

# Calculation of Annual and 5-Year Geometric Mean Total Phosphorus Concentrations to Assess Achievement of the Phosphorus Criteria for the Everglades Protection Area

Florida Department of Environmental Protection

To assess achievement of the phosphorus criteria for the Everglades Protection Area (EPA) annual and 5-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 5-year geometric means can be calculated with the different calculation methods 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 Department 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 accompanying 4-part compliance test where ever possible and 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. The rule further separates each water body into impacted and unimpacted areas and specifies that achievement of the criterion will be assessed separately in impacted and unimpacted portions of each water body. In order to evaluate compliance with the phosphorus criteria, three numbers must be calculated from the monthly data to be collected at sites comprising the monitoring networks in the impacted and unimpacted 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 5-year network geometric mean.

Prior to performing any calculations, the data collected will be screened in accordance with the methods provided in the QA/QC screening protocol referenced by the phosphorus criterion rule to assure 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 the criteria compliance assessment provides an unbiased assessment of the ambient conditions over the entire 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 (6) valid

(meeting the QA/QC screening requirements) temporally independent TP measurements during a year, the data for that site will not be included in the assessment for that 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 median value used to represent the sampling period. In addition, the samples from each site must be collected so that at least one sample is collected in both the wet and dry seasons of the year to assure 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 (62-302.540, F.A.C.) 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 method described below. These calculation methods were developed to be consistent with the approach used in deriving the criterion and associated four-part test which have been approved by both the Environmental Regulation Commission and USEPA. 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 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 criteria rule.

### **Calculation of the Annual Network Geometric Mean**

The annual network geometric mean TP concentration will be 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 5-Year Network Geometric Mean**

The 5-year network geometric mean TP concentration will be calculated as the arithmetic mean of the annual site geometric means calculated as specified above for each consecutive 5-year period. The 5-year site geometric mean for each 5-year period will be calculated as described excluding data for any individual sites having less than six (6) valid samples during a 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 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.

Therefore, to assess the need to convert impacted sites to unimpacted sites, the annual and 5-year site geometric means must be calculated for individual impacted sites. The annual site geometric mean required for this assessment shall be the same as calculated as above for the annual individual site geometric mean. Consistent with the calculation of the 5-year network geometric means as specified above, the five-year geometric mean for individual impacted sites required this purpose shall be calculated as the arithmetic mean of the five annual site geometric means for each 5-year period.

### **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 described above will be rounded to the nearest 1 ppb using standard scientific rounding methods prior to using them to assess compliance with the phosphorus criteria.

To assess compliance with the phosphorus criteria, the three calculated geometric mean TP concentrations for the impacted and unimpacted portions of each water body will be compared to the limits set forth in the 4-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 4-part assessment methodology, the phosphorus criteria will not be achieved in that segment of the EPA for that assessment period.