Appendix 1-3: *2005 South Florida Environmental Report* Authors' Responses to Comments

A panel of outside experts provided peer review of the *2005 South Florida Environmental Report* through WebBoard comments, participation in a three-day public workshop, and a written final report (Appendix 1-4). Authors revised their chapters and related appendices responsively. This appendix includes authors' responses to major comments in the panel's final report and WebBoard.[1]

With the exception of reformatting some information for better readability, the Chapter 1 appendices were not edited or spellchecked by the SFER production staff.

[1] On page 7 of the panel's final report, there are six general recommendations. These are all worthy of careful consideration and may be implemented during the development of the *2006 South Florida Environmental Report*. Several of these recommendations would require substantial resources and a reallocation of staff time. Evaluation by the District's senior management will be needed before any of these recommendations can be acted upon.

Chapter 2A: Responses to Peer Review Comments

PEER REVIEW PANEL COMMENTS

Comment: *Is the water quality assessment reported in Chapter 2 based only on data collected by the SFWMD, or were data from other monitoring programs included?*

Response: Only water quality data found within the SFWMD DBHYDRO and Everglades Research databases were used in Chapters 2A and 2C. Water quality data within these databases are collected primarily by District staff or contractors, following SFWMD standard operating procedures (SOPs). Additionally, Refuge or Park staff, in close coordination with the District, collected a portion of the water quality data reported for the Refuge and Everglades National Park.

Comment: *A number of times during the report (e.g. Page 2A-4 and 2C-4) the reader is referred to Germain (1998) for a description of the current SFWMD monitoring programs. The 2005 SFER suggests that a large number of new monitoring programs have come online since 1998. Is there a more current description of the monitoring programs?*

Response: The monitoring design described in Germain (1998) remains relevant for EPA ambient monitoring programs. Any updates, additions, or changes are described at the District's website (http://www.sfwmd.gov/org/ema/envmon/wqm).

Comment: *With the 2005 report including four major areas of South Florida, why doesn't Chapter 2A examine the status of water quality in all the four areas?*

Response: Monitoring and reporting requirements and mandates differ for each of the four areas. The 2005 SFER chapters were designed to meet the specific requirements for each area. Chapter 2A was written to fulfill a mandate in the Everglades Forever Act, which requires that the annual report "identify water quality parameters, in addition to phosphorus, which exceed state water quality standards or are causing or contributing to adverse impacts in the Everglades Protection Area." Future iterations of this report may include examinations of the status of water quality in other areas of South Florida using methods consistent with those developed for use in Chapter 2A; however, given the unique requirements for each area, the authors believe that the evaluation of the water quality status in each area should remain in its own separate sub-chapter.

Comment: *Were the data collected in a rather uniform manner across the water year? Or were there times when data were not collected, i.e., values missing for a portion of the water year? If there is not consistency in sampling frequencies over the water year, does this fact affect the accuracy of the compliance assessments? For example, if more samples were collected during the period of the year most vulnerable to compliance problems occur, the overall percent of excursions may by more an artifact of the monitoring design rather than the actual quality of the water.*

Response: Data are generally collected on a monthly or biweekly basis throughout the water year. There were no systematic data gaps. It is true that inconsistent sampling frequencies over a water year could bias the excursion analysis in the manner described. The primary objective of the excursion analysis procedure is to provide a synoptic review of water quality standards compliance on a regional scale. It is used to trigger further analysis, including an evaluation of potential monitoring design biases, particularly as these may relate to unbalanced spatial or temporal design.

Comment: *Is the data screening process the same from year to year, or is it modified each year during preparation of the SFER? If it is changed, is the total data record re-screened each year in assessing changes over time?*

Response: All data evaluated in Chapter 2A were screened using a consistent process. If future changes are made to the screening process, then the entire period of record will be re-screened.

Comment: *When there is insufficient data to apply the binomial hypothesis in a year, the excursions analysis is based on a five-year period of record. Is the comparison of excursions across areas (e.g., Refuge and WCA-2) and class (inflow and interior), when different time periods are used to support the calculations, sufficiently comparable for ranking severity of excursions?*

Response: Excursion analyses based on differing periods of record (one year versus five years) may not be fully comparable. This variation in analysis periods is a necessary concession because the chapter is using found data collected for more than one purpose. Ideally, the uncertainty introduced by the differences should be addressed through expanded monitoring. Furthermore, although the analysis provides a means of ranking the relative severity of excursions across areas, class, and time, it is primarily used to trigger further evaluation into the potential factors causing or contributing to the observed excursions.

Comment: *On Page 2A-14, "insufficient data" was noted as occurring when there are greater than or equal to 28 samples. This should be less than 28 samples.*

Response: The typo was corrected.

Comment: *Page 2A-15. The middle sentence in the first paragraph is unclear. Do you mean that all factors (conductivity, iron, pH, turbidity) had excursions every year, or only one of them did?*

Response: Only pH and conductivity had excursions every year. The sentence has been rewritten to clarify the point.

Comment: *Historically, the northern EPA was a soft water system but today alkalinity is a concern in the interior of Refuge, WCA-2, and WCA-3. What is the source of this alkalinity? Ground water? Sea water? Or both? Through what route does it enter into the system? Is it possible to use natural chemical signature, e.g., Ca++/SO-- Na+/Cl- ratios and conductivity, to trace the source(s) of the alkalinity? The information is quite important for estimating the relative contribution of rain in surface water and ultimately, the partition of P from rain and non-rain sources. The alkalinity then may be useful as a tracer to understand the hydrodynamics and spatial P distribution patterns in EPA units and structures.*

Response: Because of the rainfall-driven nature of the historical Everglades, low alkalinity was a natural condition of the northern portion of the Everglades system. The Refuge has continued to be rainfall driven because of its unique hydrology, which has maintained the naturally low

alkalinity levels in this portion of the system. In contrast, the alkalinity in other portions of the system (i.e., WCA-2 and WCA-3) have increased from pre-drainage levels, probably from the increased surface water inputs into these areas and groundwater intrusion into the canals that now deliver water to the northern Everglades. Although alkalinity in the Refuge interior has been identified as a concern in current and past reports because of excursions from the current water quality criteria ($\geq$ 20 mg/L), this parameter is not an ecological concern because the excursions are related to natural conditions.

Because of the high level of "management" of the system and the monitoring that is conducted at all inflows to the EPA, including rainfall inputs, the hydrodynamics, sources of phosphorus as well as other pollutants, and the spatial P distribution patterns within different portions of the EPA are generally well understood.

Comment: *The statement on P. 2A-23 said that "alkalinity and pH have close relationship." Fig. 2A-6, however, indicates that alkalinity and pH do not necessarily have a close relationship. In fact, alkalinity and pH could be quite independent of each other because dissolved CO2 has a great effect on pH but has completely no effect on alkalinity.*

Response: The sentence was revised to more accurately convey the idea that alkalinity has a regulatory effect (buffering) on pH.

Comment: *What are the implications of pH and alkalinity for some of the fish communities (and therefore colonial birds because of their prey base)?*

Response: The pH and alkalinity levels described in Chapter 2A are a natural condition of the Refuge. The fish and colonial bird communities evolved under these conditions and have adapted to these conditions and, from a regulatory perspective, the effects on these communities is not currently at issue. Note: FDEP rules preclude the abatement of natural conditions.

Comment: *What affects absorption of CO_2 from the atmosphere?*

Response: Carbon dioxide is highly soluble in water. Absorption of CO_2 from the atmosphere is affected by the partial pressure of the gas in the atmosphere and temperature.

Comment: *Are there currently any measures to limit the use of Atrazine in the EAA?*

Response: Atrazine is an approved and registered herbicide used to control broadleaf and grassy weeds in corn, sorghum, and sugarcane. The Department of Agriculture and Consumer Services (FDACS) regulates pesticide and herbicide use in Florida. The University of Florida's Institute of Food and Agricultural Sciences (IFAS) has provided atrazine and ametryn BMP training to EAA farmers. In addition, phosphorus control BMPs and the STAs are believed to help reduce atrazine levels entering the EPA.

Comment: *On Page 2A-30, it is noted that diatom community shifts may indicate that the current specific conductance standard may not be fully protective of the area. Does the community shift vary year-by-year or is there a long-term trend in the shift? Figure 2A-9 does not seem to indicate a trend in specific conductance nor do the observations at most other sites? Also, it is noted that differences in measurement methods may interfere with comparability of results over years. How can the above conclusion about the specific conductance standard be reached? If the conclusion is correct, what standard would be protective?*

Response: The chapter discussion was focused on a long-term pattern; however, shorter-term shifts can occur in some areas in response to seasonal and year-to-year variability in many factors, including conductivity.

The conclusions about specific conductance were reached based on reviews of paleoecological records; changes in the periphyton community along a conductivity gradient in the Refuge, as reported in Chapter 3 of the 2001 ECR; and more recent controlled experiments, which are summarized in Chapter 6 of the 2005 SFER. Additional research is required to determine the need for or the required level of a protective standard. The FDEP and District will continue to evaluate specific conductance conditions in the Refuge.

Comment: *On Page 2A-31, the difficulty in separating current human and natural impacts on specific conductance is implied. Does the historical water data record provide sufficient detail to determine if the current conditions have been observed at some point in the past?*

Response: The current human-induced impacts on specific conductance are primarily related to the drainage, ditching, and diking of the Everglades system and predate the available water quality record. The four major canals in the northern Everglades were originally constructed by 1917 and were later structurally improved by the Army Corps of Engineers; construction of the perimeter levee around WCA-1 was completed in 1961. Historical water quality data do not provide sufficient detail to determine if the current conditions have been observed during the past. However, there is sufficient data to determine whether levels have changed since the later 1970s. The general pre-drainage specific conductance conditions can be inferred from the paleo-ecological record, but that record provides little information on the level of variability or short-term changes in conductivity that may have occurred prior to drainage of the system.

Comment: *Although currently the state has no surface water criterion for sulfate, sulfate is a concern to water quality in South Florida due to its close relationship to Hg methylation (Chapter 2B). Two important sulfate questions need to be addressed in EPA: What are the sources of sulfate (ground water or sea water or both)? Why is the variation of sulfate concentration so large (Table 2A-7, in many cases one standard deviation is > 200%)?*

Response: The U.S. Geological Survey (USGS) has used sulfur isotopic composition to trace sources of sulfate contamination (Appendix 2B-3). Based on this work USGS researchers concluded that EAA canal water, rather than rainfall or groundwater, is the most likely sulfate source to the EPA. The sulfur is added as a soil amendment in the EAA.

Sulfate is a highly conservative parameter. Variability in sulfate concentrations within the EPA is related to proximity to discharge structures, rainfall, groundwater upwelling, and chemical transformations.

Comment: *Page 2A-37. Other than the effect of sulfates on methylation, what is the greatest concern regarding high levels about sulfates?*

Response: Increased sulfate levels in the surface water can promote production of sulfide under lower redox conditions commonly found within the marsh sediments. The increased sulfide concentrations can, in turn, affect microbial activity, decrease DO penetration into sediments, and affect the availability of many trace metals including important micronutrients. High sulfide levels can also have direct adverse effects on other biological communities.

Chapter 2B: Responses to Peer Review Comments

PEER REVIEW PANEL COMMENTS

Comment: *The Everglades is fortunate in having two data sets to examine trends in mercury concentrations that can be used as bioindicators of potential ecosystem effects. Both species are high level predators, and are of concern to the public; egrets for aesthetic reasons, and bass because people consume them. Agreement between the two data sets, and within each data set is a powerful demonstration of their conclusion. ...(I)t would be more impressive if the bass data were similarly presented, allowing a comparison.*

Response: Figure 2B-4, which shows mercury concentration trends in largemouth bass, has been added – time series of geometric mean mercury concentrations in largemouth bass (age 1 to 2 cohort) for four sites in the Everglades.

Comment: *This section (LINKS BETWEEN MERCURY EMISSIONS AND CONCENTRATIONS IN BIOTA) deals largely with links between mercury emissions and bass, and should be so titled. Further, a similar analysis with egrets might prove useful in examining whether the percent not explained relates to the timing of the declines.*

Response: The section title has been modified and the four topics covered in the section have been listed. Trends in mercury concentrations in egrets as related to mercury emissions are not discussed in as much detail as those for largemouth bass because the mercury declines were similar in both species. The arguments that apply for bass also apply for egrets.

Comment: *This section (CONCENTRATIONS OF MERCURY IN FISH) is a new section and is extremely valuable because of its interest to the public and regulatory relevance. However, the section might better be called "mercury in bass", and it would be more useful with a general introductory paragraph that details the issues to be discussed - what are the issues to be presented. The importance of bass to the fishing public, and the presence of fish consumption advisories should be mentioned.*

Response: The section has been re-named and revised. The importance of largemouth bass as a sport fish in the Everglades is noted.

Comment: *The lack of declines in mercury in bass in the Everglades National Park, compared to the rest of the Everglades, suggest several research needs 1) establishment of specific stations to assess mercury deposition into ENP, 2) detailed monitoring of mercury concentrations in bass at more places within ENP, 3) modeling of atmospheric movement over ENP, and 4) monitoring of sulfates in different parts of the ENP. Sediment analysis should also be considered as well as impact of flooding and drying cycles. The increase in mercury concentrations in fish in ENP should be a high priority research area, particularly since it has occurred for several years (since 1999).*

Response: We agree and will be seeking additional support for ENP mercury research.

Comment: *This section (CONCENTRATIONS OF MERCURY IN FISH) would also benefit from a paragraph that places the mercury concentrations in bass within a larger context of other similar estuaries or regions.*

Further, data on mercury levels in other fish in the Everglades should be examined. Some of the data might have some temporal information which might aid in understanding the anomalies with mercury in bass.

Response: The report makes it clear that the Everglades is an ecosystem that is very efficient at methylating mercury as compared with most other water bodies. It is shown that largemouth bass in the Everglades generally are well above the USEPA's fish tissue mercury criterion. Appendix 2B-1 reports extensively on mercury in other Everglades fish species.

Comment: *Attempt to make all mercury graphs coincide when a given issue is discussed. For example, Figures 2b-1 and 2b-2 would be most useful if they covered the same time period. Additionally, a graph of global atmospheric mercury deposition should be included.*

Response: The figures have been revised.

Comment: *The Body of the report would be more useful if the division of topics was clear, there was a clear statement of topics to be discussed, and they were discussed in that order.*

Response: Section titles and organization have been revised for clarity.

Comment: *There is strong evidence now to say that mercury, sulfur, and carbon play equal roles in the set of complex processes that lead to the transformation of mercury to methylmercury, the most bioaccumulative form of mercury in the environment.*

Response: The summary has been revised to reflect the importance of mercury, sulfur, and dissolved organic carbon.

Comment: *p. 2B-2, first bullet on the page: include the DOC in the listing of controlling water quality factors; p. 2B-2, fourth bullet on the page: should say that in fact some monitoring locations (are) showing rapidly increasing Hg levels in fish in the National Park.*

Response: These revisions have been made.

Comment: *In discussing Fig. 2B2, the authors say that declines in volume-weighted means in wet deposition agree "reasonably well" with declines in local emissions. However, the graph shows that VWM scarcely declined at all from 1994-2000, while local emissions declined by ~80%.*

Response: The explanatory text has been modified and the graph has been eliminated.

Chapter 2C: Responses to Peer Review Comments

PEER REVIEW PANEL COMMENTS

Comment: *Will the new phosphorus criterion compliance monitoring efforts be totally separate from other water quality monitoring or integrated with other monitoring programs in not only the EPA but the entire South Florida region?*

Response: To make the most efficient use of available resources, it is expected that the required phosphorus criterion compliance monitoring will be integrated with other monitoring programs within the EPA to the greatest extent possible.

Even though every effort will be made to make the new monitoring program consistent with other monitoring programs, the phosphorus criterion only applies to the unique freshwater marshes located within the EPA. Other portions of the South Florida region (e.g., Lake Okeechobee, Kissimmee River, etc.) have different requirements that dictate the monitoring programs conducted within these areas. Therefore, full integration of the new monitoring program with those being conducted outside the EPA is less likely.

Comment: *How will the new monitoring program(s) connect with the historical data used to establish the criterion?*

Response: It is anticipated that as many of the existing sites will be incorporated into the phosphorus criterion monitoring program as possible (including those used to establish the criterion as well as from other monitoring programs). This will provide an extended period of record for many of the sites within the monitoring program and allow a better evaluation of long-term trends within many parts of the system.

Comment: *How would the lack of load reduction to Lake Okeechobee, where BMPs are being implemented, be compared with the reduced concentrations in all inflows to the EPA, where BMPs are also being implemented (realizing that loads are discussed in Chapter 10 and concentrations are discussed in Chapter 2C)? It appears the BMPs are working in one area, but not in the other.*

Response: It is important to remember that the reduced phosphorus concentrations in the inflows to the EPA are the combined result of BMPs and STAs. While the BMP program in the EAA has significantly reduced the amount of phosphorus being lost from the agricultural land, a much larger reduction results from the stormwater treatment provided by the STAs prior to the water entering the EPA. Also, the type of agricultural activities within the two areas is very different. Within the EAA, the primary agriculture is sugarcane with some row crops grown on organic soils with highly controlled canal systems. In the Okeechobee basin the agriculture consists largely of pasture/cattle and historic dairy operations on mineral soils. Because this type of system represents more of a non-point source of phosphorus, it is much more difficult to control without large-scale STAs. Several STAs are planned for the Okeechobee basin in the future as a part of CERP.

