

---

## MEMORANDUM

**TO:** TOC Members

**FROM:** Gary Goforth, P.E., Ph.D.

**DATE:** June 14, 2006

**SUBJECT:** Comparison of Florida Class III Phosphorus Concentrations and the Long-Term Levels of the Consent Decree for the Refuge

The Everglades Consent Decree requires that the TOC make a determination of whether the Florida "Class III total phosphorus concentration levels are lower than the long term total phosphorus concentration levels" (Appendix B page B-4). To assist the TOC with this determination, estimates of the long-term total phosphorus (TP) levels given in Appendix B were compared to the Class III phosphorus water quality standard for the Everglades Protection Area (62-302.540, F.A.C.) for Water Years 1999-2006.

**Method.** The following computational method was used in this comparison.

1. Daily stage readings through April 2006 for gages 1-7, 1-8C and 1-9 were obtained from the District's DBHydro database.
2. The stage data were averaged and then evaluated with respect to the minimum (15.42 ft NGVD) and maximum (17.14 ft NGVD) thresholds as described in Appendix B. Days with the 3-gage average of less than 15.42 ft NGVD were eliminated from further analysis. Days with the 3-gage average greater than 17.14 ft NGVD were assigned a value of 17.14 ft NGVD.
3. The long-term TP level was calculated using the equation in Attachment II to Appendix B.
4. Monthly average TP levels were computed by taking an arithmetic average of the long-term TP levels for the days within each month.
5. For WY1999-2006, annual geometric mean TP concentrations were then calculated by computing the geometric mean of the 12 monthly average TP levels. WY1999 was selected as the starting point because it roughly coincides with the beginning of the interim compliance period for the Refuge.
6. Since the Class III standard contains a 5-year geometric mean test, a 5-year geometric mean TP concentration was then calculated by computing the geometric mean of the 5 annual TP levels within the 5-year period.
7. The resulting long-term annual and 5-year geometric mean TP concentrations were compared to the State of Florida's Phosphorus Water Quality Standard for the Everglades Protection Area (Ch. 62-302.540, F.A.C.).



In accordance with 62-302.540(4)(d), F.A.C

(d) Achievement of the Criterion in WCA-1, WCA-2 and WCA-3.

1. Achievement of the criterion in unimpacted areas in each WCA shall be determined based upon data from stations that are evenly distributed and located in freshwater open water sloughs similar to the areas from which data were obtained to derive the phosphorus criterion. Achievement of the criterion shall be determined based on data collected monthly from the network of monitoring stations in the unimpacted area. The water body will have achieved the criterion if the five year geometric mean averaged across all stations is less than or equal to 10 ppb. In order to provide protection against imbalances of aquatic flora or fauna, the following provisions must also be met:

- a. The annual geometric mean averaged across all stations is less than or equal to 10 ppb for three of five years;
- b. The annual geometric mean averaged across all stations is less than or equal to 11 ppb; and
- c. The annual geometric mean at all individual stations is less than or equal to 15 ppb.

Individual station analyses are representative of only that station.

2. Achievement of the criterion shall be determined based on data collected monthly from the network of monitoring stations in the impacted area. Impacted Areas of the water body will have achieved the criterion if the five year geometric mean averaged across all stations is less than or equal to 10 ppb. In order to provide protection against imbalances of aquatic flora or fauna, the following provisions must also be met:

- a. The annual geometric mean averaged across all stations is less than or equal to 10 ppb for three of five years;
- b. The annual geometric mean averaged across all stations is less than or equal to 11 ppb; and
- c. The annual geometric mean at all individual stations is less than or equal to 15 ppb. Individual station analyses are representative of only that station.

Note that in addition to the five-year geometric mean of 10 ppb, the three other provisions must also be met.

**Results.** The results of the computations and comparison to the Class III 4-part test are presented in Table 1. This analysis indicates that the Class III total phosphorus concentration levels are lower than the long-term total phosphorus concentration levels of Appendix B. All data and computations used in this analysis are contained in the accompanying Excel data file.

Attachment: Excel file: "Refuge Long-term levels.xls"



**Table 1. Comparison of Class III and the Long-term Levels of the Consent Decree.**

Water Year*	Consent Decree Long-Term Levels based on measured daily stage from WY1999 - WY2006		Class III Criteria	
	Annual Geomean of Monthly Levels (1)	5-year Geomean of Monthly Levels (2)	Annual Geomean Limit	5-year Geomean Limit
WY1999	10.6		11.0**	10.0
WY2000	9.6		11.0	10.0
WY2001	12.0		11.0	10.0
WY2002	9.8		11.0	10.0
WY2003	10.2	10.4	11.0	10.0
WY2004	9.6	10.2	11.0	10.0
WY2005	11.5	10.6	11.0	10.0
WY2006	10.9	10.4	11.0	10.0
<b>Average</b>	10.5	10.4	11.0	10.0
* Water Year = May 1 - April 30				
** Class III criteria specifies an annual limit of 11 ppb with the annual geometric mean of at least three out of each 5 years being 10 ppb or less.				
(1). Annual geometric mean calculated as the geometric mean of monthly arithmetic average TP levels calculated based on the daily average 3-gage stage using the long-term level equation from Appendix B of the Consent Decree.				
(2). 5-year geometric mean calculated as the geometric mean of the 5 annual geometric means comprising the 5-year period.				
Comparison of Consent Decree with Class III Criteria (4-part test) Based on 1999-2006 Data				
Component of 4-Part Test	Consent Decree	Class III Criteria	Lower/More Protective	
Part 1: 5-year geometric mean of 10 ppb or less	10.2-10.5 ppb (10.4 ppb avg)	10.0 ppb	<b>Class III</b>	
Part 2: Annual geometric mean of 11 ppb or less	9.5-12.0 ppb (10.5 ppb avg) (two years above the 11 ppb Class III Max.)	11 ppb limit (Part 2) and 3/5 years below 10 ppb (Part 3) (max average =10.4 ppb)		
Part 3: Annual geometric mean of 10 ppb or less in 3 of 5 years		Class III criteria specifies a 15 ppb limit for individual sites.		
Part 4: Individual station annual geometric mean of 15 ppb or less	Consent Decree does not assess individual sites.			
Other Factors to Consider				
Compliance with the Consent Decree algorithm is evaluated using a 14 site network. Compliance with the Class III criteria is evaluated using 17 sites (14 Consent Decree sites + 3 additional sites near transitional areas) in the unimpacted area and 7 sites in the impacted area, with impacted and unimpacted sites to be evaluated separately.				
Class III criteria derived based on biological response not dependent on water level management. Under the WY1999-WY2006 stage conditions in the Refuge, the algorithm of the Consent Decree allows 5-year geometric means above 10 ppb during each period.				

