

**State Response to “Comparison of Methods for Tracking Marsh Phosphorus Concentrations in Loxahatchee National Wildlife Refuge Under the Consent Decree”,
December 20, 2006, TOC Meeting**

February 20, 2007

On December 19, 2006, the day before the TOC was scheduled to determine whether the long term total phosphorus concentration levels (as established by Appendix B to the Settlement Agreement) were lower than the Class III total phosphorus concentration levels (as established by Rule 62-302.540, F.A.C. (the “Phosphorus Rule”)), DOI distributed its technical analysis of the comparison as prepared by Dr. William Walker. The TOC ultimately reached a 3-to-2 impasse on the matter. The State parties did not have a meaningful opportunity to review and comment on this document prior to the TOC meeting. Based on its review of this presentation, the State provides the following analysis as a response to the DOI analysis; it is not intended for discussion before the TOC.

I. The Comparison Must Be Between Regulatory Levels. At the outset of its analysis, DOI assumes, without discussion, that the TOC must compare long term phosphorus concentrations required by the Phosphorus Rule with a long term mean phosphorus concentration of 7 ppb (as opposed to the predicted long term total phosphorus concentration levels as calculated in accordance with the Appendix B equation). Later, it argues that a “limited, but more realistic numerical comparison of tests can be made using historical data” DOI at p. 3. Because the Settlement Agreement expressly contemplates a comparison of regulatory levels, neither of DOI’s approaches is appropriate.

A. The long term mean of 7 ppb. As noted by DOI in the first sentence to its analysis, “[t]he Consent Decree requires the Technical Oversight Committee to compare the Consent Decree’s long-term levels/limits with the State of Florida’s Class III numeric criterion and determine, for the Refuge, which is ‘lower’”¹ As demonstrated by Dr. Goforth, the long term levels do not equate to 7 ppb, but a much higher number. That said, the text of Appendix B does contain a reference to 7 ppb. On page B-3, it provides:

Effective December 31, 2006, the long term total phosphorus concentration levels for the Refuge will be the 10% rejection level of stations CA1-5, CA1-6, and CA1-16 at a mean daily stage. . . . Compliance with these concentration levels is *expected* to provide a long term average 14 station interior marsh concentration of approximately 7 ppb. *Precise values* for the levels can be calculated for a given mean daily using the equations given in Attachment II.

¹ Appendix B actually provides that “[i]f the TOC determines Class III total phosphorus concentration levels are lower than the long term total phosphorus concentration levels then the lower levels shall apply.” App. B at B-4. “Long term total concentration levels” is defined as the geometric mean of concentration levels to be measured at 14 interior marsh stations and attained by December 31, 2006, as determined by Appendix B.” Sett. Agr. at 4. The phrase “Class III total phosphorus concentration levels” is not defined *per se*; however, the Settlement defines “Class III water quality standards” as having the same meaning as set forth in Chapter 62-302, Florida Administrative Code. *Id.* at 2.

App. B at B-3 to B-4 (emphasis added).

As reflected in the preceding quotation, as well as in the definition of “long term total phosphorus concentration levels,” the actual, or “precise,” levels to be used in the “which is lower” comparison are the “long term total concentration levels . . . as determined by Appendix B” – not an assumption or guesstimate of 7 ppb.² Given the Appendix B equation’s dependence upon stage, this makes sense. Depending on whether South Florida is in a wet or dry phase, annual concentrations could vary significantly from year to year depending on whether stages have been higher or lower than those observed during the baseline period. Indeed, the range of predicted long term levels of 7 ppb to 17 ppb, *see* App. B at B-4, strongly suggests that the long term mean would have to be significantly higher than 7 ppb (recognizing that the stage is often below 17.14 feet).

B. The “statistical power” analysis. Much like its 7 ppb comparison, DOI’s “statistical power” analysis is an attempt to craft a “which is lower” test using a metric not set forth in the Settlement Agreement.³ As discussed above, the comparison must be between regulatory limits, i.e., the Class III total phosphorus concentration levels with the long term total phosphorus concentration levels as determined by Appendix B. It would have been just as easy for the Settlement’s drafters to ask for a comparison of excursions based on historical data, as opposed to a comparison of regulatory limits, but they didn’t.

