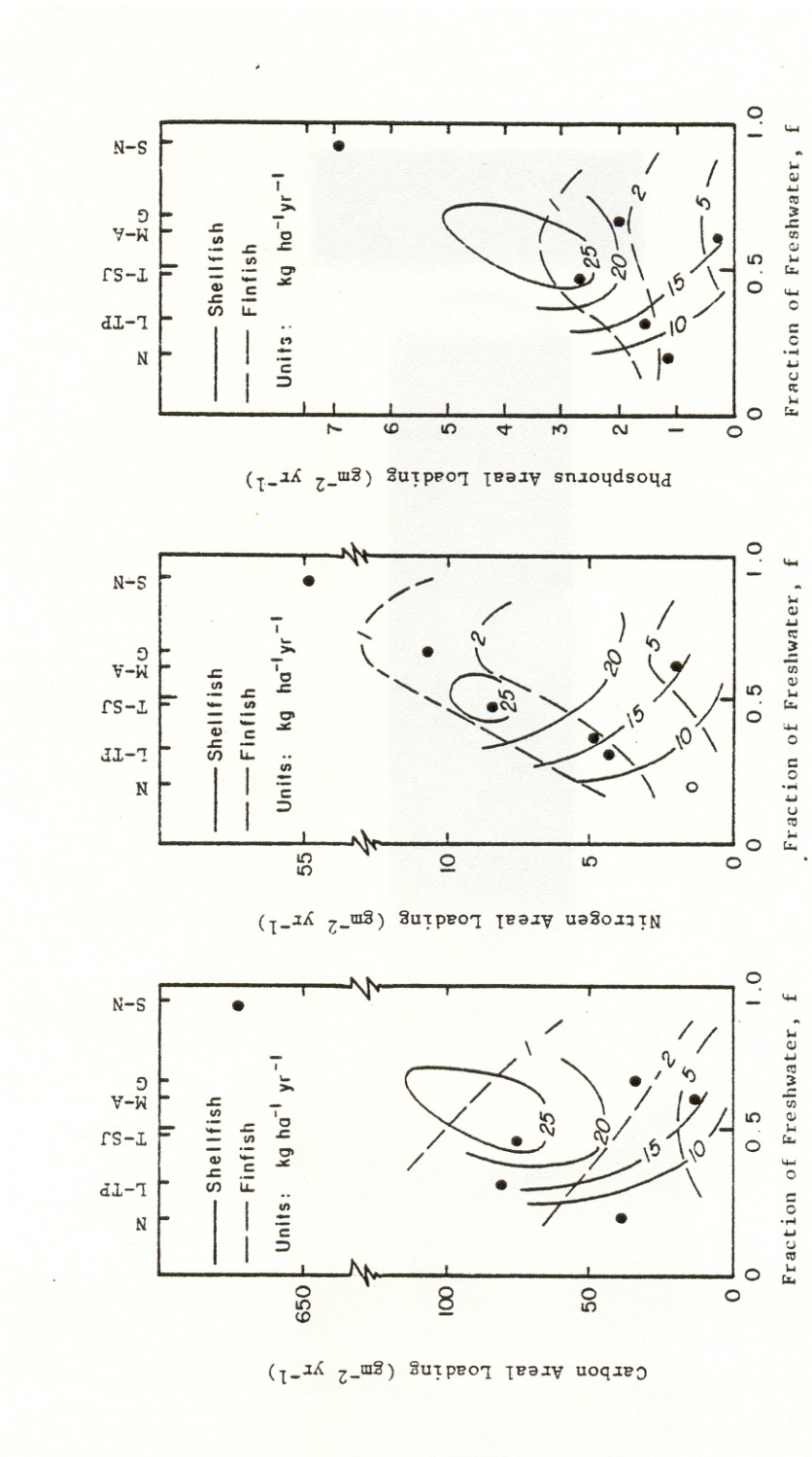


Figure 28. Influence of annual areal loading rates of nutrients and estuarine freshwater content on average annual areal yields of finfish and shellfish (Armstrong 1982). N-Nueces, L-TP-Lavaca-Tres Palacios, T-SJ-San Jacinto, M-A-Mission-Aransas, G-Guadalupe, S-N-Sabine Neches estuaries.

