Appendix 3C-1: Calculation of Annual and Five-Year Geometric Mean Total Phosphorus Concentrations to Assess Achievement of the Phosphorus Criteria for the Everglades Protection Area

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SUMMARY

To assess achievement of the phosphorus criteria for the Everglades Protection Area (EPA) annual and five-year geometric mean, total phosphorus (TP) concentrations must be calculated across the sites comprising the monitoring network in each portion of the EPA. There are several different methods by which the required annual and five-year geometric means can be calculated, all potentially resulting in slightly different results. To avoid confusion in the future and to assure consistency of future calculations required to assess compliance with the phosphorus criteria in the EPA, the specific calculation methods to be used by the Florida Department of Environmental Protection in assessing compliance with the Everglades phosphorus criteria are documented herein. The methods described herein were developed to be consistent with the derivation of the criteria and the associated four-part compliance test wherever possible to provide an unbiased assessment of ambient water quality conditions within the EPA.

For the purpose of evaluating achievement of the phosphorus criterion, the EPA is divided into four water bodies consistent with the general compartmentalization of the system as defined by Paragraph (4)(b) of the phosphorus criterion rule (62-302.540, Florida Administrative Code). The rule further separates each water body into impacted and unimpacted areas and specifies that achievement of the criterion will be assessed separately in both portions of each water body. In order to evaluate compliance with the phosphorus criterion, three values must be calculated from the monthly data collected at sites comprising the monitoring networks in both portions of each water body. The required calculated values are (1) the annual individual site geometric mean, (2) the annual network geometric mean, and (3) the five-year network geometric mean.

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Prior to performing any calculations, the data collected will be screened in accordance with the methods provided in the Quality Assurance/Quality Control (QA/QC) screening protocol referenced by the phosphorus criterion rule. Doing so assures the data were collected and analyzed in accordance with accepted methods and the results can be considered to accurately characterize ambient conditions. The data meeting the QA/QC requirements will then be used to calculate the required compliance values as described below.

MINIMUM DATA REQUIREMENTS

To assure that the criterion compliance assessment provides an unbiased assessment of the ambient conditions over the entire water year, the QA/QC screening protocol included as part of the phosphorus criterion rule specifies a minimum annual data requirement for sites to be included in the criterion compliance assessment. If any monitoring site does not have a minimum of six valid (meeting the QA/QC screening requirements) temporally independent TP measurements during a water year, the data for that site will not be included in the assessment for that water year. To be treated as independent samples, samples from a given site shall be collected at least two weeks (14 days) apart. Samples collected at the same site less than 14 days apart shall be considered as one sample, with the mean value used to represent the sampling period. In addition, at least one sample from each site must be collected in both the wet and dry seasons of the water year to assure that seasonal variations in ambient conditions are captured. For the purposes of this assessment, the wet season shall extend from May 1 through October 31 and the dry season shall be from November 1 through April 30.

PHOSPHORUS CRITERION ASSESSMENT CALCULATIONS

An annual assessment will be conducted based on the four-part test specified by the phosphorus rule to determine whether or not each portion of the EPA achieves the phosphorus criterion. For the purpose of this evaluation, the annual assessment period will extend from May 1 through April 30.

The annual and five-year geometric mean total phosphorus concentrations required to assess achievement of the criterion will be calculated using the specific methods described below. These calculation methods were developed to be consistent with the approach used in deriving the criterion and associated four-part compliance test which have been approved by both the Environmental Regulation Commission and the U.S. Environmental Protection Agency. Therefore, the geometric mean total phosphorus concentrations calculated in accordance with the methods described below shall represent the long-term geometric means specified in the phosphorus criterion rule and the Everglades Forever Act.

CALCULATION OF THE ANNUAL INDIVIDUAL SITE GEOMETRIC MEAN

The calculation of the annual individual site geometric mean TP concentration is simply the geometric mean of the monthly TP monitoring values collected during the 12-month period which have undergone the QA/QC screening specified in the phosphorus criterion rule.

CALCULATION OF THE ANNUAL NETWORK GEOMETRIC MEAN

The annual network geometric mean TP concentration is calculated as the arithmetic mean of the annual site geometric means calculated as specified above for that year. If any individual site lacks a sufficient number of valid samples during a year, the annual network geometric mean for that year will be calculated as described excluding the data for that site.

CALCULATION OF THE FIVE-YEAR NETWORK GEOMETRIC MEAN

The five-year network geometric mean TP concentration is calculated as the arithmetic mean of the annual site geometric means calculated as specified above for each consecutive five-year period. The five-year site geometric mean for each five-year period will be calculated as described excluding any site-years for individual sites with less than six valid samples during the year.

CHANGING THE DESIGNATION OF SITES FROM IMPACTED TO UNIMPACTED

As phosphorus levels in the marsh improve, the phosphorus criterion rule specifies that individual monitoring sites in the impacted area network will be incorporated into the unimpacted area network when the five-year geometric mean is less than or equal to 10 parts per billion (ppb) and the annual geometric mean is less than or equal to 15 ppb. The rule does not allow sites designated as unimpacted to be converted to impacted sites.

To assess the need to convert impacted sites to unimpacted sites, the annual and five-year site geometric means must be calculated for individual impacted sites. The annual site geometric mean required for this assessment shall be calculated the same as for the annual individual site geometric mean. Consistent with the calculation of the network, the five-year geometric mean for individual impacted sites shall be calculated as the arithmetic mean of the five annual site geometric means.

DATA PRECISION AND CRITERION COMPLIANCE ASSESSMENT

Currently, most analytical labs have method detection limits in the 2 to 4 ppb range and generally report results to the nearest 1 ppb. Since the calculated values can be no more accurate or precise than the data on which they are based, the values calculated as previously described will be rounded to the nearest 1 ppb using standard scientific rounding methods prior to using them to assess compliance with the phosphorus criterion.

To assess compliance with the phosphorus criterion, the three calculated geometric mean TP concentrations for the impacted and unimpacted portions of each water body are compared to the limits set forth in the four-part assessment methodology specified in the phosphorus criterion rule. If the calculated values for any water body segment exceeds any one of the limits established in the four-part assessment methodology, the phosphorus criterion will not be achieved in that segment of the EPA for that assessment period.