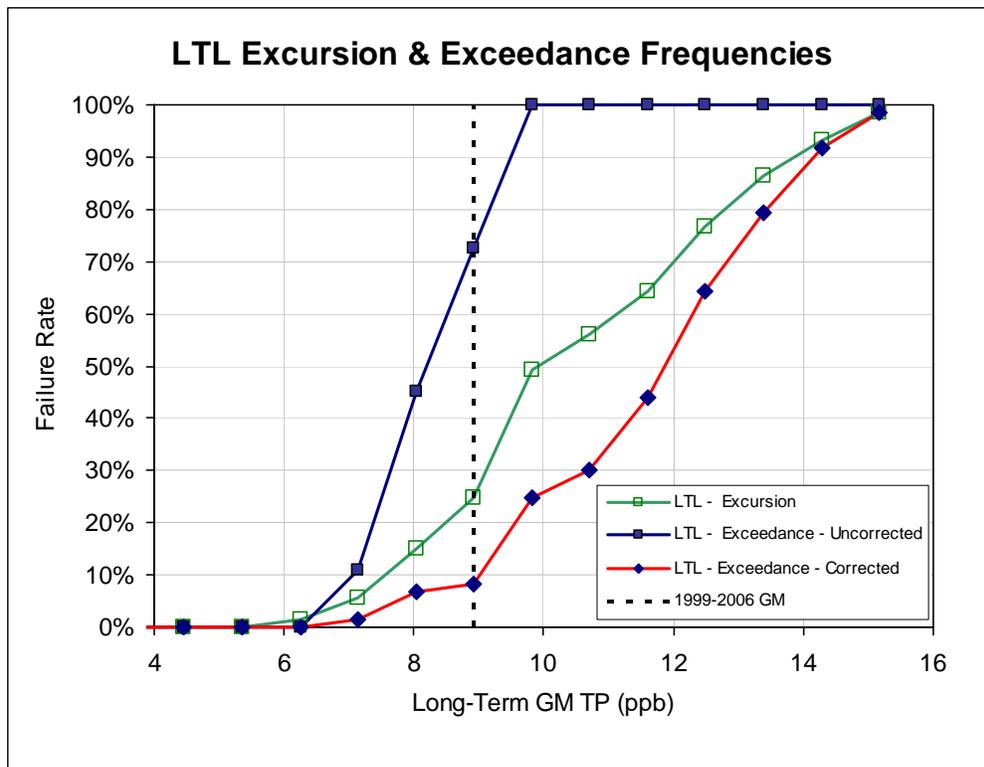
Assuming the statistical power test is appropriate, in this case DOI, in a *post hoc* power analysis, uses an incorrect definition of exceedance, thereby substantially exaggerating the statistical power of the Settlement’s long term levels. Appendix B (page 5) provides that “[a]n exceedance occurs if the 14 station mean concentration is greater than the computed concentration level two *or more times* in any 12 consecutive sample collections.” (emphasis added) Thus, a single exceedance occurs regardless of whether there are 2 *or 12* excursions within 12 consecutive

² The origin of the “7 ppb” mentioned in Appendix B is not clear. Appendix E of the Everglades SWIM Plan (USA Exh. 76) sets forth the process and data used to create the Appendix B compliance equation. Table 10 in that document identifies 7.9 ppb – not 7 ppb -- as the geometric mean based on the regression equation derived from stage and TP data for the “clean three” sites (CA1-5, CA1-6 and CA1-16) during the Base Period. The associated regulatory level after application of the 10 % rejection level for the same stage data yields a geometric mean of 12.9 ppb. Finally, applying the long-term level equation to the stage data for each day in the 1978-1983 period yields a long-term geometric mean of 10.4 ppb, which is also well above the 7 ppb value used by DOI.

³ Statistical power is defined as the probability of test failure with either compliance method based on application of actual phosphorus levels measure in the Refuge from 1999 to 2006, i.e., the number of excursions, and the phosphorus concentrations at which they occurred. More broadly, statistical power is the probability of rejecting the null hypothesis [e.g., marsh TP is less than or equal to the regulatory level of Appendix B or the State water quality standard] when it is, in fact, false and should be rejected. (Zar, J.H. 1994. *Biostatistical Analysis*, 2nd Edition. Prentice Hall, Englewood Cliffs, N.J.). The Settlement Agreement does not contain an *a priori* power analysis.

sample collections. Equally important, the number of excursions should always be greater than the number of exceedances. DOI’s analysis overestimates the number of exceedances by double counting exceedances in circumstances when there were an insufficient number of excursions. See the second figure on page 9 labeled “LTL Excursion & Exceedance Frequencies” For example, an excursion above the long term levels occurred in September 2003 and on four occasions between August and December 2004, with no additional excursions through July 2006. Under DOI’s analysis, 14 exceedances have occurred. Consistent with the language in Appendix B, however, these five excursions should count as only two exceedances, since the second set of four excursions meet the definition of “two or more times in any 12 consecutive sample collections.” Correctly calculating exceedances consistent with Appendix B, as presented in Figure 1 below, significantly lowers and reduces the sensitivity of the statistical power of the Appendix B levels presented by Dr. Walker⁴.