Robert C. Ward ('B' Review)

Comment #9: *Chapter 12 is an overview of the research activities of the Coastal Ecosystems Division (the term 'Program' was used in parts of the text). The Division seeks to provide insight and understanding of the connection between water for human needs (e.g. water supply and flood control) and the water needs for a healthy coastal ecosystem. This tension must be addressed if society is to move from the water resources 'development' orientation of the 20th century into a water 'sustainability' orientation for the 21st century. Chapter 12, along with Chapters 10 and 11, indicate that the SFWMD is on the forefront of connecting human needs with ecosystem needs and evolving a sustainability-oriented management infrastructure.*

The overview of management and research activities associated with restoring coastal ecosystems in South Florida, presented in Chapter 12, is readable and informative. The reader is left with a good understanding of the critical issues facing each coastal area as well as efforts of scientists and managers in addressing the issues.

In trying to understand connections among the staff producing Chapters 10, 11 and 12 (and Appendix 6-1), I searched the SFWMD webpage for an organizational chart. I was unable to download it. Given the stated need to connect research products with operational policy, there needs to be some indication in Chapter 12 of how the staff of each are organizationally related.

Chapter 12 and its research plan in Appendix 12-1, focuses on research and ecosystem understanding – their mission. At some point in the future, there is a need to integrate new ecosystem health and human water connections into management decision making, in an ongoing, routine, fashion. While the current coastal ecosystem knowledge base may not support strong integration, of a routine nature, it is time to begin to examine how the emerging coastal ecosystem health knowledge will become a part of the standard operating procedures in the Water Resources and Operations and Maintenance portions of the SFWMD. There are hints of such connections in Chapter 12, but they are not well developed. For example, on page 12-88, the 'stoplight' method for presenting SAV findings to managers and the public is discussed.

The Chapter could use more explanation of how its mission and research efforts are connected to the larger mandates of society and needs of a water management organization. To illustrate the vagueness of this connection, as presented at the beginning of Chapter 12, lines 42-47 contain the following terms:

1. *science activities*
2. *technical activities*
3. *freshwater flows*
4. *science strategies*
5. *restoration efforts*
6. *management efforts*
7. *Comprehensive Everglades Restoration Plan*
8. *operations and maintenance*
9. *water supply*

The exact meaning and connections of science and management, attempted to be explained in these lines, is not clear. Lines 47-49 clearly state:

"The Coastal Ecosystem Program's primary role is to provide the required information necessary to design effective restoration and protection measures for the estuaries, and inform decision makers.

I am willing to go even further with the above line of thinking and suggest, if it has not been done already, that there needs to be an operations person directly connected to, and/or serving on,

each research project's staff. It is not advisable to produce new ecosystem knowledge without having management actively involved in each step of the research itself. Why? As scientists seek new knowledge, their questions are framed around the needs of science. As new knowledge is presented to managers, they, generally, have a different set of questions that should also be incorporated into the research as it is being conducted. In this manner, when the final scientific findings are produced, most, if not all, of the water manager issues about the new knowledge will have been addressed. This greatly facilitates movement of research findings into practical application. [The above observations come from experience in directing a water and water-related research program that was designed to better inform the scientific basis for water management decisions in Colorado.]

Comment: The research plan presented in Appendix 12-1, acknowledges the need to connect legal mandates to management goals, to management objectives, and to mission element (in Figure 1). To incorporate a stronger bridge to future applications of the research findings, the plan should expand its discussion of Figure 1 to quote, directly, statements from the mandates to insure the details of the purpose of the coastal ecosystem research efforts are clear to everyone.

Response #9: Agree. Can revise accordingly.

Comment #10: *In addition, each research project description/update should indicate how the research is being connected, as it is being conducted, to its ultimate users – water management decision makers. Future research updates could then explain what issues are arising, among both scientists and water decision makers, regarding accommodating ecosystem health into water management decisions. In this way, implementation issues can, hopefully, be resolved as the new knowledge emerges and not after it is produced.*

Response #10: What processes lead to the successful integration of science and management? The two suggestions made here are good ones. Having a manager or operator on your science project team fosters communication. Furnishing a written update describing how managers and scientists are communicating about a given project reminds all involved that communication should be occurring. It also provides the opportunity make the necessary behavioral adjustments to ensure that meaningful communication continues.

The time scale for management decisions is often shorter than the time required to supply the "solid" scientific information required to inform the decision. Project schedules do not usually allow time for the science to "catch up". One solution to this temporal disjuncture is to conduct anticipatory research, so that good information is available when it is needed.

