

Proposed TOC Resolution

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Background and Rationale

The May/June 2005 Compliance Data Work Group has met twice, first on August 10, followed by a meeting on September 15, 2005. Following the May/June 2005 Compliance Data Work Group meeting held on September 15, I propose the resolution stated below for consideration by the TOC at our September 20, 2005 TOC meeting.

My proposed resolution does not address in detail sampling error or contamination. I have seen no evidence that rises above conjecture in support of causation by such errors. The Refuge believes that there is conclusive evidence that the Refuge sampling crew was well trained, and that they strictly followed all sampling protocols. Likewise, there is no evidence of laboratory error related to total phosphorus laboratory analysis in the May or June 2005 compliance samples.

The definition of “substantial evidence” is of central importance here. I assume that we are using a definition that is less restrictive than conclusive evidence, and does not require that there is enough evidence that we think the hypothesis is more likely than not to be true. The definition simply requires that there are solid facts that support the hypothesis so that the evidence is more than simple conjecture or a plausibility argument. Solid facts related to the conclusion proposed here are listed below as a part of the proposed resolution. It is also important to note that it is possible for substantial evidence to exist for multiple competing alternative hypotheses even when all the hypotheses cannot simultaneously be true.

I believe there is substantial evidence (though not conclusive evidence) that hurricane wind damage or other regional phenomena was the direct cause of the May and June 2005 excursions. Having stated this, we want to make it clear that elevated phosphorus loads discharged into Refuge canals have impacted the Refuge interior. The DOI representatives are in agreement that anthropogenic phosphorus loading impact likely played an important, though indirect, role in this event, and plays a role in how our altered ecosystems respond to natural disturbance.

Finally, we believe that data exclusion should be very rare and should follow well-defined procedures. We disagree with the view that if some samples from a collection event are flagged, then all data from that event should be excluded from use. Data should only be excluded when there is clear evidence that the sample is in some way flawed. There appears to be no end to the arbitrary chain of data exclusion that could result if data are excluded simply because of association with other data that are deemed questionable.

Proposed TOC Resolution:

Based on observations compiled for the TOC May/June 2005 Compliance Data Work Group, it is the determination of the TOC that there is substantial evidence that excursions above the interim limits in May and June 2005 resulted from extraordinary natural phenomena.

Support for this resolution is based on the following reasoning and on evidence presented in the Work Group Supporting Document (file name May-JuneWGroupEvidence.pdf) and on other facts and reasoning given below. Page numbers in the following paragraphs refer to this work group support document.

1. There is evidence that the phenomena observed in the May and June 2005 sampling impacted an area broader than the 14 Refuge compliance sites. High values for TP, and in some instances TSS, were observed in the Refuge and adjacent treatment wetlands at nearly the same time and in similar patterns. Temporal patterns similar to that displayed by the 14 Refuge compliance sites were observed in the Refuge at LOXA enhanced monitoring sites (pages 28-34) and in limited data from the X-transect (page 35). These patterns were also observed in STA-1E (page 42) and STA-1W (pages 43-45). A similar temporal pattern has also been documented in Lake Okeechobee in the Draft 2006 South Florida Environmental Report (Redfield et al. 2005), but these data were not compiled for the Work Group. An analogous temporal pattern in WCA-2A at the F-transect sites was not clearly observed (pages 38-40).

2. These observations are consistent with the hypothesis that the storms in September 2004 were the direct cause of the temporal patterns of elevated concentrations in STA-1E, the Refuge, and STA-1W. The fact that a similar pattern was not observed in WCA-2A is consistent with this hypothesis because strong winds did not severely impact the southern portion of Palm Beach County. Describing storm damage to the STAs, the draft SFER Chapter 4 (Pietro et al. 2005) reports that “The hurricanes caused physical damage to the wetlands, degrading levees and structure banks and uprooting submerged aquatic vegetation (SAV), especially at STA-1E, STA-1W, and STA-2.” It appears that wind uprooted and destroyed SAV, exposed underlying sediment, and disaggregated and stirred large amounts of sediment into the water column in the STAs and also, presumably, in the Refuge. Additionally, defoliation of the canopy of the tree islands and surrounding areas must have deposited a large additional layer of organic matter in the Refuge and STAs that would have added a load of both organic carbon and phosphorus. The Refuge’s 2004 Annual Narrative Report (USFWS 2005) documents extensive damage to Refuge tree islands and defoliation of trees. Heaviest tree damage was observed at the more interior islands (Ugarte et al. 2005), consistent with the pattern of high TP observed in the X-transect, EVPA, and LOXA sites.

3. The spatial pattern of TP concentration in May and June 2005 is atypical of past excursion events. Most typically, excursions exhibit elevated concentrations at a few sites impacted by canal water. In May and June 2005, this pattern was absent. For example, LOX11 (see May-June2005EVPA.pdf), a typically less impacted site, had highly elevated TP. This observation supports the hypothesis that the May and June 2005 excursions resulted from a spatially more widespread phenomenon such as storm-related causation. Although it is clear that elevated

phosphorus loading has impacted the Refuge and may have played a significant though indirect role here, these excursions did not directly resulted from recent point source loading.

4. The May and June 2005 data exhibit an atypical frequency distribution that is demonstrated by the median exceeding the geometric mean (page 21). Again, sites that would have been expected to have lower values were elevated in these samples. This is also evidence of a more widespread or regional causation.

5. Sites that had high TSS and TP in May 2005 also tended to be high in June 2005. This provides some evidence that the observed values were not caused by a random error, sampling error, or contamination (see May-June2005EVPA.pdf).

6. There is no compelling evidence that these high values were caused by sampling error, laboratory error, or contamination.

Citations:

- Pietro, K., Bearzotti, R., Chimney, M., Germain, G., Iricanin, N., and Piccone, T. (2005). "Chapter 4: Stormwater Treatment Area Performance, Compliance and Optimization." South Florida Environmental Report 2006 DRAFT, G. Redfield, S. Efron, and K. Burns, eds., South Florida Water Management District, West Palm Beach.
- Redfield, G., Efron, S., and Burns, K. (2005). "South Florida Environmental Report 2006 DRAFT." West Palm Beach.
- Ugarte, C. A., Brandt, L. A., Melvin, S., and Mazzotti, F. J. (2005). "Hurricane Impacts to tree islands in Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida." *Southeastern Naturalist*, (submitted).
- USFWS. (2005). "Arthur R. Marshall National Wildlife Refuge Annual Narrative Report: Calendar Year 2004." US Fish and Wildlife Service, Boynton Beach, FL.