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Nutrient Criteria Technical Guidance Manual

Wetlands

Full Guidance Document available in full at:
http://www.epa.gov/waterscience/criteria/nutrient/guidance/

EXECUTIVE SUMMARY

The purpose of this document is to provide scientifically defensible guidance to assist States, Authorized Tribes, Territories, and other authorized jurisdictions—hereafter referred to as States—in assessing the nutrient status of their wetlands, and to provide technical assistance for developing numeric nutrient criteria for wetland systems in an eco-region. The development of nutrient criteria is part of an initiative by the U.S. Environmental Protection Agency (USEPA) to address the problem of cultural eutrophication, i.e., nutrient pollution caused by human activities (USEPA 1998a). Cultural eutrophication is not new; however, traditional efforts at nutrient control have been only moderately successful. Specifically, efforts to control nutrients in water bodies that have multiple nutrient sources (point and nonpoint sources) have been less effective in providing satisfactory, timely remedies for enrichment-related problems. Development and adoption of numeric criteria into water quality standards aids nitrogen and phosphorus pollution control efforts by providing clear numeric goals for water quality protection. Furthermore, numeric nutrient criteria provide specific water quality goals that will assist researchers in designing improved best management practices.

In 1998, the USEPA published a report entitled, *National Strategy for the Development of Regional Nutrient Criteria* (USEPA 1998a). This report outlines a framework for development of waterbody-specific technical guidance that can be used to assess nutrient status and develop region-specific numeric nutrient criteria. The document presented here is the wetland-specific technical guidance for developing numeric nutrient criteria. The Nutrient Criteria Technical Guidance Manuals for Rivers and Streams (USEPA, 2000b), Lakes and Reservoirs (USEPA, 2000a) and Estuarine and Coastal Marine Waters (USEPA, 2001) have been completed and are available at: http://www.epa.gov/waterscience/criteria/nutrient/guidance/index.html.

Section 303(c) of the Clean Water Act directs States to adopt water quality standards for waters that are "waters of the United States," including wetlands that are waters of the United States.[1] A water quality standard consists of three main elements: (1) one or more designated uses of each of the State's waters, such as recreation or propagation of fish; (2) criteria expressed as pollutant concentration levels or narrative statements representing a quality of water that supports a designated use; and, (3) an anti-degradation policy to protect existing uses and high quality waters.

[1] For further information regarding the scope of 'waters of the U.S.' in light of the U.S. Supreme Court's 2006 decision in *Rapanos v. United States*, see "Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States," which was jointly issued by the U.S. Environmental Protection Agency and the Army Corps of Engineers and is available at: http://www.epa.gov/owow/wetlands/.

The information used in developing the technical approaches in this document came from references about studies of wetlands in a wide range of conditions, but not wetlands with a high degree of modification (e.g., wetlands that are considered "prior converted cropland" or artificial wetlands specifically engineered to protect or improve downstream water quality). This guidance is to assist States in developing numeric nutrient criteria for wetlands, should they choose to do so. States may choose to develop different types of criteria for wetlands protection, including site-specific or narrative criteria for wetlands protection, as long as they are scientifically defensible and protective of the designated uses (40 CFR § 131.11). This Guidance Manual includes chapters dealing with the following topics:

CLASSIFICATION OF WETLANDS

Classification strategies for nutrient criteria development include:

- physiographic regions
- hydrogeomorphic class
- water depth and duration
- vegetation type or zone

Choosing a specific classification scheme will likely depend on practical considerations, such as: whether a classification scheme is available in mapped digital form or can be readily derived from existing map layers; whether a hydrogeomorphic or other classification scheme has been refined for a particular region and wetland type; and, whether classification schemes are already in use for monitoring and assessment of other waterbody types in a State or region.