Comment(s) #11: *Line 36 – Average monthly flows are sought for management goals. These are helpful in managing water under average conditions. Are there guidelines under consideration to help decision making under natural hydrologic extremes, such as floods and droughts?*

Figure 12-4 presents the current year's data while Figure 12-3 presents data back to the year 2000. Could Figure 4's timeline be extended back in time?

Line 141 refers to Figure 12-4 as showing maximum inflows have not been exceeded, but it contains salinity data.

Line 322 indicates minimum flow target of 35 cfs. Figure 12-13, if I understand the data, shows minimum not maintained for long periods of time. As I read the text, the non-compliance is tolerated until future projects will solve the problem.

Not all coastal area research is being addressed/led by the SFWMD Coastal Ecosystems Division, e.g. the Lake Worth Lagoon. Is this the only coastal water body with another organization leading the effort?

From a strategic research planning point-of-view, why have minimum flows been developed for some coastal ecosystems, but not all (e.g. Lake Worth Lagoon and Biscayne Bay)?

Figure 12-20 has its axis labeling blocked out on my computer. Is this a problem with my computer or the text?

Joanna Burkholder

Comment #12: *What are District plans regarding the Florida Keys? (not found in Appendix 6-1 or Appendix 12-1)*

Response #12:

- Coastal's scientific effort is focused elsewhere: now Northern Everglades
- Ground water pilot study (with USGS, FIU) underway – potential link of Keys' nutrients to algal blooms
- Most science organized and implemented by FKNMS (NOAA and USEPA, but coordination with District)
- District funding local Keys storm-water improvement ($2.6M in FY08), water conservation, education

Comment #13: *In the generalized conceptual model (p.4), does sediment refer to bottom sediments? (sediment is particulate matter)*

Response #13: Alber's paper does not explicitly define each of the terms in this box of the conceptual model. Since sediment and particulate matter are descriptors of environmental conditions in estuaries, I would interpret sediment to mean bottom sediments.

Comment #14: *How much area has the District rehabilitated (p.10), by estuarine ecosystem, with mangrove plantings, construction of artificial oyster reef habitat, and trial SAV plantings?*

Response #14:

Estuarine System	Mangroves	Oyster Reefs	SAV Plantings
Caloosahatchee and	3.6 km of Shoreline	8	2 small scale experimental
Charlotte Harbor	2 Experimental Studies		1 pilot scheduled for 2008
Estero Bay		8	
Naples Bay		2	

Notes: Mangroves: 3.6 km of shoreline replanted , Clam Bayou, Sanibel Island 2004

1 experimental study testing different methods of planting

Shell Point: Restoration feasibility study, 2005 showed that restoration would fail without substantial hydrologic restoration.

Oyster Reefs: These vary in scale between 10 and 50 m^2

SAV Plantings: All involved *Vallisneria americana* in the upper Caloosahatchee Estuary

Small scale experiments had 1-2 m^2 plots.

The 2008 study will involve 5 sites each with 2 ($5m^2$) plots.

The District has also contributed funds to several mangrove projects on the upper east coast and to restoration of about 700 acres of wetlands near Biscayne Bay.

Comment #15: Contaminated sediments (heavy metals, other toxic substances) are identified as a major problem in the St. Lucie Estuary (pp.7-8). Yet, the St. Lucie plan mentions nothing about toxics in research, monitoring or modeling efforts. How will the Strategic Science Plan for the Coastal Estuaries address toxic substances in the St. Lucie and other affected coastal estuaries?

Response #15: The District does not monitor heavy metals or other toxins in marine or estuarine waters. The Coastal Ecosystems Division has funded universities and other agencies to conduct surveys in the past, but we have no ongoing programs. The CERP Indian River Lagoon South Plan calls for dredging of muck sediments from the St. Lucie.

Response to three questions

Comment #16: *Is the research strategy proposed by the Coastal Ecosystems Division (CED) scientifically sound and consistent with the state of the art in coastal science?*

Appendix 12-1 did not clearly describe strategic scientific plans (research strategies) to address the four major objectives that were the stated focus. The writing does demonstrate in-depth understanding of the "state of the art in coastal science", but conceptualization of clear plans for each coastal ecosystem need to be strengthened in the descriptions provided in Appendix 12-1.