Comment: *The reduction in TP geometric means, indicated in Table 2C-1, are rather dramatic for a one-year time period, both in uniformity of reduction across the EPA and in magnitude at some regions and classes (e.g. Refuge rim – medians 68.0 to 39.0). Is there reason to expect similar reductions next year? Or are the reductions in 2004 within the normal variability in the system, which means the climatologically normal 2004, when followed by a climatologically active 2005, indicates a high probability of an increase in 2005? What will be the effects of this reduction on different components of the ecosystem (and how long will it take for them to show up)?*

Response: As shown in Figure 2C-1, the decreases observed in WY2004 are a continuation of the general decreasing trend in phosphorus concentrations that started in the mid 1980s. This decreasing trend has been the result of increasing implementation of BMPs and stormwater treatment prior to entering the EPA. The continuing efforts to maximize the effects of the BMPs and to optimize the performance of the STAs, as well as to bring the finial STAs into operation, provide no reason to believe that the decreasing trend in phosphorus levels entering the EPA will not continue in the future. As pointed out in the comment, the amount of phosphorus entering the EPA in a particular year can be affected by many uncontrollable factors such as climatic conditions. Because many of the efforts to optimize the performance of the BMPs and STAs focus on minimizing the effects of the pulsed stormwater flow on the phosphorus concentrations in the inflow to the EPA, the variability between years will likely be reduced in the future in addition to a continued decreasing trend for the average inflow phosphorus concentrations.

As the levels of phosphorus entering the EPA continue to decrease, the reductions will be reflected in the conditions observed in the marsh. However, there is much uncertainty about exactly when and how the recovery of the phosphorus-enriched portions of the marsh will occur. There is consensus that full recovery of the marsh will occur over an extended time period, possibly decades, mostly because of the large amount of phosphorus that has accumulated in the sediment and that may be released slowly as the phosphorus concentrations in the water are reduced. It is expected that the lower inflow concentrations will result in lower phosphorus concentrations in the impacted portions of the marsh. As the phosphorus concentrations in the water and sediment within the impacted portions of the marsh are reduced, conditions will be favorable to the restoration of a more natural biological community within these areas.

Comment: *Will the new monitoring program be designed to measure TP compliance status only or will it be designed to both measure compliance and why compliance is possibly changing from year-to-year? These are two competing information objectives, requiring different spatial and temporal scales of sampling.*

Response: The monitoring program is intended to generate the data necessary to determine if the water body is achieving the criterion. By integrating the monitoring required by the phosphorus criterion rule with other ambient monitoring being conducted, additional information will be generated that will help determine why a change in phosphorus concentration occurs. In addition, other monitoring being conducted within the EPA provides extensive information concerning climatic conditions, phosphorus levels entering and exiting each area, flow rates into and out of each area, water levels, etc. It is expected that the combination of this monitoring will provide sufficient information to determine the cause of significant variations in marsh phosphorus levels.

Comment: *The two major components of the TP compliance monitoring program, presented on Page 2C-8, suggest an even set of sampling sites for TP criterion compliance purposes, but does not clarify how the second component will be designed to "protect against localized or shorter-term imbalances …" Is it possible to further elaborate on the TP monitoring design? Perhaps on*

Page 2C-2, the addition of a paragraph on the monitoring plan, believed best to monitor the phosphorus criterion, would meet this request.

Response: As stated in the phosphorus criterion rule, the monitoring sites will be evenly dispersed across the impacted and unimpacted portions of the marsh. The protection from localized or short-term imbalances results from the combined application of the four parts of the assessment methodology as outlined in the next. The requirement to maintain a five-year geometric mean concentration across all sites within an area of 10 ppb or less provides little restriction on the shorter-term concentrations, especially at individual sites. The other three requirements specified in the assessment methodology were designed to provide the necessary protection from localized or short-term imbalances when applied to the evenly dispersed network (or the individual sites within the network).

Comment: *Page 2C-8-9. The Panel is still a little unclear if the standard is for each station, summed over 5 years? Not over a water management unit? Is this going to be a problem since phosphorus is higher at the northern end (inflow to the Refuge and SCA-2)?*

Response: To assess achievement of the phosphorus criterion, the rule specifies a methodology consisting of four components, all of which must be met to demonstrate that the criterion has been achieved. The achievement test will be applied separately to the impacted and unimpacted portions of each water body (Refuge, WCA-2, WCA-3, and Everglades National Park). The four parts of the test are:

1. the five-year geometric mean averaged across all stations within each portion (impacted or unimpacted area) of the water body must be less than or equal to 10 ppb:
2. the annual geometric mean averaged across all stations within each portion (impacted or unimpacted area) of the water body must be less than or equal to 10 ppb for three of five years; and
3. the annual geometric mean averaged across all stations within each portion (impacted or unimpacted area) of the water body must be less than or equal to 11 ppb; and
4. the annual geometric mean at all individual stations must be less than or equal to 15 ppb.

The phosphorus criterion and the assessment methodology described above are intended to prevent imbalances in the natural flora and fauna. Because the flora and fauna observed across all portions of the EPA are very similar and were demonstrated to respond similarly to phosphorus enrichment, a single criterion was appropriate for all portions of the system. Even though there is a natural phosphorus gradient from north to south, the background levels in all regions are below the 10-ppb criterion. Thus, applying the same criterion to all portions of the EPA should not be a problem.

Comment: *Page 2C-11. Will there be a problem when there is another severe drought?*

Response: Another severe drought will likely have an affect on phosphorus levels in the marsh. If the marsh dries and the sediment becomes exposed and starts to oxidize, then phosphorus will be released and the concentrations in the marsh will be increased temporarily when the marsh is rewetted. However, the phosphorus criterion rule recognizes this possibility and specifies that data collected during or after (until normal conditions are restored) any extreme natural event will

not be used to assess achievement of the criterion. Extreme natural events cannot result in an exceedance of the phosphorus criterion.

Comment: *Page 2C-16. What are the biological effects of progressively lower phosphorus levels?*

Response: As stated above, the reductions in the level of phosphorus entering the EPA will slowly result in lower phosphorus concentrations in the water and sediment in the impacted portions of the marsh. As this occurs, the natural biological communities found within oligotrophic portions of the marsh will increasingly have the ability to outcompete communities more tolerant of phosphorus-enriched conditions. As the native biological communities (periphyton, macrophytes, macroinvertebrates, etc.) are restored and the amount of open water is increased, the function of the marsh will be improved (higher DO levels, better habitat for birds and fish, etc.). There is a high degree of uncertainty regarding the manner and speed in which the recovery of the phosphorus-enriched portions of the marsh will proceed. It is likely that full recovery of the marsh will occur over an extended time period, possibly decades.

Comment: *Page 2C-17. Is there any reason to expect the nitrogen inputs from the agricultural area will increase or decrease in the next few years?*

Response: Nitrogen levels in the inflows have remained relatively consistent over recent years and the authors do not know of any large-scale changes in land use or agricultural practices within the EAA that would result in increased nitrogen inputs. Also, with the continued implementation and refinement of the BMPs as well as improved stormwater treatment, there is reason to expect that nitrogen inputs to the EPA will decrease slightly in the future.

Chapter 3: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Comment: *The BMP "equivalents" system for BMPs is innovative, but it is not clear how the "equivalents" system was derived and what these numbers mean. It would help to understand the rationale, for example, for Nutrient Application Control being assigned 2.5 points while Slow Release P Fertilizer is assigned 5 points.*

Response: The section on BMP equivalents has been expanded in the chapter to address this issue. Nevertheless, there is no body of data or research that conclusively defines a difference of effectiveness for differing BMPs. For this reason, it was not possible to create a system of credits based on effectiveness of individual BMPs. The intent of the point system was to ensure a comparable level of comprehensive BMP participation among permittees. Points were originally determined by consensus among District personnel, UF-IFAS researchers, and growers based on considerations of difficulty, expense, and past experience.

Comment: *The distribution of TP in the EAA is given in Figures 1 and 2 (Appendix 3), and it is recommended that some explanation be provided for the distribution found.*

Response: The appendix has been expanded to include an explanation of how the figures were derived.

Comment: *TP sample preservation in the field is an issue, particularly if left in the field in the automatic samplers for up to seven days or longer. Sample deterioration may render the analytical results questionable unless proper sample preservation procedures are followed since the normal sample preservation procedure for total phosphorus (TP) is acidification with H_2SO_4 to a pH level <2 and a temperature ≤4 °C followed by analysis within 28 days, and for ortho-phosphorus, samples should be stored at ≤4 °C followed by analysis within 48 hrs (see the USEPA Region IV procedures cited by FDEP). Though the FDEP laboratory standard operating procedures for field sampling with automatic samplers permit preservation with acidification only, this can be done if TP is the only constituent analyzed in the sample and the results are not being used for NPDES purposes, given that TP standards are now in place, the District and FDEP should determine whether NPDES conditions now apply and whether more rigorous sample preservation procedures be followed.*

Response: These are valid considerations, but beyond the scope of the chapter. As long as TP sampling and analyses are performed by methods recognized and approved by the FDEP, they are acceptable for use in the models used for rule compliance.

Comment: *Where mass balance information is given throughout this chapter, the sources and sinks need to be itemized. The time period over which the mass balance applies also needs to be clear.*

Response: The model used to determine compliance calculates inflow and outflow from the EAA at all basin boundary locations. For each inflow and outflow, the rule defines a structure where flow and concentration are measured, and therefore a load can be calculated. The issue of mass balances for P in the EAA is very complex, and, for some sources, poorly defined and/or understood. Accordingly, the regulations have focused on measured flows and loads that can be determined with a sufficient degree of certainty. Flows and loads coming into the EAA, not attributable to farm runoff, are defined as sources. To determine the amount of phosphorus attributable to the farms, a mass balance between the inflow sources and the outflows is accomplished. If the outflows are greater than the inflows, then the difference is attributed to runoff (source) from EAA farms. If the inflows are greater than the outflows, then the difference is attributed to irrigation (sink) to EAA farms. Furthermore, the mass balance is applied on a daily time step. An itemized list of sources was previously available in Chapter 8, Table 8-4, and for the final report, is presented in Chapter 2.

Comment: *BMP effectiveness for controlling TP needs to be continued, and comments regarding monitoring programs for such determinations noted elsewhere in this report should be heeded.*

Response: BMP effectiveness does need to continue to be monitored; that is the essence of significant portions of the responsibilities of the Everglades Regulatory Program. The program continues to try to improve the monitoring programs that allow assessment of BMP effectiveness.

PEER REVIEW PANEL RECOMMENDATIONS

Recommendation: *The Panel recommends that the District conduct an analysis of the research program that concentrates on evaluating BMPs. It appears that more rigorous research or BMP effectiveness is required.*

Response: As stated above, evaluating BMPs and research into maximizing the effectiveness of BMPs is an ongoing commitment. The recommendation is noted.

Recommendation: *The Panel recommends that a new area of concern in BMP research could examine the atmospheric deposition of phosphorus.*

Response: Atmospheric deposition of phosphorus has been considered in the past; proposed programs designed to further define its impact on the Everglades have not been funded by the Governing Board or other agencies. One major concern involved in such research is the lack of definitive methods that would provide more exact quantification of atmospheric deposition than already exists in the literature. The Everglades Regulatory Program would welcome any research efforts that would shed more light on the issue of phosphorus deposition and fate in the EAA; however, the focus of this program is phosphorus in surface water discharges, regardless of the source.

RESPONSE TO USDOI – TECHNICAL REVIEW COMMENTS

Comment: *p. 3-3, final para, 2nd sentence: Should be changed to read "Except during bypass events, the basins designated as ECP do not discharge directly to the EPA, but discharge to the STAs for further treatment."*

Response: The text has been revised.

Comment: *p. 3-10: It is difficult to reconcile the farm level monitoring results with estimated EAA concentration and load calculations presented elsewhere in this report. This section does present plausible conjectures about why these values are so different, but we should also consider the possibility that the simplified methods for budgeting loads from the Lake and runoff may be flawed. A better understanding of these mechanisms is not simply a regulatory issue. Water quality improvements from new management practices and water operations depend on a clear understanding of sources and mechanisms.*

Response: The District is continuing to work toward better understanding of BMP practices, P phosphorus sources, and mechanisms. It is also currently evaluating the EAA farm data and those results may shed light on this issue.

Comment: *p. 3-12: The BMP research reported here provides vital information for management and operational improvements. Continued support of such studies is clearly of central importance to improved water quality.*

Response: This is true and the District continues to support BMP research and studies of existing BMPs.

Comment: *p. 3-20, Section II: The non-ECP basin information is important. More of this information should be moved from appendices to the main body of the report.*

Response: The non-ECP basin section has been significantly expanded in the revised text of the chapter to include this information.

Comment: *Table 3-5: under "EAA to WCAs" the flow and load through the G-300/301 structures should be reported. Table 8-4 reports 2629 Kg of TP (2.6 mtons) from the EAA were passed by these structures in WY04. These structures should be included every year, even if it is zero in a particular WY.*

Response: While these structures are inflows to WCA-1 ("Refuge"), they are outside the modeling boundary of the EAA for determining compliance with the BMP rule and therefore outside the scope of the chapter. As stated, the information for flows and loads through G300/G301 were reported in Chapter 8, Table 8-4 (the table has since been moved to Chapter 2), along with a breakdown of the contributing sources from upstream structures, which includes inflows from the EAA.

Comment: *Tables 3-10 and 3-11: It would be of value to the reader to also display a line on the graph (or alternatively a note) showing the median and average values for the percent of farms.*

Response: This comment is under advisement.

Comment: *App. 3-2, General: This appendix is clear and well written. The information presented here is a major component of the monitoring supporting Everglades restoration. The appendix is essential reading for all reviewers interested in water quality in the EPA. Future reports could consider adding this information to the main volume by adding a chapter or incorporating it into an existing chapter.*

Response: The matter of the appropriate venue for the presentation of highly detailed technical data, whether in the main text, appendix, or even an associated separate technical document, is one of continued consideration and discussion. Recognition of the value of these data is appreciated and this comment will be considered further in future volumes. However, this section of the report has already been significantly expanded, and space may become an even greater consideration.

Comment: *App. 3-2-5: It is stated that Appendix 3-2 does not track compliance with the interim and long term TP concentration levels set forth in the consent decree. This information from the quarterly Settlement Agreement Reports should probably be summarized or referenced somewhere in the SFER.*

Response: Other chapters of the report may be more appropriate venues for the presentation of these data.

Comment: *App. 3-2-9: The specific conductance numerical criterion of 1,275 mmhos per centimeter or 50% above background, whichever is greater, is not protective of low conductivity water like that naturally present in most of the Northern Everglades. Background concentrations in the Refuge are in the range of 100-200 mmhos per centimeter. A reasonable value for comparison, 50% above background, would be 300 mmhos per centimeter. All Refuge sites (App 3-2b) appear to have conductivities well above this value and are of great concern.*

Response: The concerns about conductivity in the Refuge are valid, but the purpose of the Everglades Regulatory Program is the effective control of P at its source. The consideration of conductivity is outside the scope of the program. From a practical consideration, it may be a more complex issue that will need to be addressed at a policy level, which is beyond the scope of the chapter.

Comment: *App. 3-2-11: The alkalinity numerical criterion is not appropriate for the Refuge. Water in the Refuge is naturally very low in alkalinity, and the native communities of periphyton within the Refuge are dependent on the continued maintenance of this condition. Thus, the numerical criterion of alkalinity not being below 20 is not protective or appropriate.*

Response: This particular state standard may not be appropriate in all areas of the EPA, but this issue is beyond the scope of this chapter.

Comment: *App. 3-2-13: The first sentence is confusing. Are these gates always open, or always open when the upstream pumps are in operation?*

Response: This has been clarified in the text of this chapter.

Comment: *App. 3-2-15: the use of G-94B as a surrogate for G-94A and G-94C may no longer be appropriate. As STA-1E comes into operation, we expect that significant changes in flow patterns will occur. In particular, G-94A and B may be in canal reaches that gain flow from the interior. There may also be significant differences in water quality between these sites because of velocity*

differences. Canal cross sectional area is considerable larger at G-94A, and some change in entrained sediments from the reduction of velocity at this site may occur.

Response: This observation will be taken into consideration as changes to the non-ECP account for changing flow patterns into and out of the Refuge.

Comment: *App. 3-2-15: The statement that direction of flow at the G-94 structures has "always" been toward LWDD is not correct. At times the LWDD canal stages are higher than the Refuge L-40 Canal. Historically, flows into the Refuge have occurred through the G-94C, and perhaps other structures.*

Response: This statement has been modified in the text.

Comment: *Appendix 3-2a: Quarterly sampling of major ions at Non-ECP sites is not adequate. There are concerns within the Refuge for impacts from alkalinity, calcium, chloride, and hardness. These concerns are greatly increased by the potential impacts of STA-1E discharges on Refuge flow patterns and impingement of canal water into the interior. Sampling frequency for major ions should, at a minimum, be monthly with biweekly sampling when flowing. Because nutrient sampling is already performed at this frequency, little added cost of collection would be involved.*

Response: The decisions concerning monitoring need to be made at the policy level with the involvement of the FDEP and other interested parties, and are beyond the scope of this chapter and the Everglades Regulatory Program. The program will continue to perform all necessary and mandated monitoring.

Chapter 4: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS (BERGER)

Comment: *I assume that load reduction is multi-year?*

Response: The load reduction percentage listed is for WY2004; TP retained is presented for both annual and multi-year.

Comment: *What are the issues with the permits?*

Response: All permit requests for additional information are complete.

Comment: *How is floating aquatic vegetation controlled?*

Response: Floating aquatic vegetation is controlled using herbicides.

Comment: *Burning prior to flooding usually results in an increase in mercury following flooding. Has this been considered?*

Response: STA-3/4 Cell 2B burned prior to flooding; no anomalous mercury levels were noted.

Comment: *At what point are measures instituted to protect Lake Okeechobee – does it have to do with a given water level in the Lake?*

Response: Regulation of Lake Okeechobee depths is based on lake and regional ecosystem protection (see chapter on Lake Okeechobee).

Comment: *Are the management activities instituted to manage the overload event the same that are in place for other STAs?*

Response: In general, the activities are the same; however, each STA has specific management activities.

