

# NUMERIC NUTRIENT CRITERIA IN FLORIDA – HOW IT HAPPENED AND WHAT IT MEANS FOR GEORGIA

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**Abstract.** The US Environmental Protection Agency has promulgated numeric nutrient criteria for Florida. This unusual action was the result of a settlement in a lawsuit by environmental interests alleging that EPA was not enforcing the Clean Water Act with respect to Florida waters. Prior to EPA finalizing the criteria, Florida had spent a decade and some \$20 million to gather and analyze information to set its own criteria. The nitrogen and phosphorus limits EPA has imposed on Florida are low enough that virtually all public and private sector entities with water management responsibilities have expressed serious concern over the cost and the technical ability to comply. Particularly vocal interests include local governments with MS4 stormwater permits, wastewater utilities, the agricultural community, phosphate mining interests, the pulp and paper industry, and even the Florida Department of Environmental Protection. Over 3,300 comments were submitted to EPA expressing concern over scientific processes used to derive the criteria, lack of demonstrated dose-response relationships between nutrients and biology, massive costs to build or upgrade treatment systems, inability of conventional technologies to achieve the criteria, how the criteria will be enforced at the state level, and the legal precedent established by EPA stepping in to promulgate water quality criteria for a state which was working cooperatively with the federal agency for years to establish criteria on its own. This presentation provides insight into scientific issues surrounding the new criteria, implementation and compliance issues, and the associated cost projections. These issues are relevant to Georgia because EPA has made it clear that other states will have numeric nutrient criteria. Also, Georgia has several watersheds exiting through Florida on their way to the Gulf of Mexico, some of which have already seen controversy and legal wrangling over water issues. Nutrient criteria may be the sequel to that story.

## INTRODUCTION

In November 2010, the US Environmental Protection Agency (EPA) promulgated numeric nutrient criteria (NNC) for the State of Florida (Fed. Reg. Vol. 75, No. 233). Publication of the final criteria came approximately

11 months after the release of draft criteria from EPA in January of 2010. EPA accepted public comment for 90 days after the initial draft was released, and accepted comments for another month in August after a supplemental Notice of Data Availability was published by EPA offering several alternatives to the initial draft NNC. Although EPA had been providing guidance and pressure for states and tribes to establish NNC for more than a decade, there was no precedent for EPA's actions with respect to Florida.

This unusual action was the result of a settlement in a lawsuit brought against EPA by EarthJustice and associated environmental interest groups alleging that EPA was not adequately enforcing the Clean Water Act with respect to Florida waters. The threat of severe algae blooms, fish kills and human health risk were among the justification for accelerating NNC development in Florida. The action was also unexpected in that Florida is among the most progressive states in the nation with respect to water resource management, with a statewide Department of Environmental Protection (FDEP), five regional Water Management Districts, and a large number of county governments with water quality protection programs. The State has a comprehensive and active program for establishing Total Maximum Daily Loads (TMDLs), including many TMDLs for nutrients. Prior to EPA finalizing its criteria, FDEP had spent a decade of continuing effort and some \$20 million to gather and analyze a broad array of information to develop NNC for the state. EPA was a full participant in the FDEP process, and provided written feedback to the State largely concurring with the schedule and the approaches being pursued.

Over 3,300 comment documents were submitted EPA expressing concern over the scientific and analytical approaches used to derive the criteria, the lack of demonstrated dose-response relationships between nutrients and biology, potentially massive costs to build or upgrade treatment systems, the possible inability of conventional technologies to achieve the criteria, the manner in which the criteria will be enforced at the state level, and the legal precedent established by EPA in stepping in to promulgate water quality criteria for a state which was working cooperatively with the Federal agency for years to establish criteria on its own. Particularly vocal interests included

local governments with MS4 stormwater permits, wastewater utilities, the large agricultural community in Florida, phosphate mining interests, the pulp and paper industry, and even FDEP and Water Management Districts.

### THE CRITERIA

NNC were promulgated for all freshwater springs, streams and lakes (very broadly defined) in the state, except for the southern portion of the peninsula, which is dominated by artificially created canals, and by Lake Okeechobee and the Everglades (which already have phosphorus TMDLs in place). EPA has established dates in 2011 for the publication of NNC for the southern part of the state, and for the many brackish estuaries surrounding Florida.

As noted above, EPA has provided extensive guidance to states and tribes for developing their own NNC, emphasizing the need to rely on sound scientific principles, but some of the strongest criticism leveled against the EPA approach was where EPA appeared to disregard its own guidance. As one example, EPA relied on a geographic separation of the state into five “nutrient regions” for the determination of nitrogen and phosphorus criteria for streams, while criteria for lakes are based upon their alkalinity and color regardless of their location, and the nitrate criterion for springs is the same value for every spring in the state. Obviously, this can be expected to lead to discontinuity in the application of the NNC since springs, streams and lakes may all be part of the same hydrologic system in some watersheds. In addition, EPA guidance for stream criteria (EPA 2000) clearly states the need to classify streams by their physical morphology within each ecoregion based on the fact that nutrients will respond differently in different stream types. However, the final criteria do not include any stream classification structure, instead relying on the assumption that all streams within a nutrient region will respond similarly to nutrient inputs. Another example of EPA straying from its own guidance is in its failure to establish any biological “response” variables for streams, even though the need for response variables was continuously emphasized by EPA during FDEP’s efforts to develop NNC. In fact, the EPA rejected a suggestion from the FDEP to include a “biological validation” step designed to ensure the criteria were implemented in appropriate systems. The inability to derive dose/response based criteria was openly acknowledged by EPA because it could find no reliable linkage between nutrient levels and biological conditions in streams at the landscape level.