Response #16: The Coastal Ecosystems Science Plan presents a "general research strategy, intended to achieve management objectives..." Regarding the individual plans: "These are not meant to be exhaustive or highly detailed, but only to provide some background and an outline of future direction. The water bodies will be ranked in accordance with the District's priorities and detailed plans will be developed over the next few years." Over the next year, the Coastal Ecosystems Division will produce strategic research plans for at least one system (St. Lucie or Caloosahatchee).

Comment #17: *Given that the District is a water management agency, is this a good strategy for addressing water quality, water quantity, and habitat problems that may be related to water management, or are there better alternatives?*

As indicated in the above response, a clear strategy for addressing the water quality, water quantity, and habitat problems for each coastal ecosystem seemed lacking. It was also difficult to determine timescales of the plans (e.g. Table 6, Timeline column).

Response #17: See response to 1 above [Response #16].

Comment #18: *If this is a reasonable strategy, how could the strategy or its application be improved?*

See above answers. The projects described are reasonable and valuable, but strategic planning is not clear. The Florida Bay plan (Appendix 6-1) provides a strong template that could be followed to clarify, strengthen, and/or develop strategic science plans for each coastal ecosystem in Appendix 12-1.

Response #18: We concur with the comment and endorse the importance of a strategic plan for each coastal water body. We have not gone through a strategic planning process for each water body.

General Comments

Comment #19: *Chapter 12 discusses eight prioritized estuaries, combining the Caloosahatchee and Southern Charlotte Harbor. Appendix 12-1 considers the nine estuaries and their watersheds separately. The overall identified stresses to the coastal estuaries are disruption of the natural magnitude and timing of freshwater input, increasing pollution (nutrients, bacteria, toxic substances, suspended sediment); and loss of critical estuarine habitat and biological communities.*

The stated major goal of this plan contributed by the District's Coastal Ecosystems Division (CED) is to manage, protect and rehabilitate coastal ecosystems. This plan describes a generalized applied research strategy to address four major management objectives (below). The plan's foundation is a [very] general conceptual model developed by Alber (2002), and use of a resource-based Valued Ecosystem Component approach (nicely explained on p.12) in combination with an Integrated Modeling and Resource Assessment Framework (including watershed models; estuarine hydrodynamic, sediment transport, and water quality models; and ecological models – p.11). The intent logically is to consider each coastal ecosystem and its watershed, i.e. watershed-scale management.

The benefit of using models that range from simple to complex are clearly conveyed (p.13), but it would be helpful to add, following Table 1, a new table providing examples of different levels of complexity of linked models to address estuarine water quality issues.

Response #19: Will do.

Comment #20: *The CED's intent is logically to apply models as an iterative, evolutionary process as available data increase, understanding is strengthened, and models are improved. Three clear examples are included which provide excellent illustrations of the application of this process (Caloosahatchee River and Estuarine MFL, Southern Indian River Lagoon Feasibility Study, Restoration Plan for the Northwest Fork of the Loxahatchee River).*

The second major part of this Appendix is divided into four (I suggest three) components:

Response #20: We will consider reorganizing.

Comment #21: Background. The background section demonstrates the CED's knowledge of "state-of-the-art" estuarine/coastal science. This section also provides the very general conceptual model used as an overall framework for the CED Science Plan. The authors clarify the important point out that while the conceptual model integrates science, it does not address temporal and spatial variability. The next section of this Appendix, "Summary of Coastal Ecosystem Models", has a helpful table of estuary and watershed models that the CED has applied in each coastal ecosystem that shows where (by coastal ecosystem) and how the CED has applied various models to date.

This section might better be included as the last subsection of the "Background" section.

Response #21: We will certainly consider this suggestion.

Comment #22: *Major Environmental Problems and Management Objectives. This section might be more appropriately retitled because it also summarizes approaches that have been taken or are planned to address the major objectives, as follows:*

Objective 1 – Improve freshwater quantity/timing – the plan relies upon CERP, Acceler8, and the Northern Everglades Protection Plan to construct new infrastructure that will partly restore more natural freshwater deliveries (p.7).

Objective 2 – Improve operation of District Infrastructure – Two identified components are provision of weekly input based on the status of the Caloosahatchee and St. Lucie estuaries (based mostly on best professional judgment), and application of science (evaluation of different discharge scenarios, development of improved predictive tools) to the operational rules and protocols of District infrastructure.