Comment: *Are you sure the conditions will not prevail in Lake Okeechobee again?*

Response: If similar conditions prevail in Lake Okeechobee, then STA-3/4 (not STA-1W) is designed to capture and treat releases.

Comment: *Have the effects of the use of diquat been examined (on fish as well as invertebrates)?*

Response: Effects of diquat on fish and invertebrates have been well documented.

Comment: *What is nuisance vegetation (if it is not floating vegetation?)*

Response: Nuisance vegetation includes floating vegetation and cattails in SAV cells.

Comment: *Are contaminants (like mercury) regularly monitored in the STAs?*

Response: Mercury and other organics are monitored and the results are reported.

Comment: *The results of the dye study will be interesting.*

Response: STA-1W Cell 5 tracer study results will be reported next year.

Comment: *How frequent are drydowns?*

Response: The goal is the prevention of drydown through structural and operational means.

Comment: *Could you comment on the general level of total phosphorus leaving the system (it looks constant regardless of the inflow). Does this imply that it can only remove so much, that there is a limit to efficiency?*

Response: There is a lower biological limit to phosphorus removal. The goal of STA optimization is to create conditions needed to achieve that limit.

Comment: *Does this imply that no surface aquatic vegetation exists, or that it was not controlled. How large are the woody invasives – remaining from a long time ago? How are they being controlled?*

Response: In STA-3/4, there are about 100 acres of floating aquatic vegetation throughout the project and about 200 acres of hardwoods, mostly found in Cell 1B.

Comment: *What is the source of ametryn and atrazine?*

Response: The upstream agricultural land use is the source of ametryn and atrazine.

Comment: *Are shrubs a problem in this one.*

Response: There are small woody species, such as willow, growing in the Rotenberger. Currently, these are not considered to be a problem.

Comment: *At the bottom where you refer to field observation of obstructions. Isn't there routine monitoring of all such outflows, with appropriate corrections?*

Response: Flow obstructions impact flow patterns and contribute turbidity through scouring.

Comment: *Isn't the US F&WS part of the interagency group for the RWMA?*

Response: USFWS is not part of Rotenberger interagency group, USACE, FDEP, Florida Fish and Wildlife Conservation Commission, Miccosukee Tribe and Friends of Everglades (invitees).

The goal of Rotenberger restoration is to reestablish improved hydroperiod, which should, in turn, restore Everglades vegetation communities.

Comment: *Again, I think it would be useful to summarize some of the control measures for all the units in one place to get an overview of the use of diquat and other chemicals, and for the amount of different types of vegetation controlled.*

Response: This will be taken under consideration for next year's report.

PEER REVIEW PANEL COMMENTS (STRAYER)

Comment: *A clear description of a very interesting project. I have very few comments.*

It appears that the STAs require occasional herbicide treatment. Are the herbicide treatments followed by water-quality problems (drops in DO or spikes in nutrients)? Why is Hydrilla being controlled in the STAs (p. 4-23)?

Response: There were no noticeable problems following herbicide treatments. Hydrilla in low-TP cells is being managed as a preventive measure.

Comment: *Table 4-6 and Fig. 4-8 refer to a mesocosm treatment that appears not to be described in the text – add some text or remove from the Table and Fig.?*

Response: The STA-1W DO mesocosm site is located within an open slough area. A description will be included in the final report.

Comment: *Several of the STAs are scheduled for modifications – it would be nice to have diagrams showing the planned improvements.*

Response: STA enhancement schematics have been included in the final report.

Comment: *Why so little outflow from Rotenberger WMA (p. 4-53)?*

Response: The reduced outflow from Rotenberger is caused by a reduced inflow.

Comment: *It might be useful to use a distinctive symbol for WY04 data in Fig. 4-33, so we can see the consequences (if any) of high water loads.*

Response: The STA performance charts have been revised to include water years.

Comment: *Will measurements of P in peat be precise enough to measure accumulation usefully?*

Response: They should be. The accuracy of accumulation measurements function of sampling density and analytical methods. The natural variability of the soils will be determined by analysis of the cores collected.

Comment: *Typos: Page 4-12, line 5: should read "in the inflow than in the outflow"*

Response: The sentence has been changed in the final report.

Comment: *Table 4-14 is an exact duplicate of Table 4-13 and should be eliminated.*

Response: The duplicate table has been eliminated.

PEER REVIEW PANEL COMMENTS (PING HSIEH)

Chapter 4 of this year's report is much comprehensive and well written than last years report. The summary is a good synopsis of the chapter which is very important for a report of this nature. Following are some questions:

Comment: *Vegetation management seems to be increasingly important in the STAs. The presentation on vegetation management seems a bit too general. Also practices were given (e.g. use of herbicides, fire etc.) but not the results. For example, did control of FAV achieve expected results? Or, how does the start-up of SAV become? (By the way, why SAV is important to the performance of STAs?)*

Response: Herbicide control of floating aquatics was very effective, as seen in STA-5, which demonstrated a 30-percent reduction in the outflow concentrations as compared with WY2003. SAV has demonstrated a greater ability to reduce TP than emergent vegetation. To establish SAV depended on existing vegetation, herbicide, burn, flood to 60 cm for 30 to 60 days; lower depths to 15 to 30 cm, inoculate with SAV fragments.

Comment: *Vegetation distribution in the STAs is very important and valuable information. It may be used to evaluate the effectiveness of vegetation management practices and help to interpret STA performance. Did you get the vegetation distribution information by remote sensing technology? How frequent has vegetation survey been conducted? The vegetation distribution maps presented in Chapter 4 are all outdated (year 2000). They should be updated (There is more current information in Appendix 4-12). Comparison of current and archived maps can give valuable vegetation distribution information pertaining to the operation and performance of the STAs.*

Response: The vegetation maps will be updated as information becomes available.

Comment: *Hydrology residence time (HRT) is an important element in the operation and performance of STAs. Include HRT information may help to understand the performance of STAs. Flow pattern analysis of STAs may also be valuable for the interpretation of the performance.*

Response: Hydraulic residence times are included in the final report.

Comment: *Is Rotenberger WMA a part of STA? A statement of why RWMA appears in chapter 4 would help readers to understand the context.*

Response: Rotenberger is not a treatment area; the information is provided to satisfy the permit reporting requirement.

Comment: *What are the criteria for stabilization and post-stabilization phases of STAs*?

Response: Operational phases are as follows (this information will be included as a footnote to Table 4-2):

- Start-up phase: inundate for vegetation growth; no discharge; phase ends when cell demonstrated net improvement in phosphorus and mercury
- Stabilization phase: discharge; phase ends when 12-month outflow TP $\leq$ 50 ppb

- Post-stabilization phase: after stabilization phase

Comment: *What do you meant in p. 4-62 "In addition to linear regression analysis, a logarithmic relationship was analyzed to examine whether the removal rate dropped off at a higher loading rates?" I can not see any advantage of doing the logarithmic analysis.*

Response: Environmental data typically fit a log-normal distribution. Transforming the data helps to normalize the data and remove effects of outliers. The figure and text have been replaced by the charts presented at the public workshop.

Comment: *p. 4-68. Again, I can not understand why do you want to do the statistical analysis using log10-transformation of the data? Is it not the linear data more sensitive and non-problematic?*

Response: Environmental data typically fit a log-normal distribution and transforming the data helps to normalize the data and remove effects of outliers.

PEER REVIEW PANEL COMMENTS (ARMSTRONG)

Comment: *The STAs are essentially wet detention ponds being used to remove phosphorus from flows leaving the EAA and other areas. For phosphorus, these systems rely on physical, chemical, and biological mechanisms to achieve removal. The mechanisms are affected by flow and volume management in the ponds, dissolved oxygen conditions at the sediment/water interface, and other factors. There is considerable literature information on the principles of detention ponds design and operation, their application to stormwater treatment. It would be useful to add to this chapter the design principles the District used to establish these STAs originally and the operational principles being followed to insure their continued performance at levels and efficiencies expected.*

While these STAs are being operated, it seems that information such as hydraulic, organic material, and nutrient areal loading rates, dissolved oxygen concentrations within the STAs, water depths, detention times, and other operational information could be gathered and related to phosphorus removal. Such information would enhance the design and operational basis for these ponds and future ones and assist the District in managing these ponds effectively. If this is being done, please provide such information.

Response: References for basis of STA design (Walker 1995, Goforth 2000, et al.) have been added to the final report. Here are the general operational principles:

- Try to ensure that inflows (flows and TP loads) are within the design envelope
- Avoid dry out – minimum of 15 cm depth
- Avoid too deep for too long – maximum 137 cm depth for 10 days
- Maintain target depths between storm events: Emergent, 38 cm; SAV, 45 cm
- Frequent field observations by site managers
- Adaptive management for performance optimization
- Will provide phosphorus removal information related to operational parameters in final report

RESPONSE TO USDOI – TECHNICAL REVIEW COMMENTS

Comment: *The discussion of water quality at sites downstream of STA discharges is very limited in scope and discusses only dissolved oxygen. These discussions should be amplified to include nutrients and other relevant water quality parameters.*

Response: Water quality downstream of the STAs is discussed in Chapter 2.

Comment: *Very large amounts of effort and funding are expended in collection of flow and water quality data within the STAs. It seems, therefore, uneconomic to fail to gain as much useful information as possible from these data. Past ECRs have provided annual water and total phosphorus budgets for the STA treatment cells. This was a valuable part of the report that provided insight not only into STA performance, but also helps to evaluate data quality and future data needs. It was therefore disappointing to find that once again these analyses were not a part of the draft 2005 SFER. In previous years comments it has been suggested that mass balances should be extended to other constituents. At a minimum this should include chloride and total nitrogen. For discharges to the Refuge, it would also be of value to see such an analysis for calcium and alkalinity. It is recommended that these balances be incorporated in next year's SFER, and that previous mass balances for all previous years be included in appendices of that report. We do note that Appendix 4-11 suggests that there is an effort underway to automate these budget analysis reports. We strongly support any effort that will make this valuable information once again available.*

Response: Water and nutrient budgets for the STAs will be included in next year's report. Please contact Dr. Jana Newman for additional details.

Comment: *p. 4-1, 2nd para: Does "as early as this summer" refer to summer of CY 2005?*

Response: As was presented during the public workshop, the final flow-way for STA-3/4 began flow-through operations on September 16, 2004. The final report reflects this information.

Comment: *p. 4-2, Table 4: This table should include values or ranges of design specifications for hydraulic and TP area loading rates. This will give the reader a better understanding of the implications of the WY2004 annual loading rates relative to design (i.e. was there overloading or underloading).*

Response: Design information is an important aspect for understanding STA performance. This information is discussed in the text; it was not added to the table because of space limitations. In addition, background information on the basis of STA design and the STA operational design envelopes was added to the final report.

Comment: *Table 4-2 and Page 4-7 paragraph 1: The authors conjecture that "Had STA-1E been operational, the TP loads and concentrations entering the Refuge would have been lower; performance enhancements are under way." This is not factual. Even if STA-1E removes TP as efficiently as STA-1W has in peak-performance years, it will very significantly increase loading because it substantially increases the total inflow to the Refuge. STA-1E will aid the restoration of the EPA by providing new water that previously has been sent to the Lake Worth Lagoon. This benefit, also presents the challenge of limiting total Refuge TP loading while delivering this new water to the natural areas south of the Refuge. STA-1E is designed to take only a small part of the load now entering STA-1W, and would have had little value in reducing the 80% overloading cited in the chapter. STA-3/4 was designed to treat 250,000 acre-feet of Lake water annually (Page 4-33). Had the much larger STA-3/4 been fully operational during the time of STA-1W*

overloading, substantial quantities of the Lake water might have been diverted to the STA-3/4 system.

Response: STA-1E was designed to capture and treat EAA runoff. Until STA-1E is fully operational, additional phosphorus from the EAA will enter the Refuge. Table 4-2 was corrected by adding the phrase"from the EAA" prior to "entering the Refuge."

Comment: *p. 4-8, number 8: The SFWMD demonstrated innovative and adaptable management in finding novel ways to minimize water supply deliveries through the Refuge.*

Response: Comment of appreciation noted.

Comment: *Table 4-5 and Figure 4-7, the site of MESO01 should be added to the map.*

Response: Station identification will be added to the table and figure.

Comment: *p. 4-17: The XYZ transects are miles from the STA-1W discharge, and are nearly totally irrelevant to a discussion of DO in the STA-1W discharge. Downstream monitoring should be located closer to the outfalls. The XYZ transects are relevant to penetration of water and contaminants, including TP from STA-1W, into the Refuge in their vicinity.*

Response: We do not agree that the data collected on the XYZ transects "are nearly totally irrelevant to the discussion of DO in the STA-1W discharge." Data from these sites (Appendix 2A3) indicate that dissolved oxygen in discharges into the L-7 canal from STA-1W do not have a significant impact on canal dissolved oxygen concentrations and that concentrations increase substantially as distance from the discharge increases. Since the X0 and Z0 sites are in the L-7 canal adjacent to the vegetation fringe of the interior marsh, it is obvious that penetration of that water into the interior marsh is not the cause of the lower average dissolved oxygen concentrations at X1, X2, X3, X4, Y4, Z1, and Z2. We contend that oxygen consuming processes exceed oxygen producing processes at these marsh sites and cause the lower dissolved oxygen concentrations observed.

Comment: *p. 4-17: Of the 9 marsh XYZ sites, all but Z3 and Z4 fail the SSAC test (Appendix 2A-3) and are highly impacted by canal water intrusion, much of which likely originating at STA-1W. Comparison of pump outfalls to heavily impacted marsh sites does not demonstrate a lack of impact. Future monitoring might consider locating sondes at LOX 11, LOX 12, and LOX 13.*

Response: Comment is noted.

Comment: *p. 4-51: The concept that hydropattern restoration with contaminated water has a net benefit to Everglades wetlands is unproven. It may take many years for recovery of P contaminated wetland soils following this practice. A better approach may be to delay discharge to these sensitive wetlands until appropriate treatment levels can be achieved.*

Response: We disagree with your suggestion to delay the hydropattern restoration in Rotenberger. Years of too little water have wreaked havoc on wetland vegetation communities through increased frequency and intensity of fires, invasion of terrestrial species, and other adverse impacts. By contrast, using treated water from STA-5 to rehydrate Rotenberger and using treated water from STA-2 to rehydrate the northern portion of WCA-2A has demonstrated very positive benefits.

Comment: *p. 4-62 and Figure 4-33: There are several problems with this figure and analysis (See Attachment 1 below). First, it is suggested that if the figure is retained, a 1:1 line of complete removal be added. Second, the regression line should be forced to have an intercept of zero. With no loading there is no removal. Third, the R2 statistic is improperly applied here. More complex statistical tools must be used when the x and y values in a regression use the same or highly correlated variables in their calculation. Removal equals the input load minus the outflow load. Thus, inflow load appears on both axes. Additionally, inflow and outflow discharge is highly correlated. Both circumstances cause the apparent quality of the regression to be artificially high. This statistical problem is widely recognized by hydrologists in the analysis of stream loads – plotting load against discharge gives an artificially good fit because discharge is used to calculate load. Sophisticated statistics are required to analyze such problems.*

Response: Figure 4-33 was replaced with the charts presented at the public workshop.

Comment: *p. 4-68: The citation of Tukey-Kramer HSD is not listed in the Literature Cited.*

Response: The literature cited will be revised to add the appropriate reference.

Comment: *App. 4-12: This pdf is unreadable.*

Response: We will try to enhance the readability of the pdf file by enlarging the legend and acreage table with each map. Please contact Dr. Jana Newman for a copy of the vegetation maps.

Comment: *App. 4-13: Tracer studies are of great value and should be continued.*

Response: We plan to continue tracer testing; a contract is underway for a tracer study in STA-2 Cell 3.

Chapter 5: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Comment: *Chapter 5 addresses the hydrology in all four areas now covered by the SFER. The hydrology of the Everglades Protection Area has been well documented in previous Everglades Consolidated Reports. Are there similar descriptions of the hydrology associated with Lake Okeechobee, Kissimmee River system, and the coastal areas? These should be placed on the web with links noted in the SFER.*

Response: The chapter has been expanded to cover the whole District area, which includes the Kissimmee-Okeechobee system and coastal areas. The author is not aware of hydrologic reports for Lake Okeechobee, Kissimmee River system, and the coastal areas that can be referenced or placed on the web as a link. But efforts will be made to expand chapters to include hydrologic details of these systems in the following years.

Comment: *The graphical means of presenting data and information regarding rainfall, potential evapotranspiration, water levels, inflows and outflows summarizes considerable data in an effective, short hand, manner. It would be helpful, for some key sites, to graph past annual measures of each of the above hydrological categories of data, to provide insight into annual variation.*

Response: A section on hydrologic variation will be added in next year's report to show temporal and spatial variation of the hydrology of South Florida.

Comment: *The SFWMD hydrometeorologic monitoring design details are provided in a reference that is not linked to the SFER. There appear to be a number of hydrologic monitoring systems operating in the area covered by the SFER (listed on Page 5-4). Are the monitoring systems documented? Such documentation would help answer questions such as: Are all the monitoring programs using the same methods? Are the data from these other monitoring systems stored in DBHYDRO in a common format? Is the Meta data common?*

Response: Data in DBHYDRO from all sources (monitoring agencies) are stored in a common format. Most of the hydrologic data used in Chapter 5 is from the SFWMD's monitoring network. Monitoring program documentation of other agencies is available from respective agencies.