Figure 1. Corrected Excursion and Exceedance Frequencies



II. Dr. Walker’s Analysis of Which Approach is Lower Did Not Include Impacted Areas.

The State’s water quality standard applies to both unimpacted areas and impacted areas of the Refuge. By contrast, the long term levels of Appendix B do not apply to the impacted areas, thus providing no regulatory protection for those portions of the Refuge. Consequently, application of Florida’s water quality standard is more protective of the designated use of the Refuge than application of the Appendix B algorithm.

⁴ Additionally, Dr. Walker’s analysis incorrectly excluded data when the average Refuge stage is 15.42 ft; data should be excluded when the average stage is less than 15.42 ft. Fortunately, this mistake influences only one sampling event (June 2001).

III. Third, there are inaccuracies in Dr. Walker’s discussion of rounding protocols.

1. Contrary to Dr. Walker’s assertion, the Settlement Agreement does not require compliance levels to be rounded to the 0.1 ppb. In fact, every mention of a compliance level for the Refuge or STA discharge limit in the Settlement Agreement is rounded to the whole ppb:
 - i. Paragraph 8B: “8 and 22 ppb”
 - ii. Paragraph 8D: “50 ppb” “50 ppb”
 - iii. Page B-2: “10 ppb” “22 ppb” “8 ppb” “50 ppb”
 - iv. Page B-3: “50 ppb” “7 ppb”
 - v. Page B-4: “17” “7” “50 ppb”

Although the TOC has been reporting calculations to the 0.1 ppb, it would be a more appropriate for the TOC to compare the long-term levels of the Settlement Agreement, after rounding to the whole ppb, to Florida’s water quality standard, so that there is consistency between the TOC analysis, the Settlement Agreement and the Florida water quality standard.

2. Contrary to Dr. Walker’s assertion, the statement “Step 1. Is the annual geometric mean 10 ppb or less” in the DEP table referenced by Dr. Walker (reprinted below) clearly shows the consistent intent of the State’s assessment method to round off to the whole ppb. Had more precision been intended, the statement would read “Step 1. Is the annual geometric mean 10.0 ppb or less”. It is standard practice to show more decimal places in data tables than in the final result.

Table 5-5. Example application of phosphorus criterion measurement methodology using WCA-2A gradient transect data

| Year | Annual Geometric Mean TP concentrations (ppb) | | | | | | |
|---|---|-------|------|------|--|-------|-------|
| | Reference Sites | | | | 1st Impacted Sites | | |
| | E5 | F5 | U1 | U2 | U3 | E4 | F4 |
| 1994 | 8.80 | 9.76 | 7.85 | 7.98 | 6.81 | 19.26 | 16.94 |
| 1995 | 5.95 | 7.69 | 5.25 | 5.63 | 5.37 | 13.08 | 17.47 |
| 1996 | 7.75 | 9.95 | 8.70 | 8.23 | 8.44 | 14.56 | 16.68 |
| 1997 | 8.50 | 10.63 | 9.79 | 8.04 | 8.35 | 13.91 | 17.45 |
| 1998 | 7.94 | 10.12 | 7.43 | 9.42 | 9.61 | 14.77 | 13.75 |
| 1999 | 7.55 | 10.43 | 6.99 | 8.32 | 6.72 | 12.41 | 17.57 |
| 2000 | 4.58 | 9.45 | 5.18 | 8.64 | 6.15 | 13.53 | 16.74 |
| 2001 | 7.65 | 10.00 | 7.79 | 8.13 | 7.46 | 13.29 | 17.33 |
| Step 1. Is annual geometric mean 10 ppb or less. | | | | | If "Yes" then in criterion achieved. If "No" then go to Step 2. | | |
| 1994 | Yes | Yes | Yes | Yes | Yes | No | No |
| 1995 | Yes | Yes | Yes | Yes | Yes | No | No |
| 1996 | Yes | Yes | Yes | Yes | Yes | No | No |
| 1997 | Yes | No | Yes | Yes | Yes | No | No |
| 1998 | Yes | No | Yes | Yes | Yes | No | No |
| 1999 | Yes | No | Yes | Yes | Yes | No | No |
| 2000 | Yes | Yes | Yes | Yes | Yes | No | No |
| 2001 | Yes | Yes | Yes | Yes | Yes | No | No |

The net effect is that there is no difference in the rounding protocol of Settlement Agreement and the State’s water quality standard, and that this factor does not influence the comparison before the TOC.