The Caloosahatchee and St. Lucie evidently were selected as the "marker" coastal ecosystems to address this objective because "larger projects" (line 388) are being built there.

Response #22: These were also selected because they are connected to Lake Okeechobee. Releases of water from the Lake to theses two estuaries are made routinely.

Comment #23: *Objective 3 – Improve and protect water quality – Appendix 12-1 describes little that has been done as of yet to address this important objective. Scientific studies have mostly focused on water quality status, trends, and pollutant loadings from the watersheds. More recently, nutrient inputs/cycling has begun to be emphasized, including development of acceptable levels (targets) and indicators. Additional Water quality models have also begun to be developed. These activities are building toward the ability to address this objective.*

Objective 4 – Rehabilitate estuarine habitats – Appendix 12-1 describes District efforts thus far to address this important objective as including funding of "on-the-ground" restoration efforts (mangrove plantings, construction of artificial oyster reef habitat, trial SAV plantings); assessing seagrass ability to repopulate habitats, and use of the Valued Ecosystem Component approach

(from the US EPA) to establish water quantity and water quality targets. The "on-the-ground" activities clearly are rehabilitation efforts; the latter two are needed to build toward the ability to rehabilitate.

It is difficult to evaluate, from the writing, the extent to which the District has been successful thus far in rehabilitating estuarine habitats.

Response #23: See response to question 1 above [Response #22]. Regionally, restoration or rehabilitation of habitat will occur through the hydrologic restoration projects proposed in CERP.

Comment #24: *Water Body Science Plans. This section unfortunately would more accurately be entitled, "Program Inventories and Some Planned Activities".*

The short introduction should clarify that Florida Bay is omitted here, providing brief rationale for its inclusion in Appendix 6-1.

Response #24: Will do.

Comment #25: *Much of the introductory writing for each coastal ecosystem is taken directly from Chapter 12, and should be omitted since the intent of this document is to provide a clear strategic science plan for each ecosystem.*

Response #25: Introductory writing was included to provide background in a stand alone document

Comment #26: *A brief history of District efforts and approaches is provided for each coastal ecosystem, providing helpful context. Each section generally also contains a description of historic and present water quality monitoring and modeling efforts, and past/present biological investigations and VEC evaluations. Each section ends with a list of planned activities for FY2008 or FY2008-9; for some ecosystems, [immediate] future information needs; and for some ecosystems, an inventory of present-into-near-future science programs.*

Comment #27: *Missing, though, is clear explanation of project and modeling integration.*

Response #27: We concur. This will occur during the strategic planning process.

Comment #28: *For example, in the St. Lucie sub-section, readers are directed to Table 6 for the science plan, only to find that Table 6 inventories current science programs; it does not present a strategic science plan to address the four major objectives identified for major focus. The sub-section for the Southern Indian River Lagoon presents no plan, even by title – rather, Table 7 is appropriately entitled, "recent investigations". Examination of this table indicates (last column) that the milestones addressed thus far help to address only Objective 1. No strategic plan is developed to chart a course for how the four objectives will be concretely addressed within a 5-year or 10-year timeframe. The plan for the Loxahatchee system is succinctly presented on p.45: it is designed to "establish and support monitoring programs which gather information on a structured, focused basis that provide information on water quantity, water quality, timing, and distribution of increased dry season flows and improved wet season flows. The writing indicates that the information gained (addressing only Objective 1 above) will be used to form the basis for addressing objective 2. Readers are referred to Table 8 for a summary of the science plan; again, they find only an inventory of projects. The project objectives are listed, but there is no indication of how the projects will be integrated into a science plan to address the four major objectives identified in this Appendix for each of the coastal ecosystems. Nor is there indication of what the priorities mean (effort planned? timeline?), except that 1 is the highest rating (footnote).*

Response #28: As stated before we have yet to go through a strategic planning effort for each water body.

Comment #29: *The "science plan" offered for the Lake Worth Lagoon is contained in several lines (lines 1524-1533), summarized by the first sentence therein – "The CED Science Plan for Lake Worth Lagoon currently anticipates a continuation of the existing level of effort". This is not a plan.*

Response #29: Agree. Palm Beach County has a Management Palm that is currently being updated and we are partnering in it. The North Palm Beach CERP Plan, when implemented will reduce flows to the central portion of the Lagoon. The District is working to implement these two plans. Revisions will better delineate planning activities in the Lagoon.