Comment: *On Page 5-42, it is noted that due to the extensive coverage of this year's report, the extent of data analysis is limited. What are the planned data analysis procedures? What hydrologic information should the reader expect to receive in next year's report? What information the year after? In general, what hydrological information is deemed critical to water management in South Florida and how will that information be summarized in future chapters on hydrology of South Florida?*

Response: Full documentation of hydrology of South Florida requires resource allocation. If more man-hours are rendered available, then detailed analysis of South Florida hydrology can be

presented in future reports. Some of the critical hydrologic information that would be useful for water management are as follows:

- Hydrologic sources and sinks characterization (rainfall, ET, surface water flows, groundwater, and surface water)
- Hydrologic mass balance
- Temporal and spatial variations of hydrologic parameters
- Rainfall runoff relationships, drainage
- System storage, retention time
- Stage-storage relationships
- Hydropattern, stage-duration
- Flow pattern
- Hydrologic extremes and impacts on water management system
- Groundwater

ADDITIONAL QUESTIONS

Comment: *There is an implication that all rainfall data used in the SFER was obtained by the SFWMD's Operations and Maintenance Department (Page 5-7). Is there not data from other networks used in the SFER? If this other data is not used in preparation of Chapter 5, can it be used to provide quality assurance for the SFWMD's rainfall data?*

Response: The SFWMD's Operations and Maintenance Department (OMD) rainfall real time monitoring network provides up-to-date data for the report and Theissen-weighted areal average rainfall for each rainfall area. Due to the limited time available for analysis and report writing, data quality evaluation was not applied.

Comment: *What model is used to estimate ETp (page 5-16)?*

Response: The following model was applied to estimate potential Evapotranspiration or evaporation from wetlands and shallow open water (Abtew, 1996). Evapotranspiration Measurements and Modeling for Three Wetland Systems in South Florida. *J. of Amer. Water Res. Assoc.,* 32(3): 465-473.

$$ET = K_1 \frac{R_s}{\lambda}$$

Where ET is daily evapotranspiration from wetland or shallow open water (mm d^{-1}), R_s is solar radiation (MJ m^{-2} d^{-1}), λ is latent heat of vaporization (MJ kg^{-1}), and K_1 is a coefficient (0.53). The *Evapotranspiration* section in the chapter is edited and the ET estimation model is added.

Comment: *Chapter 11 reports that water levels in the Kissimmee River ranged between 2 and 10 feet prior to implementation of the C&SF project and 2 to 3 feet afterwards. There is no summary of historical flows in Chapter 5. With the river restoration project underway, will future hydrology chapters include data and information on Kissimmee River flow changes over time? If so, have "expected conditions," for future hydrologic data interpretation purposes, been defined?*

Response: Literature searches will be performed and referenced on historical hydrology of the Kissimmee River. Contemporary flows in the current year's report as presented as outflows of Lake Kissimmee (S65S; Figure 5-34; Appendix 5-2, Table 1) and discharges through S65E into Lake Okeechobee (Appendix 5-2, Table 2). These structures are at the upper and lower end of the Kissimmee River. In next year's report, we will consider providing additional information on water levels and flows along the middle reaches of the Kissimmee River.

Comment: *While Chapter 5 presents a summary of Lake Okeechobee water levels, Chapter 10 provides an interpretation of what the levels mean and what objectives, regarding future lake levels, will be sought. How will future SFERs combine the basic lake level data summaries with an interpretation?*

Response: A current regulation schedule for Lake Okeechobee will be added to Chapter 5 with its entirety in the coming year's report. The schedule has sufficient legends of interpretation of the ranges of lake water levels.

Comment: *As noted in Chapter 5, due to the extent of data collection, only limited analysis and synthesis are presented in this year's report. Could the inflow/outflow information be predicted based on the rainfall, potential ET and water levels of lakes? Is there any effort to analyze the data in that direction?*

Response: This question is addressed on page 2: "Full documentation of hydrology …"

Comment: *What are those "+" and "-" rainfall of WY2004 in Fig 5-5 to Fig. 5-19?*

Response: Plus (+) and minus (-) signs indicate changes from annual mean. On page 8, the last sentence is modified as follows: "The deviation in water year rainfall from the historical average is shown in the legends of Figures 5-5 through Figures 5-19 for the respective rain area." Increase is shown as a (+) and decrease is shown as a (-).

Comment: *Why are the inflow and outflow of St. Lucie Canal and Caloosahatchee River not balanced? How are the significant differences explained?*

Response: Along the canals, water is withdrawn and local runoff is added. Therefore, Lake Okeechobee releases and discharges from the canals may not balance.

PEER REVIEW PANEL CONCLUSIONS

Conclusions: *Chapter 5 addresses the hydrology in all four areas now covered by the SFER.*

The graphical means of presenting data and information regarding rainfall, potential evapotranspiration, water levels, inflows and outflows summarizes considerable data in an effective, short hand, manner. Water Year 2004 appears to have been close to a normal year.

Chapter 5 notes that, due to the extensive coverage of this year's report, the extent of data analysis is limited at this time. While this is recognized as a constraint on the 2005 SFER, it would be helpful if some indication were provided regarding the hydrologic analysis that can be expected to appear in the 2006 SFER.

Response: Please see the response on page 2 regarding expansion of the hydrology chapter.

PEER REVIEW PANEL RECOMMENDATIONS

Recommendations: *There is a need to graph past annual measures of each of the hydrological categories of data, to provide insight into the annual variation. The current system masks such understanding by combining all data prior to 2003 in one number.*

Add a brief explanation of the hydrologic data analysis procedures to be used when there is more time to prepare Chapter 5.

Response: A section on hydrologic variation will be added in next year's report.

With the assumption that more time is available, the chapter, in general, will be expanded to address reviewers' comments. The following will be added:

- a section on hydrologic variation
- an expanded *Evapotranspiration* section
- the 2004 hurricane season
- complete regulation schedules for lakes and WCAs

RESPONSE TO USDOI - TECHNICAL REVIEW COMMENTS

Comment: *General - Historical average for WCA-1 (throughout document): There have been four different regulation schedules in WCA-1. The "historical" information masks the effects of each schedule. It may be more relevant to look at the period of record for the current regulation schedule (1995 on).*

Response: From historical average water level point of view, the current historical average water level graph is an objective presentation. Regardless of the cause of change in water level, the historical average is of significant interest. Also, the WY2003 and the WY2004 stages are presented along with the current regulation schedule. For next year, the monthly average stage for

the current regulation schedule (1995–2004) will also be presented in a separate graph compared to the current and previous year water levels.

Comment: *p. 5-1, Summary, 1st para: "This chapter updates hydrologic data and analysis from the 2004 Everglades Consolidated Report and has expanded coverage to address the hydrology of the area within the District's boundaries, providing a more comprehensive overview of the South Florida hydrology.. Be more explicit as to what this means. What areas were added that were not in last year's report?*

Response: The following sentence in the same paragraph states that the 2004 Everglades Consolidated Report covered only the Everglades Protection Area. In this chapter, the hydrology of the major hydrologic systems from the Upper Kissimmee Chain of Lakes in the north to the Everglades National Park (Park or ENP) in the south is presented." The following paragraphs, maps, and figures provide details of the areas included. As we revise the chapter for next year, clarity will be an objective.

Comment: *p. 5-4, 3rd para: Thank you for correctly describing the relationship between WCA-1 and the Arthur R. Marshall Loxahatchee National Wildlife Refuge!*

Response: Comment of appreciation is noted.

Comment: *p. 5-4, Hydrology: In sentences like the one below (throughout the chapter), make one sentence by eliminating the parts after the reference to the figure:*

"The SFWMD area is divided into 14 rainfall areas for operational purposes. Figure 5-2 depicts these rainfall areas…"

Response: Figure 5-2 depicts these rainfall areas and ENP. The reason why it is two sentences is because of the phrase "and ENP."

Comment: *p. 5-4, Hydrology: It would be very helpful to have a table showing which stations are used for which summaries, the period of record and any references to data summaries.*

Response: Published sources of historical average annual rainfall are cited. Interested readers can find the list of stations, data analysis, data gaps, and data quality issues and other details from the literature cited. Providing a list of stations and period of records will enlarge the volume of this report without providing the complete picture of how the annual average rainfall was acquired by the authors cited in this report.

Comment: *p. 5-4, Hydrology: Which stations are used for WCA-1 and WCA-2 rainfall values? Are they averaged? Why is it mentioned that the ENP rainfall is an average of 4 stations, but there is no indication of how other values are calculated?*

Response: The District OMD rainfall website provides Theissen-weighted average daily rainfall data for all 14 areas. The stations for each rain area and the data can be found at http://www.sfwmd.gov/org/omd/ops/weather/site_frm.html. Because there is no Theissen-weighted data for ENP, a simple average of four stations was used.

Comment: *p. 5-4, Hydrology: The varying length of data from rainfall stations means that among areas comparisons are being made to different benchmarks. We know that there are decadal and greater patterns in rainfall. The table mentioned above would help the reader be able to evaluate the data in the appropriate temporal context.*

Response: The source of average rainfall data has been cited and references added. Interested readers who want details on the stations used, period of record, and effect of decadal variation on the means can refer to the source reference publication.

Comment: *p. 5-7, 3rd full paragraph: Hydrologic indicator for what? This seems out of place.*

Response: The statement has been eliminated.

Comment: *p. 5-4, Hydrology, Figures: Lines on monthly rainfall and ET graphs were hard to distinguish when printed in black and white. Maybe use a third type of dashed line and increase the symbol size.*

Response: This report is prepared primarily for electronic format (in color). For the next report, every effort will be made to put more contrast in figures with black and white printing in mind.

Comment: *p. 5-16, Evapotranspiration: Same comment as for rainfall station–a table listing the sites used would be helpful.*

Response: In next year's report, the *Evapotranspiration* section will be expanded and will include details of the ET model applied and the weather monitoring sites.

Comment: *p. 5-16, Evapotranspiration: Are ETp values based on pan evaporation at weather sites, other field measurements, or on some equation? If an equation is used, please provide the equation and a citation to support its appropriate use.*

Response: Revision has been made in the current chapter where the ET model (equation) is included. In next year's report, the *Evapotranspiration* section will be expanded and will include details of the ET model applied and the weather monitoring sites.

Comment: *p. 5-17, Water Levels, General: Make it clear what stations are used for the analysis.*

Response: Revisions have been made as suggested to include water level stations in the text and in the caption of the monthly average graphs.

Comment: *p. 5-24: There are six water level stations in WCA-1(1-8c, 1-8t, 1-7, 1-9, north Lox, south Lox). Four of them are used for determining water management (1-8c, 1-8t, 1-7, 1-9) depending on the time of year and whether water is rising or falling. Whether WCA-1 is within the regulation schedule is not measured by the 1-7 gauge alone.*

Response: Changes have been made as suggested. Stations 1-8C, 1-8T, 1-7, and 1-9 are used as required in the regulation schedule.

Comment: *p. 5-24: The regulation schedule for WCA-1 has two parts–the upper line and the lower line. In the discussions in this chapter only the upper bound is mentioned.*

Response: The regulation schedule that was relevant to WY2004 water levels is shown in the figure; for next year, we will include full regulation schedule for all WCAs and lakes, probably as an appendix.

Comment: *p. 5-25, Figure 5-29: As mentioned earlier, it may be more relevant to compare water year 2004 to water levels since the implementation of the current regulation schedule, rather than the entire period of record.*

Response: Please see response for comment # 1.

Comment: *p. 5-25, Figure 5-29: For those of us who are used to looking at the regulation schedule as prepared by the COE, the presentation here was a little confusing. A note in the caption of how the values on the graph relate to what we see on the schedule would be helpful.*

Response: In the text where Figure 5-29 and other related figures are cited, the following text has been added: "regulation schedule corresponding to WY2004 water levels, as reported in the SFWMD's Daily System Storage Report, available online at http://www.sfwmd.gov/org/ema/reports/sstorage/sstorage.pdf."

Comment: *p. 5-35, 1st sentence: Give some examples of what the "other water management decision factors" are.*

Response: The phrase "other water management decision factors" has been removed.

Comment: *p. 5-35: For a better historical understanding of flows in WCA-1 and WCA-2, it should be noted that the S-10E structure has not been significantly used since April 1997, and that the S-6 pump was diverted from the Refuge to STA-2 in May 2001.*

Response: S-10E has been removed from the list of outflow points for WCA-1 for WY2004. The following sentence has been added to the section on inflows to WCA-1: "S-6 pump discharge has been diverted from WCA-1 into STA-2 since May 2001."

Comment: *p. 5-25, Everglades Protection Area Flows, General: Same comment as previously with historic values (#1). Maybe more relevant to use 1995 on.*

Response: It is anticipated that readers will be more interested in a longer period of inflows and outflows than 1995 to the present.

Comment: *p. 5-25, 2nd para: Mention that discharges through G-300 and G-301 are bypass events and point the reader to where in the report these are discussed in relation to water quality compliance issues.*

Response: Inflows into WCA are on page 5-35. The statement with reference to G300 and G301 inflows to WCA-1 has been edited as follows: "The remaining 5 percent of the inflow were mainly through structures G-300 and G-301, which discharge from the inflow and distribution impoundment of STA-1W, where almost all the source is the S-5A pump station bypassing STA-1W." Because there are many structures cited in Chapter 5 and there aren't any links to chapters on water quality, there is no reason why G300 and G301 should be singled out.

Comment: *p. 5-25, 2nd para: Were there outflows through S-10E? If not delete it from the list.*

Response: As suggested, S-10E has been removed from the list of outflow points in WCA-1 for WY2004.

Comment: *p. 5-41, Figure 5-50: Inflows and outflow arrows were confusing since outflows from one area are inflows to another. In looking at WCA-1 I expected to see an inflow arrow at the north end. For the outflow arrow from WCA-1, since 51% of the outflow is out S39, move the arrow south. What criteria were used to put the arrows on the map? In the text more outflow areas are discussed. 29% from WCA-1 goes into WCA-2, but this is not shown. Explain what is meant by major hydrologic components.*

Response: Major changes will be made in the format of Figure 5-50 in next year's report; arrows will be distinguished by color and thickness proportional to magnitude of flow.

Comment: *p. 5-42: It would be nice in the future to have a synthesis for each major area that pulls together all the pieces of the water budget presented– rainfall, ET, inflow, outflow and discusses it in the context of recent and longer term conditions. The conclusions section is a start on this, but does not discuss how rainfall and ET relate to inflows and outflows.*

Response: Comment will be given consideration in the continuing expansion of the chapter.

Comment: *p. 5-42, paragraph 4: Please note that the difference between current average annual stage and historic average is likely the result of the change in regulation schedule in 1995.*

Response: Please see response to comment # 1.

Comment: *App. 5-1-11: Make it clear what station the data are from how does this relate to the discussion in the text since it appears the text was based on the 1-7 and appendix is for 1-8c?*

Response: Please see response to comment # 13.

Comment: *App. 5-1 general: Make the graph landscape (or at least two panels) so that it can be read more easily. Put on labels for when the WCA-1 regulation schedule changed.*

Response: The graph format has been changed to landscape.

Chapter 6: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS (STRAYER)

Comment: *This is a useful, but uneven, chapter, with both strong and weak sections. The sections on wading birds and landscape ecology seemed fine (are wading birds the only aspect of "wildlife" to be considered?).*

Response: There is little to report on wildlife because three of the four wildlife ecologists left the District during the past year. The District is in the process of hiring new staff and developing a new Wildlife Research Plan.

Comment: *It would be helpful to open the plant ecology section with a little more contextual information – a map of the Rotenberger WMA (showing hydrologic connections), and an explanation that it will receive water from an STA would help set the stage and make the text easier to understand. Near the bottom of page 6-6, it would be helpful to give some numbers showing how high "elevated" P concentrations are.*

Response: The Rotenberger map has been revised to highlight its location in the system, the adjoining STA, and the inflow pump structure (G-410). The text has been modified to include the mean surface water TP concentration levels near the inflow (at 0.25 km from inflow) and at 4.0 km from inflows. The respective mean TP concentration values are 0.058 mg/L and 0.022 mg/L.

Comment: *Do tree seedling studies (p. 6-8) include exotic species? It would seem useful to know the responses of exotics to changes in the water regime.*

Response: This study does not include exotic species. More is known about invasive exotic trees such as Brazilian pepper and melaleuca than native species because other agencies, such as the USDA, study exotics and spend significant resources to eradicate them. However, little is known about the exotic/invasive *Lygodium*, and this plant will be included in the District's 2005 experiments.

Comment: *Questions on Periphyton & Hard Water included: What are the broader, long-term impacts? Will there be enhanced marl precipitation? Will there be soil conversion from peat to marl? What about enhanced sulfate reduction?*

Response: The experiment was not designed to answer these questions; however, the points are valid and may illustrate what has happened as a result of EAA runoff in WCA-2A. This statement has been added to the text: "These experimental results may aid in the management of the Everglades to prevent the loss of peat-dominated regions due to long-term exposure to mineral-rich surface waters."

Comment: *Questions on Tree Island Processes: Why focus on litterfall and root biomass? How many tree islands were included in the litterfall study? Litterfall = primary production and health? What about herbivory and competition? Conclusions need more support.*

Response: Tree growth and community structure are also being investigated, as well as soil and plant nutrient content. Litterfall and roots are the only two processes with new information. There are four–10 x 10 m plots per island, nine islands, and about 30 to 60 trees per plot. The total number of trees is between 10,800 and 21,600.

The text has been revised to clarify that litterfall does not equal primary production and that health is a multi-dimensional index that has yet to be developed.

Herbivory and competition effect litterfall at the species level.

The conclusions have been revised to reflect community-level responses, not species-level contributions.

Comment: *In the section on roots, why was it thought that hydroperiod would affect root biomass? Why was root biomass studied at all? What does root biomass tell you about system function?*

Response: The measurement of belowground (and aboveground) biomass is needed to establish the big picture of forest ecosystem productivity and dynamics. It is a critical facet of wetland ecology that is both seriously overlooked and not understood properly. This research will contribute to the understanding of how growth and stress are related to the hydrologic environment, which will then contribute to better water management with the eventual hope of reversing past tree island trends. Hydroperiod and depth have already been shown to influence tree islands; the roots are studied to learn the mechanics of this process.