SAMPLING DESIGN

Three sampling designs for new wetland monitoring programs are described:

- probabilistic sampling
- targeted/tiered approach
- BACI (Before/After, Control/Impact)

These approaches are designed to obtain a significant amount of information for statistical analyses with relatively minimal effort. Sampling efforts should be designed to collect information that will answer management questions in a way that permits robust statistical analysis. In addition, site selection, characterization of reference sites or systems, and identification of appropriate index periods are all of particular concern when selecting an appropriate sampling design. Careful selection of sampling design will allow the best use of financial resources and result in the collection of high quality data for evaluation of the wetland resources of a State.

CANDIDATE VARIABLES FOR ESTABLISHING NUTRIENT CRITERIA

Candidate variables to use in determining nutrient condition of wetlands and to help identify appropriate nutrient criteria for wetlands consist of supporting variables, causal variables, and response variables. Supporting variables provide information useful in normalizing causal and response variables and categorizing wetlands. Causal variables are intended to characterize nutrient availability (or assimilation) in wetlands and could include nutrient loading rates and soil nutrient concentrations. Response variables are intended to characterize biotic response and could include community structure and composition of macrophytes and algae. Recommended variables for wetland nutrient criteria development described in this chapter are:

1. Causal variables – nutrient loading rates, land use, extractable and total soil nitrogen (N) and phosphorus (P), water column N and P;

2. Response variables – nutrient content of wetland vegetation (algal and/or higher plants), aboveground biomass and stem height, macrophyte, algal, and macroinvertebrate community structure and composition; and,

3. Supporting variables – hydrologic condition/balance, conductivity, soil pH, soil bulk density, soil organic matter content.

DATABASE DEVELOPMENT AND NEW DATA COLLECTION

A database of relevant water quality information can be an invaluable tool to States as they develop nutrient criteria. In some cases, existing data are available and can provide additional information that is specific to the region where criteria are to be set. However, little or no data are available for most regions or parameters, and creating a database of newly gathered data is strongly recommended. In the case of existing data, the data should be geolocated, and their suitability (type and quality and sufficient associated metadata) ascertained.

DATA ANALYSIS

Data analysis is critical to nutrient criteria development. Proper analysis and interpretation of data determine the scientific defensibility and effectiveness of the criteria. Therefore, it is important to evaluate short and long-term goals for wetlands of a given class within the region of concern. The purpose of this chapter is to explore methods for analyzing data that can be used to develop nutrient criteria consistent with these goals. Techniques discussed in this chapter include:

- Distribution-based approaches that examine distributions of primary and supporting variables (i.e., the percentile approach);

- Response-based approaches that develop relationships between measurements of nutrient exposure and ecological responses (i.e., tiered aquatic life uses);

- Partitioning effects of multiple stressors;
- Statistical techniques;
- Multi-metric indices; and,
- Linking nutrient availability to primary producer response.

CRITERIA DEVELOPMENT

Several methods can be used to develop numeric nutrient criteria for wetlands.They include, but are not limited to, criteria development methods that are detailed in this document:

- Comparing conditions in known reference systems for each established wetland type and class based on best professional judgment (BPJ) or identifying reference conditions using frequency distributions of empirical data and identifying criteria using percentile selections of data plotted as frequency distributions;
- Refining classification systems using models, and/or examining system biological attributes in comparison to known reference conditions to assess the relationships among nutrients, vegetation or algae, soil, and other variables and identifying criteria based on thresholds where those response relationships change; and,
- Using or modifying published nutrient and vegetation, algal, and soil relationships and values to identify appropriate criteria.

A weight of evidence approach with multiple attributes that combine one or more of the development approaches will generally produce criteria of greater scientific validity.

The purpose of this document is to provide guidance on developing numeric nutrient criteria in a scientifically valid manner, and is not intended to address the multiple, complex issues surrounding implementation of water quality criteria and standards. Implementation will be addressed in a different process and additional implementation assistance will also be provided through other technical assistance projects provided by EPA. For issues specific to constructed wetlands, States should refer to http://www.epa.gov/owow/wetlands/watersheds/cwetlands.html.