Comment #30: *It does not provide a roadmap of how/what efforts will be integrated to tangibly address the four objectives in order to improve this highly impacted, highly urbanized system. Table 9 in the Biscayne Bay subsection tellingly has blank space under every project for "District Strategic Milestones" that are targeted or achieved. The other coastal ecosystems, similarly, suffer from lack of presentation of a clear, strategic science plan that addresses and integrates the four overarching major objectives identified by Appendix 12-1 for all of the coastal ecosystems.*

Response #30: We concur. This will occur during the strategic planning process.

Overall Evaluation (integrative, technical)

Comment #31: *While the abbreviated technical information presented seems scientifically sound, this Appendix falls short of presenting clear, strategic, integrated science plans for each of the coastal ecosystems considered.*

Response #31: The intent of the Coastal Ecosystems Science Plan is to present a "general research strategy, intended to achieve management objectives..." The water bodies will be ranked in accordance with the District's priorities and detailed plans will be developed over the next few years."

Comment #32: *In Appendix 6-1, the Florida Bay strategic science plan (which should be mentioned in Appendix 12-1, although a small amount of overlap is included in the [incomplete?] coverage of Florida Bay in Table 2) is framed around several key hypotheses that guide the research. It includes an Application of Results section that is well conceived and clearly presented. It provides a strong illustration of project integration, planned through several levels of numerical analysis including calculations of improved nutrient budgets, statistical analyses/models of monitoring/Dataflow data, mass balance modeling, and dynamic water quality modeling. In the seagrass component, the approach to understand interactions of freshwater flow, salinity, water quality, and seagrass dynamics is planned to integrate modeling, fieldwork and laboratory research including a strong set of mesocosm studies to measure nutrient uptake and kinetic parameters of seagrasses under different inter-specific competition treatments, strengthened by field verification studies to "ground-truth" the data.*

It is recommended that the Florida Bay plan be considered as a model for developing plans for the other coastal ecosystems in Appendix 12-1.

Response #32: We will certainly consider using Florida Bay as a model.

Ellen van Donk

Comment #33: *I just wondered why have minimum flows not been developed for all the coastal estuaries?*

Comment #34: *What are the plans for research regarding monitoring of nutrients, toxins and the development of models?*

Comment #35: *Response to the three questions: "Is the research strategy proposed by the Coastal Ecosystems Division scientifically sound and consistent with the state of the art in coastal science?" I have the opinion that the research strategy proposed by the Coastal Ecosystems Division is only partially consistent with the state of the art in coastal science. The strategic scientific plans are not very clear described in this Appendix.*

Responses #33, 34 and 35: See responses to reviews by Armstrong and Burkholder

Comment #36: *"Given that the District is a water management agency, is this a good strategy for addressing water quality, water quantity, and habitat problems that may be related to water management or are there better alternatives?" The approach could be improved by including a clear strategy for addressing the water quality, water quantity, and habitat problems for the separate coastal ecosystems.*

Response #36: The Coastal Ecosystems Science Plan presents a "general research strategy, intended to achieve management objectives...". Regarding the individual plans: "These are not meant to be exhaustive or highly detailed, but only to provide some background and an outline of future direction. The water bodies will be ranked in accordance with the District's priorities and detailed plans will be developed over the next few years." Over the next year, the Coastal Ecosystems Division will produce strategic research plans for at least one system (St. Lucie or Caloosahatchee).

Comment #37: *"If this is a reasonable strategy, how could the strategy or its application be improved?" The District's coastal system management approach is based primarily on freshwater inflow to the estuaries and salinity limits in those systems. Also strategies for addressing nutrient loading and other water quality problems are necessary.*

Response #37: Historically, as a water management agency, our work has centered on water quantity and salinity tolerances of estuarine organisms have been used to address this issue. As a Division, we have not done the same amount of work on nutrient loading, water quality and estuarine productivity. As District priorities stand now, these issues will be emphasized over the next few years. While we are developing a water quality model for the St. Lucie, most of the work that we have done with water quality is statistical in nature. What may help in explaining the Framework is to include as an example an instance where we have used the linked model approach to address a nutrient issue. In the Caloosahatchee estuary, we have used a series of statistical relationships between chl *a* and light attenuation and chl *a* and nitrogen loading to estimate a nitrogen loading threshold and to set water quality chl *a* targets.