Comment: *The (root) study is not very well replicated (one site in each of four hydrologic regimes), limiting its ability to support inferences.*

Response: Four islands were used for this report and five additional tree islands will be used for the final analysis. All results at this point are still preliminary because of this constraint. It is also important to note that each island has two root-bag studies (one associated with the Head and another associated with the Tail), creating a total sample size of 18.

Comment: *Did colloidal silica provide a reliable separation of live and dead roots? Provide a reference or data from your own study showing that this is a good method. (Dead roots are so abundant that a small amount of contamination of the live root samples by dead roots could greatly change the pattern shown in Fig. 6-11).*

Response: Colloidal silica is a method that has been utilized since 1993 and has proven to work for tropical woody species. Robertson and Dixon (1993) found that silica removed 96% (± 2%) of the dead roots from root samples obtained from *Ceriops tagal* forests and 90% (± 4%) of those obtained from *Rhizopohora stylosa* forests. Based on the initial trails, the colloidal silica technique is reliable and live root production will not be masked by dead root "contamination."

Comment: *In reference to the Long-Term Plan: "Page 6-34, top paragraph: note that water redistribution will newly expose areas to high calcium, sulfate, etc., as well as P.*

Response: The outflow from the STAs is characterized as hard water and may impact downstream soft-water rain-driven systems, such as the Refuge, with low alkalinity water. Downstream nutrient and ionic effects are currently being monitored. This section of Chapter 6 has been modified to indicate that while the monitoring program focuses on TP, it also includes monitoring for the effects of other constituents.

LITERATURE CITED

Robertson, A.I., and P. Dixon. 1993. Separating live and dead fine roots using colloidal silica: an example from mangrove forests. *Plant and Soil*, 157: 151-154.

Ehrenfeld, J.G., W.F.J. Parsons, X. Han, R.W. Parmelee and W. Zhu. 1997. Live and dead roots in forest soil horizons: contrasting effects on nitrogen dynamics. *Ecology,* 78: 348-362.

Majdi, H. 1996. Root sampling methods-applications and limitations of the minirhizotron technique. *Plant and Soil,* 185: 255-258.

Vogt, K.A., D.J. Vogt and J. Bloomfield. 1998. Analysis of some direct and indirect methods for estimating root biomass and production of forests at an ecosystem level. *Plant and Soil*, 200: 71-89.

PEER REVIEW PANEL COMMENTS (VAN DONK)

Comment: *It is not clear for me whether the experiments, to examine how the softwater periphyton assemblages in the refuge might change as a consequence of mineral content, are performed in flow-through systems.*

Response: The experiment was not performed in a flow-through system. Each treatment was an independent core containing the water of a specific conductivity. It has been addressed with the following statement: "Treatment water was added to each core once a week to maintain conductivity and account for evaporative losses."

PEER REVIEW PANEL COMMENTS (BURGER)

Comment: *This is a useful chapter, but I would like to see the section titles reflect the topic being discussed. For example, the topic is 'wildlife', but all that is discussed is nesting wading birds.*

Response: The section titles are consistent with previous reports; however, this point was addressed by inserting a short introductory paragraph after each section topic. As previously noted, there is little to report on wildlife because several wildlife ecologists left the District during the past year. The District is in the process of hiring new staff and developing a new Wildlife Research Plan.

Comment: *The second Paragraph of the wading bird monitoring section is confusing. How can the number of wading bird nests equal 45,885 (a very exact number), and yet later in the same paragraph, the statement is made that nest numbers of other wading birds (other than ibis) 'have yet to be ascertained'?*

Response: The exact number is what was available at that time (figures for wood stork and smaller herons were not complete). The nesting numbers for South Florida are now final: 52,638 nests. This is a 56% increase from 2003 and a 2-percent decline from the record year of 2002.

This continues a recent trend toward a larger number of total nesting attempts and is caused by a greater nesting effort by white ibis. Nesting attempts by wood storks, snowy egrets, tri-colored herons, and little blue herons decreased compared with 2003 and 2002.

Comment: *I am wondering about the statement that Wood Storks are more sensitive to reversals later in the season. Doesn't it depend entirely upon exactly when in their breeding cycle these occur, and upon the duration of the reversal?*

Response: This is correct: The timing and duration of reversals are critical. A high proportion of wood stork nests were abandoned after water level reversals occurred in late February and again in early April. No abandonment was observed during a water reversal in May (when chicks were older). Wood storks appear to be less sensitive to reversals later in the season.

Comment: *Were the white ibis nesting in the same place as wood storks?*

Response: They nest together in some areas and not in others. Nest desertion by these two species is usually simultaneous; however, this year stork-nest desertion occurred before the onset of ibis nesting.

Comment: *Is the appropriate group looking at the target numbers for Wood Storks. Historically the numbers were much higher, and a higher target may now be appropriate as the Everglades recovers?*

Response: Wood storks fared poorly in 2004. Nesting attempts were down by 26 percent when compared with 2003 figures; they were down by 41 percent when compared with 2002 figures. CERP uses numerous scientists and an adaptive management approach to adjust restoration target numbers.

Comment: *It might be useful to state what the management goal is for the Rotenberger WMA. What is the target vegetation?*

Response: The original permit and MOA for the RWMA states a very vague objective for ecosystem restoration goals and does not specify a vegetation community. Similar comments were addressed in the final Rotenberger report submitted to the FDEP with the following statement:

> While a 1983 Memorandum of Agreement outlining the restoration plan for the RWMA specified in general terms the need to manage this system in a manner that attempts to restore and preserve natural Everglades habitat, a specific ecosystem restoration target (i.e. defining the target habitat and specific vegetation cover) for the RWMA has not yet been established. However, the STA-5 discharge Permit No. 0131842, requires the District to monitor downstream receiving areas, such as RWMA, in order to assess for any ecological effects of discharge. Therefore, the monitoring and research program was designed to assess not only the success of hydropattern restoration but also the ecological effects of inundation. This information will provide decision-makers with the ecological data needed to implement sound environmental management decisions that will aid in the restoration of the Everglades.

Comment: *Are there data that examines the effect of different distances between tree islands on plants themselves and on wildlife that use them. If there are fewer now overall than in the past, is there a landscape level problem with their distribution? Are there more tree islands in the southern part of the Everglades?*

Response: A few studies have examined tree islands from a landscape perspective. Brandt (2002) has shown that the shape of islands and their distribution has shifted in WCA-1 because of hydrology and fire. Gaines (2002) has shown that cotton and rice rat abundance and movements are affected by island size. No one has developed a study to specifically understand the effect of distances between islands; however, the District expects to complete a spatial analysis of tree island change (1940–2000) to partially address this issue by summer 2005.

Comment: *How long is the greenhouse study? Are there any preliminary results? What phosphorus/nitrogen regime is being used? Is it typical of the north or more southerly parts of the Everglades?"*

Response: The seedling study was designed to last one year; it may be extended after the results are reviewed. Preliminary results indicate that pond apple may be the most plastic in terms of hydrologic niche space. Nutrient regime: Soil for this experiment came from islands in the southern regions of WCA-3.

Comment: *Just for understanding the entire ecosystem, would it be possible to add mercury levels to Table 6.2?*

Response: Because of the sampling complexity for Hg, the District maintains separate Hg Monitoring and Ecology Research programs.

Comment: *How will the information on litterfall be used? in management? How were the hydrological environments determined? Perhaps this needs a little expansion.*

Response: As part of the island selection process, the hydrologic environments were determined "a priori." The litterfall section has been revised and expanded to refer to previous ECRs and emphasize that litterfall is an ecological function associated with tree island nutrient dynamics, soil formation, and primary production. As such, it will be used as part of a carbon-flow model to understand how islands maintain their elevations and keep up with subsidence. The study of litterfall was initiated because the public reported that trees were losing leaves from poor hydrologic management at "inappropriate" times. The timing of litterfall for these tropical species was previously not known; it is now known that some species will "naturally" lose leaves over a relatively short period of time, most trees lose leaves during the dry season, and extended hydroperiods can reduce litterfall production. Note: This study is scheduled to end December 31, 2004.

Comment: *Do the 4 (tree) species contribute more because they are more common, or produce more leaves proportionally? Presumably the islands did not have equal tree species composition.*

Response: The four species produce more litterfall per square meter than all other species combined. They are also commonly found on tree islands; however, islands do not have equal tree-species composition. A more detailed litterfall analysis will be produced once a detailed analysis of tree island community structure is completed. The text has been modified to emphasize island effects rather than species effects.

Comment: *The belowground work is crucial - will it continue for a few years to assess differences due to water level differences?*

Response: The belowground growth study will occur for three years and will assess differences due to water levels and hydroperiods, both across and within as many as nine islands. This new, difficult work could shed significant light on the hydrologic stresses responsible for the loss of 60% of the islands in WCA-3 since 1940.

Comment: *What is the long range objectives of the WCA-3 Mapping Project?*

Response: The chapter has been revised and now discusses the objectives of the project more explicitly. The project will be used to document vegetation changes at the landscape scale. It will also be correlated with operational and structural changes associated with CERP (especially the Decompartmentalization Project) and used by RECOVER to measure the success of Everglades restoration.

RESPONSE TO USDOI - TECHNICAL REVIEW COMMENTS

Comment: *This chapter is an important component of the SFER and contains much information that is relevant to restoration, particularly CERP. The authors have made great improvements over previous years' efforts to tie together the loosely organized compendium of sections that are written in different styles and that contain different levels of detail. The chapter would benefit even further from a synthesis section that suggests what the management implications are of the results presented – that is, a more refined version of the existing Summary section. The management implications are very important to elucidate, and the authors should present possible implications wherever possible. This would be more useful if it was a synthesis of the needs, objectives, and results in a synthesized form, rather than a cut and past of the individual section summaries. For example, here are a few of the main take-home messages from this chapter with potential management implications we observed:*

Several water level reversals (from rain events) led to more variable wading bird nesting in 2004 than 2003.

While hydropatterns were improved in Rotenberger, cattail continued to expand and high phosphorus levels near the inflow remain of concern. The District is committed to continuing detailed efforts to better understand the ecological effects of hydropattern restoration.

Conductivity is a sensitive measure of canal intrusion and continuous monitoring may be a valuable tool to optimize operational decisions to protect the softwater nature of the Refuge.

Structural changes in Refuge periphyton occurred over a temporal period of less than one month when exposed to high-conductivity marsh water.

Response: These are excellent suggestions and management implications are given wherever possible. But there is a strong need for synthesis and the resources are not available to do a synthesis on an annual basis. This issue will be discussed with management to determine if this can be accomplished on a five-year timeframe.

Comment: *General (may be applicable to other chapters too): Is the correct term flood control or flood protection?*

Response: Flood protection is the correct term.

Comment: *General (may be applicable to other chapters too): What is the time period that the report/chapter covers? The hydrology chapter covers the water year. This chapter goes beyond that through at least June.*

Response: Occasionally, to support a conclusion or hypothesis, the chapter does go beyond the water year at times. The report should cover only the water-year.

Comment: *General: The first paragraph of the summary states that the "Programs of study were based on the short-term and long-term needs of the South Florida Water Management District operations, regulations, permitting, environmental monitoring, Everglades Forever Act mandates, and the Comprehensive Everglades Restoration Plan (CERP)" but there is not a consistent description of the need or tie-back to these needs in the individual sections. How are these studies relevant to management? There needs to be a more explicit tie to how the information presented here will be used in water management decisions. Some sections do a better job than others.*

Response: All summaries have been revised.

Comment: *General (may be applicable to other chapters too): A stronger tie to the hydrologic analyses presented in Chapter 5 would help to pull the hydrologic and ecologic chapters together.*

Response: That is true.

Comment: *General: Out of all the projects being conducted, why were the ones presented here included and others not? For example, where is the update on LILA?*

Response: Because the review panel has specifically stated it does not want to see all the projects, only projects or studies that have made significant progress are reported.

Comment: *p. 6-1: There is no mention of the conductivity mapping in the summary section for ecosystem.*

Response: This has been revised.

Comment: *p. 6-3, Introduction, 1st para, 4th sentence: van der Valk, not Valk.*

Response: This has been corrected.

Comment: *p. 6-4, Wading Bird Monitoring: In the first paragraph there is reference to wading birds playing a prominent role in adaptive protocols, minimum flows and levels and day-to-day operations of the District. We expected further discussion of this. How do the findings tie back to this?*

Response: It is assumed that the reader knows that the water policy is to protect the environment. Previous Everglades Consolidated Reports have discussed this information in more detail.

Comment: *p. 6-4, Wading Bird Monitoring: A graphic of the nesting effort by region would help to illustrate the spatial distribution of nesting.*

Response: Refer to the Annual Wading Bird Report for more details on this subject.

Comment: *p. 6-4, Wading Bird Monitoring: Discuss levels of uncertainty associated with bird count estimates.*

Response: Calculating the levels of uncertainty will be considered for inclusion in the next report.

Comment: *p. 6-5 last para: Three groups of species met the numeric nesting targets proposed by the South Florida Restoration Task Force. Need a reference for this. The table references CERP targets. These are not the same thing. The targets may be the same, but the origins are different.*

Response: This has been revised.

Comment: *p. 6-5, Table 6-1: What is the Base Low/High. Explain in the caption.*

Response: The "Base Low/High" is the range observed during the "CERP-based" period from 1986–1995. Table 6-1 has been modified.

Comment: *p. 6-6: It is clear from this section that Rotenberger Wildlife Management Area is responding to increased hydroperiods as part of the hydropattern restoration effort. However, there are no corresponding water quality data provided as part of this section to allow the assessment of hydropattern restoration with nutrient-rich water. It is our understanding that the SFWMD has been collecting water quality data, and perhaps sediment nutrient data. A "preliminary analysis" is noted in the last paragraph, although data were presented in the 2004 ECR. The primary concern is that research and experience strongly suggests that recovery of a marsh from nutrient enrichment takes far longer than recovery from being too dry. In fact, the relatively rapid response of the plant community in Rotenberger supports this suggestion. Also, data from other marshes that have been subjected to nutrient enrichment suggest that it will take decades or more for recovery without human intervention. These different time scales raise the very important question of the wisdom of hydrological restoration proceeding with dirty water.*

Response: Additional water quality information has been included.

Comment: *p. 6-6, Restoration of Rotenberger: Include data and sample locations for phosphorus concentration levels in relation to vegetation types.*

Response: This has been revised.

Comment: *p. 6-6, 5th para: It would help to have citations supporting statements about obligate plant species and their response to nutrient status.*

Response: Citations will be included in the next report.

Comment: *p. 6-7, Figures 6-1 and 6-2: Explain why there is a 0.25 ft offset.*

Response: There will be an attempt to revise this before the report goes to press.

Comment: *p. 6-7, Figure 6-2: Make the graphic larger (change stage scale to 11-13.5) so that the confidence intervals can be seen. Maybe present as a shaded band with the lines as overlays.*

Response: This has been revised.

Comment: *p. 6-8, Tree island seedling study: Need a reference for pond apple, red maple, and gumbo limbo as being dominant tree island species. Also explain that they are dominant in WCA 3 and 2(?). They are not dominant in WCA-1. Why these species when litterfall work show greatest volume from pond apple, cocoplum, wax myrtle, and willow?*

Response: This has been revised.

Comment: *p. 6-8, Tree island seedling study: Define for the reader what "compound treatments" are.*

Response: This has been revised.

Comment: *p. 6-8, Tree island seedling study: How will the results of this study provide the district with critical information necessary to meet urban water demands…? Give examples.*

Response: The reference to urban water demands has been removed.

Comment: *p. 6-8, Tree island seedling study: Will the treatments of wet and dry correspond to the times of year when the trees would experience wet and dry conditions? Could this be a factor in the results?*

Response: Actual wet and dry seasons were factored into the design.

Comment: *p. 6-11, Influence of water mineral content: In first paragraph write out Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge).*

Response: This has been revised.

Comment: *p. 6-11, Influence of water mineral content: Synoptic survey information is not described in the summary.*

Response: This has been revised.

Comment: *p. 6-11: The SFWMD is to be commended for initiating this very important research effort, as it has significant implications to the Refuge. Chapter 2A of this report indicates significant increases in conductivity and other indicators of canal water intrusion (such as sulfate) into the Refuge interior. Chapter 6 should included a discussion of those potential impacts to the Refuge using the actual data that are presented in another section of the very same report. This observation points out the need for some level of discussion or collaboration between authors of different chapters.*

Response: This has been revised.

Comment: *p. 6-15, 1st para: It should be no surprise that a biologically reactive element such as P shows no distinct spatial pattern when compared to conservative tracers such as chloride. It is much more likely that uptake of reactive P species led to the lack of a spatial pattern than artifacts potentially introduced by sampling methods. In fact, grab sampling is the method utilized in the Refuge to collect water quality samples used for assessing compliance with the Settlement Agreement.*

Response: That is a relevant point.

Comment: *p. 6-18, Table 6-3 caption: delete the –1 for "tube–1"".*

Response: This has been revised.

Comment: *p. 6-19, last para: Again, actual data reported in Chapter 2A should be used in this discussion section to relate the experimental results to patterns of water chemistry inside the Refuge.*

Response: This has been revised.

Comment: *p. 6-21, Tree island ecological process: Have one introduction for the two sections: litterfall and belowground biomass that explains how these two projects are related to the creation of tree island performance measures and other management.*

Response: This has been revised.

Comment: *p. 6-21, Tree island ecological process: Is there a report further describing the determination of the inundation depths and durations? If so, cite it.*

Response: There is no other report or manuscript.

Comment: *p. 6-21, 2nd para: Should long hydroperiod be "inundated more than 50 percent…" or59 percent as written? If 59 what is the category between 50 and 59?*

Response: This has been revised.

Comment: *p. 6-21, Tree island ecological process: Explain how the results help establish performance measures as is stated in the first paragraph. What does the relationship between hydrology and litterfall tell you about the condition of the tree island and what we hope to achieve with restoration/appropriate water management?*

Response: The entire tree island section has been revised.

Comment: *p. 6-22, Fig. 6-10: What are these error bars?*

Response: These are SD bars. There will be an attempt to revise this before the report goes to press.

Comment: *p. 6-23, Belowground biomass: How does below ground biomass help with understanding how the vegetation composition, diversity and structure vary over the range of environmental conditions? Is biomass a vegetation structure attribute? More information is needed as to how hydrology is directly related to the creation of organic matter.*

Response: The entire tree island section has been revised.

Comment: *p. 6-23, Belowground biomass: How does this section relate to the previous section on litterfall and the bigger picture of establishing performance measures and making appropriate management decisions?*

Response: The entire tree island section has been revised.

Comment: *p. 6-23: The four islands sampled have both different hydropatterns and different species yet the conclusions/discussions focus on the former with only a brief mention of the later. Don't the tree species have different growth forms that might significantly affect the patterns?*

Response: The entire tree island section has been revised.

Comment: *p. 6-25, Figure 6-11: Define in the caption the box-whisker plots.*

Response: This has been revised.

Comment: *p. 6-26, Landscape Ecology: First paragraph does not match with what is in the section. It appears to be from last year's report.*

Response: This has been revised.

Comment: *p. 6-26, WCA-3 Mapping: What year was the photography? Why are these results being presented here if they are from an effort started in 1994? Do they represent an update?*

Response: This is more than an update – it is the finished product of a 10-year effort and has never been presented before. The image is from 1994.

Comment: *p. 6-26, WCA-3 Mapping: How will this information be used within the context of DECOMP?*

Response: DECOMP needs base conditions as does CERP.

Comment: *p. 6-26, WCA-3 Mapping: How will what was learned be incorporated into RECOVER vegetation mapping?*

Response: Techniques and scopes of work for RECOVER are based on the experience developed during the WCA-3 mapping.

Comment: *p. 6-34: Discuss the status and intent of the external peer review of the ELM so the reader knows where the model development stands overall.*

Response: That is a good point; however, ELM is no longer in the District's Everglades Division and its discussion is more appropriately placed in the chapter(s) that examines CERP and/or the Interagency Modeling Center.

Comment: *p. 6-35, Options for accelerating: Should be "Recovery" not "RECOVER".*

Response: This has been revised.

Chapter 7: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Response: The authors appreciate the positive comments on this year's chapter and the recognition that the integration function of RECOVER should continue to be emphasized. The importance of consensus building was also highlighted in the panel's comments.

Response: "RECOVER" was identified in the text as an acronym.

RESPONSE TO USDOI – EVERGLADES PROGRAM TEAM

The authors appreciate the Everglades Program Team's comments. In general, the authors agreed with the comments made and added clarifying language in the text.

RESPONSE TO USDOI – U.S. FISH AND WILDLIFE SERVICE, SFFO

The authors appreciate the comments of the FWS. The text in the chapter was revised as per the USDOI's suggestions.

Chapter 8: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Comment: *This chapter is a summary of the Long-Term Plan, and its implementation. The chapter includes sections dealing with the Plan's overview, revisions, challenges to achieving long-term water quality goals, and conclusions. The importance of the Plan is clear as it guides the achievement and maintenance of water quality standards in the EPA, including the new phosphorus criterion.*

The numerous and diverse regulatory requirements that have been implemented over the years present unique challenges to the regulators and well as those regulated. The 2005 SFER, like those before it, has addressed these requirements and how the District's response. In doing so, the District has brought together the various initiatives and projects underway, the results achieved so far, and the conclusions that can be reached and lessons. There is however a certain fragmentation in the report that is inherent due to the many regulatory requirements involved.

The Long-Term Plan can integrate the regulatory requirements with the water quality management activities undertaken and planned and identify the scientific studies needed to underpin management actions. This chapter provides some information about those regulatory and management plans, but it could be enhanced considerably with an elaboration of the management process, the overall results to date, and progress in achieving the water quality goals.

The fact that additional measures are necessary to achieve the overall Everglades water quality goal should come as no surprise to anyone following this complex process for the last several years. Nevertheless the Panel noted progress made in achieving reduced TP levels in water discharged into the EPA as required by the Everglades Forever Act. In referring to Chapters 3 and 4 of the 2005 report, the Panel also noted that the best management practices implemented in the Everglades Agricultural Area and the impact of the Stormwater Treatment Areas have had a positive and measurable affect in terms of reducing P loads into the Everglades system.

The organization of the Long-Term Plan into Pre 2006, Process Development and Engineering, and Post 2006 is a logical one given the December 31, 2006 deadline for complying with the terms of the EFA. It is likely that additional water quality improvement measures will be required after 2006.

The Panel agrees with the rationale utilized in preparing the Long-Term Plan objectives – adaptive management, continued investigations, and measurement of performance and economic benefits realized by implementing water quality measures – as logical given the iterative nature of this planning and restoration process as well as the reality of changing variables (input totals and sources) from the many contributing sources to water entering the EPA.

Several challenges to achieving long-term water quality as defined in the law were noted in the report including regulatory issues, uncertainty in terms of the long-term performance of new technologies, and unknowns related to the CERP. The Panel noted these concerns. The report also stresses that many CERP projects are still in the early planning stages and therefore it is unclear as to how they will impact water quality. However, now that the final decision has been made supporting the adopted phosphorus rule, the District can at least put that particular debate behind it as planning and implementation activities proceed.

A review of the Long-Term Plan continues to raise the issues related to monitoring as a way of gathering new data and improving the Plan itself. In Sections 5 "PDE" and 8 "Operation, Maintenance and Monitoring" of the 2004 SFER, the operational aspects of monitoring progress towards attaining water quality goals were noted, but neither that report nor the 2005 SFER provides insights into how such information will be treated either legally or scientifically as implementation of new projects proceeds.

Specific recommendations are as follows:

Comment: *Clarify who - the District or FDEP - has the responsibility for updating the baseline data sets noted on Page 8-7.*

Response: The District is responsible for updating the baseline data sets. The text has been clarified.

Comment: *Provide the bases for the assumptions presented in the "comparison of WY2004 P Loads to the 1979-1988 Baseline" section of the report over the long-term, given that no basis for long-term predictions exists.*

Response: These assumptions were based on relevant professional judgments. The text has been revised.

Comment: *Updated baseline data sets should distinguish between pre-TP controls and post-TP controls.*

Response: The baseline data sets, as well as the updated data sets, distinguish between the pre- and post-BMP periods.

Comment: *Studies of basins with limited current data, such as C-51W, should also be undertaken.*

Response: The Long-Term Plan includes studies for other basins with limited current data, including C-51W.

Comment: *TP loads to the EPA are not given in a way that is easily comprehendible. Since a focus of this chapter is the phosphorus load to the EPA, Table 8-3 needs to be rearranged so it depicts the TP mass balance for the EPA. TP loads going from areas into STAs need to be separated so that only loads into and out of the EPA are included.*

Response: Table headings were clarified to distinguish those loads going into the EPA.

Comment: *A figure should be added showing the EPA and surrounding areas with the TP loads from those areas shown. Such a visual presentation will clearly indicate the major sources of TP to the EPA as well as help explain the TP concentrations found in the water within the EPA.*

Response: Such a figure was included in previous reports; however, it was removed this year in response to comments that the figure was confusing.

Comment: *Table 8-3 estimates that 65% of all TP inputs of the EPA come from atmospheric sources, yet theses inputs are poorly characterized and scarcely mentioned anywhere in the 2005 report. Atmospheric sources may be especially important because they reach directly into even the most remote parts of the EPA, bypassing many of the P-control efforts of the SFWMD. Are deposition rates really as estimated in Table 8-3? Is there large spatial and temporal variation in atmospheric inputs of TP? Is atmospherically deposited TP derived from local sources (which might be controllable by changing management practices within the SFWMD service area), or from more diffuse sources?*

Response: The following sentence has been added to the text for clarification: "Deposition rates are highly variable, and very expensive to monitor and as such, atmospheric inputs of TP are not routinely monitored."

PEER REVIEW PANEL RECOMMENDATIONS

Recommendation: *The Panel would like clarification on the comment (P. 8-12) that "comparatively little is known about the technical efficacy and economics of controlling total P loads…" The Panel's understanding is that a great deal is known about the overall impact of BMPs on TP loads. What is not clear is the impact and total cost of applying individual BMPs.*

Response: The text has been revised as follows: "Compared to what is known about source control measures in the EAA, minimal information is currently known about the technical efficacy and economics of controlling TP loads from the non-ECP basins (i.e., urban and non-EAA basins). Controlling phosphorus loads at the source, both in the EAA and the non-ECP basins, is a high priority in the Long-Term Plan. For this reason, source control development and implementation funding was provided in FY2004 and will continue to be provided throughout the implementation of the Long-Term Plan."

Recommendation: *More attention should be given to atmospheric inputs of total phosphorus. The Panel recognizes that atmospheric inputs may be difficult to measure. Nevertheless, such sources may merit increased attention, given their apparent magnitude.*

Response: Recommendation is noted.

RESPONSES TO USDOI – TECHNICAL REVIEW COMMENTS

Comment: *A portion of the excess load to the Refuge is attributed to excess runoff from the S5A basin that was not considered in the STA design. STA1E will not solve this problem.*

Response: Comment is noted.

Comment: *p. 8-12, Source Control Measures: It is asserted, "comparatively little is known about the technical efficacy and economics of controlling total phosphorus (TP) loads from these other non-ECP basins." We disagree. Great effort has been expended in recent years to investigate both the efficacy and economics of source controls within the EAA and elsewhere. Often,*

controlling pollution at its source is found to be far more effective and economical. This conclusion is supported by information presented in Chapter 3 that describes (page 3-12) the efficacy of specific management alternatives, and by TP reduction success reported in Chapter 2C and attributed to BMPs. Failure to address source controls under the LTP program cannot be justified by lack of understanding. We urge the LTP program to pursue source controls as an important element in Everglades restoration.

Response: The text has been revised as follows: "Compared to what is known about source control measures in the EAA, minimal information is currently known about the technical efficacy and economics of controlling TP loads from the non-ECP basins (i.e., urban and non-EAA basins). Controlling phosphorus loads at the source, both in the EAA and the non-ECP basins, is a high priority in the Long-Term Plan. For this reason, source control development and implementation funding was provided in FY2004 and will continue to be provided throughout the implementation of the Long-Term Plan."

Note: The following comments and responses pertain to a portion of Chapter 8 that has been moved to Chapter 2.

Comment: *p. 8-14: Table 8-4 fails to include the G-94C flow in the "From WCA1" section. In Appendix 5-2 Table 7 the total from G-94C was listed as 26 thousand acre-feet. Concentrations for G-94A, B, and C are monitored at the G-94B. The G-94B TP concentrations are the highest of all outflow monitoring sites averaging 118 µg/L (App. 3-2b-20). Thus, this is not an insignificant part of the "From" load.*

Response: The table has been revised to include G-94C.

Comment: *p. 8-14, Table 8-4: The report of "ENP Outflows" is inaccurate & misleading. Structures S334 and S197 are not outflows from the Park. S334 is clearly "upstream" of the Park (usually an inflow) and S197 reflects flows passing through C-111 canal into Biscayne Bay and not entering the Park. The Park primarily discharges to Florida Bay as marsh sheet flow at concentrations in the <4-6 ppb range, as reflected by the Park interior marsh sites.*

Response: The table has been revised.

Comment: *p. 8-16, Deduction of STA-1W load recycled from the Refuge would be acceptable only if the STA outflow does not mix with the rim canal or marsh before reentering the STA.*

Response: The text has been revised.

Comment: *p. 8-15 through 8-17: This text provides an accounting and discussion of the cumulative P loads to the Refuge relative to 1978-1988 conditions and evaluation of compliance with the consent decree's load reduction requirements. We support inclusion of the SFWMD's interpretation of this information in the SFER. However, there are potential areas of disagreement about the interpretation of the Settlement Agreement language and how the details of these calculations should be performed. These issues have not yet been fully discussed by the settling parties, and no agreement on specific computational methods has been reached. We therefore urge the authors to add sentences similar to:*

"Settling parties have not agreed on specific interpretation of load reduction language in the Settlement Agreement and Consent Decree, or details of load reduction calculation algorithms

for compliance determination. Therefore, the interpretations and calculations presented here may be different from methods ultimately selected for compliance determination."

Response: This section on phosphorus loads was added to the chapter at the request of the TOC. We await further direction from the TOC regarding future revisions to this section.

Chapter 9: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Comments: *The title of this chapter suggests that this is a comprehensive review of invasive exotic species in the South Florida environment. The chapter also reports the District's effort to control some priority species and management strategy. A more appropriate title may be: Invasive Exotic Species in the South Florida Environment. In fact, reporting the effort and results of invasive exotic species control and management strategy probably should be emphasized in this chapter.*

Response: The authors have modified the chapter title as follows: "Invasive Exotic Species in the South Florida Environment."

Comment: *The summary should also include more results of the District's effort to control priority species in the EPA other than just melaleuca.*

Response: Acreage and expenditure data has been added for other species.

Comment: *What do you mean in the statement in P. 9-3&4 "Overall, the major issue is the lack of meaningful information concerning the effect of invasive exotic species in South Florida?" How about the information described in 9-16-27?*

Response: Although the issue of invasive species is becoming a mainstream topic in some scientific circles, practical research and documentation of the impacts that these species have to native communities, both plant and animal, are still extremely limited.

Comment: *P. 9-5. What are the specific problems in the NEWTT-developed comprehensive strategic plan?*

Response: The document outlines the problem of exotic plants in general terms and provides a framework for problems specific to Florida. Key elements include the need for cross-agency consistency in assessment techniques, cross-agency consistency in data collection, an exotic plant information system, and a risk-assessment system to evaluate species invasiveness.

Comment: *P. 9-22. What do you mean by "To date, 8% of the Brazilian pepper forest has been restored"? Restored to the native species?*

Response: Substrate removal, including the removal of Brazilian pepper, is complete, and native species are colonizing these areas.

Comment: *It might be useful to add a 3rd paragraph to the introduction that explains specifically why exotic species are a problem for protection and restoration of the Everglades, naming some of the species and the ecological problems they cause.*

Response: Comment is noted.

Comment: *What is known of the biogeochemical consequences of exotic species control, especially for P, over the short-term (death of exotics) or long-term (replacement of exotics with natives)? Does exotic species control increase or decrease problems with P in the Everglades?*

Response: The answer to this question is unknown. District researchers are starting to look into this issue as it relates to *Lygodium* control.

Comment: *On Page 9-7, what is the reference for there being 40 species of marine exotics established in South Florida?*

Response: The reference is as follows: Symposium Proceedings: Invasive Species in Florida's Saltwater Systems: Where We Are and Where We're Going. Tampa Bay, Florida, November 5–6, 2002.

Comment: *On Page 9-30, the authors rightly lament the ineffective patchwork of regulations for keeping new exotics from establishing themselves in North America. Does the SFWMD work with other regional authorities to push for national and international controls on the movement of exotics, or must SFWMD wait until an exotic is well established and moving into the District before investing its resources in control?*

Response: The District has no authority to regulate importations.

Comment: *Today, the melaleuca infestation on SFWMD managed lands is no longer increasing in most areas, it has been significantly reduced. Can you give the numbers that sustain this assessment?*

Response: Yes, funding and acreage data show that District-managed lands are now under maintenance control.

Comment: *The ultimate control of melaleuca throughout the District will depend primarily on the future availability of funds. The magnitude of the treat of melaleuca and the cost of current control efforts are enormous. What are the numbers?*

Response: Funding and acreage data have been added and a cost-to-date figure has been included.

Comment: *What is missing from this chapter is a discussion of what efforts were undertaken in FY 2003 for all species listed (and what the preliminary results/conclusions were for all) except melaleuca and torpedograss, where some treatment information was provided?*

Response: Species-specific treatment data was added when available. A new tracking system is going online in FY2005, and it is hoped that this system will provide cross-department and cross-agency data on control programs regionwide.

Comment: *P. 9-14, Herbicide toxicity to Wildlife: the section is too short and not particularly well composed. Including a table listing the most commonly used herbicides in the EPA or CERP area for treatment for treatment of aquatic and upland species, their toxicity and safety, and citing studies or research indicating low toxicity or their effectiveness, could help.*

Response: A list of the most commonly used herbicides has been added to the chapter; however, the purpose of this chapter is not to reiterate information that is readily available on USEPA-approved labels. The authors feel that the inclusion of detailed toxicity data here is not particularly useful.

Comment: *P. 9-15 and 9-16, prescribed burning and water level manipulation: Section poorly written; more information is available and sections lack flow entirely.*

Response: Information on prescribed burning and water level manipulation in the context of this chapter is meant to provide a brief summary of these tools in the context of operational invasive species control. The authors do not feel that a detailed summary of these tools is warranted here.

Comment: *P. 9-27. Lobate Lac Scale: Section is entirely too short. Additional detailed information is available on this subject (e.g., the UFL/USDA fact sheet is 3 pages long).*

Response: The authors have added additional information on this species.

Comment: *P. 9-28, near middle of page: it's "Dreissena", not "Dresseina."*

Response: It has been corrected.

Comment: *P.9.1. Is the statement correct that "213 are listed primarily or exclusively due to losses caused by invasive exotic plants" or should it be invasive exotic plants and animals?*

Response: It has been corrected.

Comment: *P.9.2. Shouldn't there be an "Adaptive Management" strategy for exotic plants that is iterative?*

Response: The nature of invasive species control requires the use of adaptive management strategies. Weed control programs have a long history of both flexibility and adaptability, as well as the ability to use selected methods and approaches for site and target species conditions.

Comment: *P.9.6. While the Panel agrees that for much of the Everglades, invasive plants are the dominant problem, is the problem equally severe for fish communities?*

Response: The animal issue is much bigger than the fish issue. The problem has yet to be fully described and the magnitude of the problem is unknown.

Comment: *P.9.7. How well have efforts been coordinated between the Everglades groups and those in adjacent regions that serve as seed sources for the plants in the Everglades?*

Response: The invasive plant program is well coordinated through the Florida Exotic Pest Plant Council and NEWTT. Private landowners are beginning to play a bigger role in the invasive plant program through TAME Melaleuca and other initiatives.

Comment: *P.9.13. Could there be a table of herbicide use and amounts (within areas) of the Everglades*?

Response: A table of commonly used herbicides is provided. Currently, amounts are not easily tallied across agencies and it is hoped that the new tracking system set to go online in FY2005 will allow for the presentation of this type of data.

Comment: *P.9.13-14. Can you give some indication of how often each of these techniques is used in the Everglades?*

Response: Plant managers in South Florida use Integrated Pest Management (IPM) techniques as a standard. Effective control technologies have not been developed for animals.

Comment: *P.9.16 and following discussion: Some indication of the potential effects on wildlife should be included. Are they used as foraging or nesting places by some birds? This is an especially important question for Casuarina.*

Response: Given the known impacts of invasive plant species in the Everglades, these types of questions have not been a priority for resource managers. They would be difficult to quantify and some might ask, to what end? Native animals foraged and nested before the introduction of these invasive species. And given the limited resources we have to control invasive species, the managing agencies wish to focus on effective, adaptive management of known pest species.

Comments: *P.9.28. What do you do with Cattle Egret that arrived on its own in the 1940s? Is the distinction between immigrant, exotic, and invasive clear? And who is to make the decision about which species to control, and are there clear criteria that are understandable to a range of stakeholders?*

Response: There is a distinction between species that arrive naturally and those that are introduced. There are many factors to consider when deciding which species to prioritize for control. None of the invasive species we work with arrived naturally and the agencies working in the Everglades have developed, and recently updated, a list of priority plant species. Work with exotic animals is ongoing.

Comment: *P.9.29. Again, with respect to management, the costs to other wildlife of removal of some vegetation needs to be discussed (particularly, some trees provide nesting sites for sensitive species). This is recognized in one sentence on the bottom of 9.29, but deserved more.*

Response: Given the known impacts of invasive plant species in the Everglades, these types of questions have not been a priority for resource managers. They would be difficult to quantify and some might ask, to what end? Native animals foraged and nested before the introduction of these invasive species. And given the limited resources we have to control invasive species, the managing agencies wish to focus on effective, adaptive management of known pest species.

Chapter 10: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Comment: *An outline at the beginning of the chapter is recommended by the Panel.*

Response: A bookmarked outline is included in the electronic version of the final report.

Comment: *In this chapter it is stated that it was determined that sediment removal from the lake would not be effective in reducing internal phosphorus loading and that alternative measures, like large pits dug in the lake bottom to trap P-rich sediment material, are not feasible. The Panel should like to see that there is a clear reference in Chapter 10 to the Lake Okeechobee Sediment Removal Feasibility Study.*

Response: The feasibility study is referenced on page 10-55 in this chapter.

Comment: *Research should include the possible role of sulfate on the mobilization of phosphate. It is known that an increase in sulfate may increase the mobilization of especially phosphate from the sediments. This may be an important part of the internal eutrophication. A monitoring program for measuring other minerals than P and N is recommended.*

Response: The statement about sulfate presumes that concentrations of that substance have increased over time along with the documented increases in P. This has not occurred. In fact, the historical trend (1973–2003) for sulfate in the lake's pelagic region is a significant decline (Kendall's Tau p = 0.03 with a slope of -1.7562 mg/L/year). The statement about developing a monitoring program for minerals other than P and N seems to be grounded in the fact that Chapter 10 of this report did not mention that more than 20 other chemical constituents are analyzed along with P and N in every lake sample that is collected (since 1973). This point now is clearly made in the introductory section of Chapter 10, so that readers understand that our assessment program focuses on a broad range of chemical constituents, not just P and N.

Comment: *More research should focus on the role of SAV in nutrient recycling and uptake. Is SAV responsible for nitrogen limitation of algae in the littoral and is SAV acting as a nutrient pump moving phosphorus from sediment to the water column?*

Response: Staff agrees that more research is needed to quantify the role of SAV in the lake's nutrient cycle, especially in shallow shoreline areas where plants are abundant. In fact, this has been a focal area of our research program since 2000. Details of that program are provided on page 28 of Chapter 10. We have not specifically addressed the issue of whether attached algae are responsible for the observed N-limitation of phytoplankton, but as indicated in a verbal response to the Panel, this is unlikely. Phytoplankton display N-limitation on a lake-wide basis during certain summer months, even at locations miles away from where any plants/periphyton occur. The N-limited condition of phytoplankton is most likely just a response to the low N:P ratio in inflowing water, which gives rise to lake water with a low N:P ratio (both total and dissolved).

Comment: *The Panel suggests that in this chapter more connections can be made with the other chapters.*

Response: In this chapter, it is clearly indicated that the lake occupies a central position in the regional hydrologic system and a map is provided in the report where this can be seen. A sentence has been added to the introduction of Chapter 10 to make this even clearer, providing the names of major tributary inflows and noting which downstream systems receive water from the lake. Additional changes to Chapter 10 in response to this comment do not seem warranted, given that Chapter 5 addresses regional hydrology.

Chapter 11: Responses to Peer Review and Public Comments

PEER REVIEW PANEL COMMENTS

Comment: *The chapter could be reorganized to proceed from the introductory material straight to "Kissimmee River Restoration Project", which is the meat of this chapter, and then close the chapter with the series of short sections describing projects that follow from or complement the KRRP/KRHPP.*

Response: The chapter has been reordered in the manner suggested by the panel.

Comment: *There really ought to be a good map (or multiple maps) of the area that shows all of the locations and structures in the basin that are mentioned in the text or figures.*

Response: The maps (Figures 11-1 and 11-6) have been updated.

Comment: *The panel recommends adding an outline of the chapter's contents at the beginning of the chapter*

Response: The paragraph at the end of the introduction outlines chapter contents.

Comment: *How are the data collected in the Ambient Water Quality Monitoring Project (Kissimmee Chain of Lakes) used?*

Response: A statement that explains that the primary purpose is to monitor long-term trends, especially parameters related to eutrophication, has been included.

Comment: *Some parts of the chapter that deal with phosphorus need attention. On Pages 11-24 and 25, assumptions 1, 3, and 4 are not well explained (a reference is given for assumption 2)… It is not evident to the Panel that these assumptions are true (in fact, they seem likely not to be completely true), so it would be good to see references or reasoning defending the assumptions.*

Response: The analysis that included these assumptions, as well as the estimated values for loads and concentrations under reference and future (restored) conditions, has been removed. The assumptions were presented only to establish a probable scenario supporting the expectation that phosphorus concentrations in the river would decrease in response to restoration of natural flows and floodplain wetlands. Although the assumptions may be reasonable, the analysis could be misconstrued as establishing specific targets for phosphorus reductions. The analysis cannot be used for this purpose because of the nature of the assumptions, lack of data, and accompanying uncertainty.

The analysis has been replaced by more general language stating that river restoration should tend to favor phosphorus retention in the floodplain and lower phosphorus concentrations in the river.

Comment: *It would be good to have more explanation for why current levels of TP in the river are so high. Are they completely a result of mysterious source X of TP in southern Lake Kissimmee? At face value, the data suggest a large source of TP in the lake, adding 20-30 µg/L to the river water. Does SFWMD plan to track down and characterize the source of all this P?*

Response: As stated in the text, historical TP concentrations in the upper portion of C-38 have been similar to concentrations at S-65. This continued to be true in WY 2002–2004. Over the past few years, something in the south end of Lake Kissimmee is causing higher concentrations at S-65. Although TP concentrations have risen slightly in the middle of the lake, they account for only a minor fraction of the increase. Although the cause of higher TP at S-65 has not been identified, several possibilities have been discussed. Possible sources include agricultural runoff, lake management activities (muck and tussock removal, dredging), response of the lake to artificial drawdown and hydrilla control, wind-induced sediment resuspension, or even modifications in data collection and phosphorus load calculations. Additional monitoring should be considered. The SFWMD has obtained some *ad hoc* data that appears to indicate a probable cause, but a strategy to investigate the relative impacts of the possible factors listed above has not yet been formulated.

The river floodplain is being monitoring to determine if it is a *source* of phosphorus during the interim regulation schedule, as the floodplain is transitioning to a wetland ecosystem (floodplain soils are alternately wetting and drying). Preliminary data indicate that total phosphorus concentrations can be occasionally higher than concentrations in the river channel, but they are usually similar. Additional work on relationships between concentrations and flooding/drying events is needed.

Comment: *The author's present data suggesting that a large amount of organic matter and marl was flushed from the newly opened channels (~10 cm in 9 months). It would be useful to estimate how much material in total was flushed out*

Response: The chapter now states that it was unclear whether the organic material was transported, buried by sand deposits, or both. Because the sampling design did not allow for the discrimination between these fates, the fate of this material is unknown.

Comment: *Why were stage hydrograph and stage recession evaluated at just a single station (and different stations for each variable, at that)?*

Response: Stage hydrographs were evaluated at PC33 because of the availability of pre-channelization reference data. Stage recession rates were evaluated for PC54 because the river channel stations exhibited similar stage fluctuation patterns and because PC54 had the most complete period of record. These points have been made in the report.

Comment: *On page 11-20, the authors say that they have no estimates of baseline mean channel flow velocity. Wouldn't it be possible to calculate this number from discharge data and the cross-sectional area of the canal? Aren't these data available?*

Response: It has been clarified in the chapter that this statement applies to the remnant river channels and not the C-38 canal.

Comment: *Why should restoring flow increase dissolved oxygen?*

Response: This has been clarified in the chapter. Mechanisms that were hypothesized to result in increased DO concentrations are listed in the report.

Comment: *The authors write (p.11-16) that dissolved oxygen during and after construction was "similar" in reference and treatment reaches, but the data shown in Fig. 11-11 suggest that construction had a significant and possibly ecologically interesting effect on dissolved oxygen.*

Response: DO data did not fit the normal distribution; therefore, a square-root transformation was used to normalize the data because means were proportional to variances. During and after construction, DO concentrations at the upstream and downstream stations were similar (t-test, $p < 0.05$). Figure 11-11 shows raw data values. The caption for Figure 11-11 has been modified to include this information.

Comment: *Fig. 11-16 would be more interpretable if you added a reference line with a slope of -0.3ft/month, so that readers could make visual comparisons of observed and target recession rates.*

Response: Reference lines were added to Figure 11-16 and data for PC33 and PC54 were eliminated to facilitate reading of the graph. The report has been revised accordingly.

Comment: *Have the authors looked at the outlier on Fig. 11-17 to see if it's in error?*

Response: Outlier was an error and has been corrected on the graph.

Comment: *In the section on macroinvertebrates (p. 11-31), the authors note that several lotic species have already begun to appear. Some of these taxa (unionids, Corbicula) have long life-cycles – is it really reasonable that these species have become more abundant already?*

Response: This chapter has been clarified to indicate that some of these taxa may have been present, but not collected, during the baseline period.

Chapter 12: Responses to Peer Review and Public Comments

PEER REVIEW PANEL RECOMMENDATIONS

Recommendation: *The panel recommends that the SFWMD explicitly state its restoration goals for its work on South Florida's estuaries, in specific, numerical terms where possible, and describe the rationale for choosing these goals.*

Response: We concur with this recommendation and will evaluate the use of a tiered approach to the development of more explicit restoration goals, benchmarks, and numerical targets. We also agree there is a need to communicate clearly the underlying rationale for the application of restoration goals and targets to specific coastal ecosystems. Restoration goals and numerical targets are a vital part of CERP projects and RECOVER. The RECOVER Monitoring and Assessment Plan includes performance measures (with targets) for the northern and southern estuaries. Project-related performance measures have been developed for Indian River Lagoon, Biscayne Bay, and Florida Bay. Furthermore, performance measures have been developed for operational planning (e.g., CSOP). Descriptions of these performance measures and their justifications are documented as part of each project or program. A summary will be provided in future reports.

The SFWMD has adopted the strategy of adaptive management for long-term restoration projects. Coastal ecosystems are highly dynamic systems with multiple inputs, multiple biological and physical forcing functions, and a variety of environmental issues. The SFWMD mission focuses primarily on the management of freshwater inputs to coastal ecosystems and the effects of these inputs on water quality, harmful algal blooms, and other environmental concerns. Problems, such as over-fishing, exist that the District cannot address through water management. The completion of this task is an evolving process involving the continued participation of District staff and other resource managers and stakeholders.

Recommendation: *Although the SFWMD appropriately focuses on altered hydrology and habitat loss as primary threats to South Florida's estuaries, the panel recommends that the SFWMD assess the potential for excessive nitrogen loading to compromise the recovery of these ecosystems even if problems with hydrology and habitat are corrected.*

Response: We concur with this recommendation. Monitoring nitrogen concentrations and loads to estuaries and assessment of the potential for these loads to harm estuarine ecosystems is ongoing. This concern has been explicitly identified within the RECOVER Monitoring and Assessment Plan for Florida Bay and SFWMD research and modeling is addressing this concern for that estuary. For other estuaries (especially the Caloosahatchee River, St. Lucie River, and Loxahatchee River Estuaries), attention has been more focused on hydrologic stress because it is known to be an immediate and severe driver of the ecosystem and also because the SFWMD has the capability of moderating hydrologic (mostly salinity) stress via short-term operational or long-term (mostly CERP) structural modifications.

While the District does focus on hydrology, nutrient loading in many South Florida estuaries is largely a function of freshwater input. The issues of altered hydrology, nutrient loading, and estuarine water quality are not independent. Nutrient loading can be changed by changing the rate of freshwater input, the concentration of nutrient in the freshwater, or both. Changing the concentration rather than the rate of freshwater input may have a fundamentally different effect on estuarine water quality. As restoration proceeds, the changes in freshwater input that will occur could lead to alterations in both nutrient loading and hydraulic flushing. Understanding the effects of simultaneously altered nutrient supply and hydraulic flushing on nutrient cycling and utilization is central to predicting estuarine water quality under the various restoration scenarios.

In an effort to evaluate the relative importance of N and P in the estuaries, we have compiled nutrient and chlorophyll concentration data and completed a preliminary system-wide comparison. These results, presented at the 2003 Estuarine Research Federation Conference (Bennett et al., 2003), showed relatively high N/P ratios in Biscayne Bay and Florida Bay (indicating the relative importance of P as a limiting nutrient) and low N/P ratios toward the northern estuaries. Thus, these estuaries are potentially sensitive to N loads. We are following up this preliminary analysis with a compilation of loading rates. We also plan to develop simple mass-balance box models (similar to LOICZ; http://data.ecology.su.se/mnode/) to account for physical difference and residence time differences among estuaries (along with nutrient loading) and to assess sensitivity to nutrient loading as a function of freshwater flow. Progress will be reported in future SFER reports.

Recommendation: *The panel recommends that the SFWMD develop plans to take advantage of opportunities to coordinate work on the different estuaries around South Florida.*

Response: We concur with this recommendation. See reply to the previous comment about the comparison of estuarine water quality.

It is important to recognize that legislative mandates and SFWMD priorities have required that each estuary program is developed independently. The approach to research and management in the various estuaries has evolved differently. Therefore, a cross-cutting comparative compilation of estuarine resource trends and issues will have substantial variability in the amount of data available, the status of assessment activities, and the significance of long-term inferences.

PEER REVIEW PANEL COMMENTS

Comment: *The panel would like to see more attention on the restoration endpoints or targets for coastal ecosystems…It may be useful to set restoration goals at three different levels.*

First, what general goals will be set?

Second, what specific variables will serve as measurable benchmarks by which progress towards the broad goals will be assessed? The SFWMD has apparently chosen seagrasses and oyster beds as key variables. The panel agrees that these are variables, but it would be helpful for the SFWMD to state explicitly why these variables were chosen, and why other reasonable variables were excluded. For instance, fish…Are they not given a central role here because other agencies have jurisdiction, because seagrasses, oysters, and hydrology are thought to be adequate surrogates for fishes, because they're too difficult to measure, or because of some other reason?... Are ecologically important habitats other than seagrasses and oyster beds under threat from human activities and therefore the target of restoration? Are there efforts to map or

inventory remaining habitats in south Florida's estuaries? Finally, it would be useful for the SFWMD to state explicitly the range of numerical values that are acceptable for whatever key variables they choose to focus on. Does the SFWMD want to see at (say) 20-100 ha of oyster beds in estuary X? Clear definitions of restoration targets at these three levels will allow the SFWMD to share their visions for South Florida's estuaries with stakeholders and cooperating organizations, and develop yardsticks to judge progress towards restoration goals.

Response: It is true that the public may be more likely to care about fish; however, seagrass and oyster beds have been chosen as key variables for several reasons. Both are consistent features of estuarine landscapes in South Florida. Much of the subtidal physical structure in South Florida estuaries is biological – for example, coral reefs, seagrass beds, and oyster reefs – and the physical structure provided by these organisms creates vital habitat for fish and shellfish. Initial research focused on the effects of water management on the health and distribution of seagrass and oyster habitats. By examining how fish and shellfish use seagrass and oyster beds, the District hopes to establish links between water management and higher trophic levels.

Comment: *The panel encourages the authors to address the severity and ecological consequences on nitrogen loading to coastal ecosystems, in this year's or next year's report. Even if problems with hydrology and habitat are corrected, will South Florida's coastal ecosystems still be impaired by excessive nitrogen loading?*

Response: This is an important question and is clearly a direction for future applied research at the District. Planned alterations in freshwater inflow because of construction of CERP projects will change nutrient loads to coastal ecosystems. In riverine estuaries, such alterations in freshwater inflow will almost certainly change hydraulic residence time and thus the time that nutrients will be available to react; reductions in nutrient loads caused by reductions in freshwater inflow may not result in improved water quality.

Comment: *The modular structure of the chapter obscures comparisons that might be made across different estuaries. Is there any coordination or balancing of the programs on different estuaries, or are they treated as independent programs? The panel encourages the SFWMD to give some thought to this coordination, either in this year's report or in succeeding years.*

Response: We will undertake the development of a comparative framework for use in future reports.

Comment: *It would be useful for the authors to provide more information about the performance of the models they are developing. The detailed hydrology/salinity/water quality models that are being developed for the estuaries look very useful, but the chapter did not provide a sense of how well these models perform. Are they working well now, are they under development but expected to work well in the future, or is their performance suboptimal?*

Response: The watershed and the estuary models were calibrated and validated using monitoring data collected in the watershed and estuary. Figure 12-11 and Table 12-13 are examples of their performance. The watershed model has applied some of the major components in CERP. The application of the estuary model has simulated the effectiveness of some restoration alternatives on estuary water quality. More details will be provided in next year's report.

Comment: *How was the salinity envelopes for key species (p. 12-14) developed? Please provide details or a reference.*

Response: The development of salinity envelopes for key species in St. Lucie Estuary, in particular for oysters, was based on an assessment of the optimal salinity range (10 to 20 ppt for oysters), monthly freshwater inflow, and the distance from reference locations in the estuary. First, a family of salinity curves at varying freshwater inflows was plotted against the distance from the reference location in the estuary. Next, the optimal salinity ranges were identified in the figure with reference to the location in the estuary. Then the salinity envelopes in terms of monthly watershed inflow were determined. In the St. Lucie, the salinity envelope is from 350 to 2,000 cfs for juvenile marine fish and shellfish, oysters, and submerged aquatic vegetation.

Comment: *The seagrass model (Figs. 12-32 and 33) could be better explained. Is it reasonable to think that the controls are independent and multiplicative? How well does the model actually perform compared to real data? Please provide a description or reference for the source of the functional relationships between seagrass growth and controlling factors. Does the model include any carrying capacity, competition among species, or feedback between seagrass biomass and available light, nutrients, or space?*

Response: The text has been revised.

Comment: *How are live oyster beds mapped? Are the methods consistent over time? How old are "dead" oyster beds (recent or subfossil)?*

Response: St. Lucie oysters were mapped in 1997 and 2003 using the same methods. Since the water is so dark, photography could not be used for the oyster mapping. Instead, extensive groundtruthing with GPS was required.

Transects largely perpendicular to the shore were conducted throughout the study area. Additional sampling was also done near areas where suitable substrate and depth were found, where evidence of potential oyster presence was found, and in areas where the previous SLE survey indicated oyster presence. The search methodology entailed slowly motoring with a solid copper rod 0.5 inches in diameter that was dragged across the bottom along each transect and areas where oysters might be present. When the rod came into contact with oysters or rocks on the river bottom, it bounced. It also made a distinct metallic scraping sound that revealed the presence of oysters; when the rod made contact with clams and rocks, it produced a dull flat sound.

When oysters were found, the boat was maneuvered to the edge of the bed and the point was logged into the GPS as a boundary point. The boat was then positioned toward the center of the bed and began moving outward toward a separate point until another boundary was identified and logged. This process was repeated along the entire perimeter of the bed. Once the bed was delineated, random sample points were taken inside the bed to evaluate and record the density and extent of coverage. This "in-bed" sampling was used to determine if the bed contained "live" oysters. If the bed contained any live oysters it was defined as "live." If no live oysters were found the bed was defined as "dead."

The District has not conducted an evaluation of dead oyster age; however, since the St. Lucie was a freshwater system until the late 1890s when the inlet was constructed it is likely that all dead oyster shells are less than 100 years old. Many of the dead oyster beds mapped in 2003 include oysters dead within the past five years since areas upstream of the Roosevelt Bridge contained live oyster beds in 1997, but not in 2003.

Comment: *The authors say that sediment is a problem in the Loxahatchee – what data are available? How is sediment monitored? What is the evidence that it's causing undesirable ecological changes?*

Response: Since 1984, four studies have been conducted regarding benthic macrofauna in the Loxahatchee River Estuary, (McPherson et al., 1984; Strom and Rudolph, 1990; Law Environmental, Inc., 1991; and Dent et al., 1998). References for these previous studies will be included in the final report.

Comment: *Some of the figures and tables could be improved. Fig. 12-28 would be easier to interpret if a panel were added showing hydrology or salinity. Figs. 12-38 and 12-39 might be easier to understand if combined into a single graph. Table 12-15 is not needed (the single datum in the table is given in the text).*

Response: Figures 12-38 and 12-39 have been combined and Table 12-15 has been eliminated. We will consider revisions to Figure 12-28 in future reports.

ADDITIONAL LITERATURE CITED

FOR FLORIDA BAY

Bennett, R.J., P.H. Doering, D.T. Rudnick and J.N. Boyer. 2003. Nutrient – phytoplankton relationships: a comparison of South Florida's estuaries. Abstract presented at the Estuarine Research Federation Conference, Seattle, WA.

Cloern, J.E. 1978. Simulation model of *Cryptomonas ovata* population dynamics in Southern Kootenay Lake, BC. *Ecological Modeling,* 4:133–150.

Fourqurean, J.W., J.C. Zieman and G.V.N. Powell. 1992a. Phosphorus limitation of primary production in Florida Bay: evidence from C:N:P ratios of the dominant seagrass *Thalassia testudinum*. *Limnol. Oceanogr.,* 37:162–425.

Fourqurean, J.W., J.C. Zieman and G.V.N. Powell. 1992b. Relationships between porewater nutrients and seagrasses in a subtropical carbonate environment. *Mar. Biol.,* 114:57–65, 428.

Fourqurean, J.W., R.D. Jones and J.C. Zieman. 1993. Processes influencing water column nutrient characteristics and phosphorous limitation of phytoplankton biomass in Florida Bay, FL, USA: inferences from spatial distributions. *Estuar. Coast. Shelf Sci.,* 36:295-314.

Gras, A.F., M.S. Koch and C.J. Madden. 2003. Phosphorus uptake kinetics of a dominant tropical seagrass *Thalassia testudinum. Aquatic Botany*, 76(4):299-315.

Koch, M.S. 2004. Report on mesocosm experiments on multiple stressors on Florida Bay seagrasses. SFWMD. 220 pp.

Kremer, J.N. and S.W. Nixon. 1978. A coastal marine ecosystem. Simulation and analysis. Ecological Studies #24. Springer Verlag, New York, NY. 219 pp.

Madden, C.J. and W.M. Kemp. 1996. Ecosystem model of an estuarine submersed plant community: Calibration and simulation of eutrophication response. *Estuaries,* 12(2B):457-474.

FOR LOXAHATCHEE RIVER AND ESTUARY

Law Environmental, Inc. 1991. Technical Assessment Report for the West Loxahatchee River, Volume I, Environmental, Recreation, and Engineering. Project No. 55-9743.

Mc Pherson, B., B.F. Sabanskas and W.A. Long. 1982. Physical, hydrological, and biological characteristics of the Loxahatchee River Estuary, Florida. U.S. Geological Survey Water Resources Investigations Open-File Report 82-3.

PEER REVIEW PANEL COMMENTS (DAVID L. STRAYER)

Comment: *What are the restoration endpoints or targets for these ecosystems?*

Response: This question and the ensuing questions and comments are very pertinent to measuring the long term success of coastal ecosystem restoration and are addressed in our response to the peer review panel recommendation # 1 and the peer review panel comment # 1.

Comment: *There are a couple of other obvious candidates for ecological restoration that are not addressed in much detail: fishes and habitats other than seagrass and oyster beds…. Are they (fish) not given a central role here because other agencies have jurisdiction, because seagrasses, oysters, and hydrology are thought to be adequate surrogates for fishes, because they're too difficult to measure, or because of some other reason? It might be worth adding a little text explaining what's going on with fish.*

Response: New text has been added to the summary section to address this point. A complete understanding of the dynamics of these systems must include fisheries data. It is true that the public may be more likely to care about fish; however, seagrass and oyster beds have been chosen as key variables for several reasons. Both are consistent features of estuarine landscapes in South Florida. Much of the subtidal physical structure in South Florida estuaries is biological – for example, coral reefs, seagrass beds, and oyster reefs – and the physical structure provided by these organisms creates vital habitat for fish and shellfish. Initial research focused on the effects of water management on the health and distribution of seagrass and oyster habitat. By examining how fish and shellfish use seagrass and oyster beds, the District hopes to establish links between water management and higher trophic levels.

Your supposition that the District feels that the mission, staffing, and expertise for fisheries investigations reside in the jurisdiction of other agencies is correct. We do communicate and coordinate with these agencies and have funded fisheries projects in several estuaries.

Comment: *Are ecologically important habitats other than seagrasses and oyster beds under threat from human activities and therefore the target of restoration?*

Response: Yes, there is active collaboration between the SFWMD and a large number of cooperators on other habitats important to the overall restoration process. Some involve reestablishment of coastal wetlands, shoreline vegetation, tidal floodplain, and the rehabilitation

of tidal creeks and estuarine substrates. There are many government entities and non-profit groups involved in restoration activities in South Florida. In the initial effort to create this new chapter, we focused on the District's activities and our major collaborators and did not attempt to catalog all of the ongoing or potentially needed restoration efforts. We will examine how to properly incorporate this kind of information in future reports.

Comment: *Are there efforts to map or inventory remaining habitats in south Florida's estuaries?*

Response: Yes, there are ongoing and planned efforts to accomplish this. Refer to the sections on Naples Bay and Estero Bay to see the level of effort needed to accomplish this for just two watersheds.

Comment: *There seems to be a fine program of research on N and P in Florida Bay. For the other estuaries, how severe is N loading, and what are the prospects for reducing it to acceptable levels? Even if freshwater inflows are improved, will excess N loading compromise the condition and recovery of south Florida's estuaries?*

Response: This question and the ensuing questions and comments are addressed in our response to the peer review panel recommendation # 2.

Comment: *Is there any coordination or balancing of the programs on different estuaries, or are they treated as independent programs? Are there opportunities or needs to coordinate or compare the programs on the different estuaries?*

Response: This question is addressed in our response to the peer review panel recommendation # 3.

Comment: *It would be helpful to give the reader some sense of model performance. Are they working well now, are they under development but expected to work well in the future, or is their performance suboptimal?*

Response: This question is addressed in our response to the peer review panel comment # 4.

Comment: *How were the salinity envelopes for key species (p. 12-14) developed? Please provide details or a reference.*

Response: This question is addressed in our response to the peer review panel comment # 5.

Comment: *How are live oyster beds mapped? Are the methods consistent over time? How old are "dead" oyster beds (recent or subfossil)?*

Response: This question is addressed in our response to the peer review panel comment # 7.

Comment: *What do the long-term trends in seagrasses in the SLE look like (p. 12-16)?*

Response: A consultant prepared a report for the District in 1997 summarizing the history of seagrass distribution in the St. Lucie to 1997. Relying heavily on anecdotal information for historic distribution because seagrass mapping data was not available, the trend from the 1940s to 1997 has shown a decline. Some seagrass beds observed historically in the North Fork and the Middle Estuary were non-existent in 1997. Seagrasses were so sparse in the St. Lucie in 1997 that the consultant could not map beds – points were used to indicate seagrass occurrence. Although a

detailed mapping effort has not been conducted since 1997, occasional spot checks seem to confirm that seagrasses remain very sparse in the St. Lucie.

Comment: *In Table 12-3, what is RER?*

Response: The abbreviation stands for "relative error."

Comment: *Fig. 12-13 would be more useful if key features were labeled (North, Northwest, and Southwest Forks, C-18).*

Response: The suggested changes have been incorporated in the final report.

Comment: *The authors say that sediment is a problem in the Loxahatchee – what data are available? How is sediment monitored? What is the evidence that it's causing undesirable ecological changes?*

Response: This question is addressed in our response to the peer review panel comment # 8.

Comment: *...this chapter does contain some jargon-filled passages, which will be hard for an outsider to interpret. For instance, I found the paragraph on the Northern Palm Beach County Comprehensive Water Management Plan to be nearly incomprehensible, and had to consult materials on the website to figure out what the 'improvements' and 'structures' were. If it's possible, it would be better to use words like 'reservoir', 'canal', etc."*

Response: An expanded description of the Northern Palm Beach County Comprehensive Water Management Plan, which identifies the goals of the plan, the types of projects to be built, and the role each project plays in the implementation of the plan will be included in the final report.

Comment: *The current conditions and monitoring programs in the Lake Worth Lagoon are not as well described as those for the other estuaries, and could be fleshed out a bit.*

Response: Additional information has been included and more detail will be provided in future reports.

Comment: *Table 12-6 is useful, but doesn't tell us how bad the water quality violations are. Perhaps supplement with a little more text, or alter the table.*

Response: More material related to identifying the magnitude of water quality violations will be provided in future reports.

Comment: *What is thought to be causing declining P concentrations in Florida Bay (p. 12-73)?*

Response: Trends of decreasing phosphorus concentrations in waters flowing into Florida Bay and within the bay do not appear to be related to changing inputs from canals, where concentrations were relatively steady. We infer that decreases are associated with changes in internal cycling. Within the bay, decreasing phosphorus may be associated with increasing seagrass biomass and detritus accumulation. An increasing seagrass sink for phosphorus is consistent with the apparent recovery of *Thalassia* from the mass mortality events of the late 1980s and early 1990s. Increases in algal production and organic matter accumulation are also possible. Within the mangrove zone and the creeks flowing through this zone, decreasing phosphorus concentrations may be associated with past episodic inputs of phosphorus from bay sediments (e.g., from hurricanes). Dissociation of phosphorus from imported carbonate particles

would initially elevate water column concentration and have a diminishing effect over time. Non-steady state phosphorus dynamics in the mangrove zone consistent with this hypothesis were described in Rudnick et al., 1999.

Comment: *Fig. 12-28 would be easier to interpret if a panel were added showing hydrology or salinity.*

Response: Revisions to this figure will be evaluated for inclusion in future reports.

Comment: *It seems like the causes of seagrass die-off in Florida Bay aren't fully clear. What about the role of disease?*

Response: The role of disease (slime mold, *Labyrinthula*) is likely an important secondary cause of seagrass die-off. Infection varies with salinity; rates are much higher with high salinity ($\geq$ 35 psu) than low salinity ($\leq$ 20 psu). Infection is likely to be more common in plants already weakened by multiple stresses. This variable will be incorporated into the seagrass model at a later date.

Comment: *I had several questions about the seagrass model (Figs. 12-32 and 33). Is it reasonable to think that the controls are independent and multiplicative? How well does the model actually perform compared to real data? Please provide a description or reference for the source of the functional relationships between seagrass growth and controlling factors. Does the model include any carrying capacity, competition among species, or feedback between seagrass biomass and available light, nutrients, or space? The results shown in Fig. 12-33 look like transients (the system has not been calibrated) – what kinds of conclusions can you reach from such short runs?*

Response: In the current model, effects of stressors (sulfide, nutrients, light, temperature, salinity) are assumed to be independent and multiplicative. This is a reasonable and effective methodology. The model predicts real data at $r^2 > 0.75$. Current mesocosm studies and analysis will refine algorithms and incorporate interactions if appropriate.

Model inputs vary on a daily timescale. Output does not reach steady-state intra-annually; however, the model can and does approach steady state on an inter-annual basis. Initial conditions do not significantly contaminate model results. The model has been run for 10-year simulations and reflects a stable and robust equilibrium.

The model includes a density-related function that serves as a carrying capacity for *Thalassia* - 4000 gdw m^{-2}. In the dual species model (*Thalassia* and *Halodule*) there is interspecific competition for nutrients and space. Competition for light will be incorporated into the dual species model.

Comment: *What is the source for statements about the past status of Naples Bay (p. 12-87)?*

Response: Simpson B.L., 1979. The Naples Bay Study. Collier County Conservancy, Naples, FL. 500 p. This is a report on a study conducted in 1976–1977 in Naples Bay, Florida. It includes information on the bay's hydrology, water quality, and biology. The effects of canals on Naples Bay, channel design, pollution, public safety, and reclamation, as well as legal and political issues, are addressed.

Comment: *What is the basis for estimates of attainable oyster populations in the estuaries (pp. 12-95, 12-106, 12-114)?*

Response: The following factors were considered in deriving estimates of attainable oyster populations in the estuaries of southwest Florida: location of appropriate salinity regime, location of areas where successful recruitment and subsequent growth occur, and substrate availability. Distance from heavy boat traffic is also a consideration, so areas tend to be in shallower water away from navigation channels**.**

Comment: *Figs. 12-38 and 12-39 might be easier to understand if combined into a single graph. Table 12-15 is not needed (the single datum in the table is given in the text).*

Response: The text and figures in the chapter have been revised in response to this comment and the peer review panel comment # 9.

Comment: *on p. 12-108, what is meant by the growth of transplants not being "as expected"? Please elaborate.*

Response: This expectation is based on previous transplant experiments (Dr. Steve Bortone, personal communication). Potted *Vallisneria* were placed at four different locations in the estuary. Growth and survival were comparable to adjacent wild populations.

Comment: *Are snags being removed as part of channel cleaning in Lee County (p.12-110)? These may provide valuable habitat for invertebrates.*

Response: Creeks and other small flow ways provide much of the drainage in Lee County. Along with exotic vegetation, snags are removed to improve the flood control function of these flow ways. Replanting of creek banks with native vegetation provides a more natural habitat for wildlife.

Comment: *It appears that there is only one monitoring site in Charlotte Harbor (p. 12-115). Is this enough to characterize such a large, complex estuary (or is there really more than one site)?*

Response: The salinity monitoring site on the Sanibel Causeway is not meant to represent the entirety of Southern Charlotte Harbor. This site is the marine end-member of a network of continuous salinity monitoring sites used to assess the impact of discharge from the Caloosahatchee River into the Caloosahatchee Estuary and San Carlos Bay.