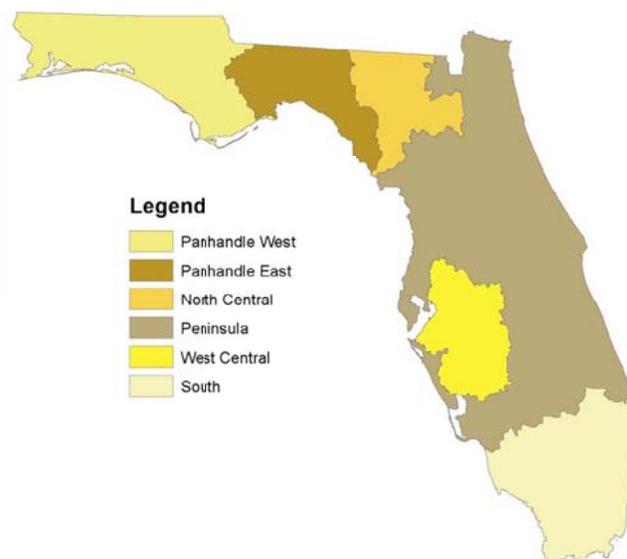
The EPA NNC are summarized in Table 1, and the nutrient regions for Florida streams are illustrated in Figure 1. The final criteria for streams were derived using a

“benchmark stream” approach for all nutrient regions except the West Central region which used a “reference approach” because significant benchmark stream data were lacking in the West Central region. Criteria based on the “benchmark stream” approach were derived from a statistical distribution of nutrient concentrations in streams that met certain benchmark criteria including land use characteristics, current impairment status, “healthy” biology, and best professional judgment. The “reference” approach for the West Central region was similar but based on a statistical distribution of nutrient concentrations in streams that exhibited “healthy” biology.

**Table 1. EPA Numeric Nutrient Criteria for Streams, Lakes, and Springs in Florida.**

Waterbody Type	Classification	TN (mg/L)	TP (mg/L)	Chl-a (mg/L)
Streams	Panhandle West	0.67	0.06	N/A
	Panhandle East	1.03	0.18	N/A
	North Central	1.87	0.30	N/A
	West Central	1.65	0.49	N/A
	Peninsula	1.54	0.12	N/A
Lakes	Colored	1.27 [1.27-2.23]	0.05 [0.05-0.16]	0.02
	Clear, High Alkalinity	1.05 [1.05-1.91]	0.03 [0.03-0.09]	0.02
	Clear, Low Alkalinity	0.51 [0.51-0.93]	0.01 [0.01-0.03]	0.006
	Springs	0.35*	N/A	N/A

\* Criterion applies to nitrate-nitrite concentrations only



**Figure 1. Nutrient Regions for Florida Streams**

As previously stated, both approaches have been met with significant criticism citing a lack of scientific defensibility, verifiable link to designated uses or biological improvement, and appropriateness to represent Florida streams. When implemented, these criteria will result in a significant increase in the number of impaired streams statewide with no indication achievement of the criteria will result in any water resource improvement. Also, it is significant to note the stream criteria are not representative of conditions observed in pristine landscapes. Nutrient runoff concentrations from natural landscapes in State Parks (presumed to represent the least degree of anthropogenic impact available) are higher than the criteria in many cases.

The lakes criteria were categorized based on color and alkalinity and derived from a relationship between nutrient concentrations (TN and TP) and chlorophyll a. While the scientific basis for the lakes criteria was more robust than those for streams, they still do not account for natural differences in geology throughout Florida. In addition, the criteria fail to account for lakes that meet designated uses with chlorophyll a concentrations that may exceed the threshold value.

The lone bright spot in this process has been the springs criteria which were derived based on a statistically and biologically significant relationship between algal growth and nitrate-nitrite concentrations. The methodology included field as well as lab studies that converged on a threshold concentration above which algal growth in springs resulted in non-attainment of designated uses.

## THE RESPONSE

Over 3,300 comment documents were submitted EPA expressing concern over the scientific and analytical approaches used to derive the criteria, the lack of demonstrated dose-response relationships between nutrients and biology, potentially massive costs to build or upgrade treatment systems, the possible inability of conventional technologies to achieve the criteria, the manner in which the criteria will be enforced at the state level, and the legal precedent established by EPA in stepping in to promulgate water quality criteria for a state which was working cooperatively with the Federal agency for years to establish criteria on its own. Particularly vocal interests included local governments with MS4 stormwater permits, wastewater utilities, Florida's large and diverse agricultural community, phosphate mining interests, the pulp and paper industry, and even FDEP and Water Management Districts.

Since the criteria have become final, a number of complaints have been filed against EPA in Federal Court. These lawsuits have come from the State of Florida, vari-

ous municipalities, private industry, and a coalition of environmental interests.

## IMPLEMENTATION AND COMPLIANCE

In many cases, the nitrogen and phosphorus limits EPA has imposed on Florida are low enough that public and private sector entities with discharge permits or other water management responsibilities have expressed serious concern over the cost of compliance and even the technical ability to comply at all. Projected methods of compliance have ranged from hundreds of thousands of acres of constructed wetlands throughout the state (with no guarantee the criteria can be met because of natural variability and limits to the ability of wetlands to reduce nutrient levels) to hundreds of reverse osmosis plants statewide. The EPA's projected cost of compliance ranged from \$100 to \$130 million annually (EPA 2010), however the EPA analysis was widely criticized as inadequate and grossly underestimating the costs. An independent economic analysis of compliance costs cited significant deficiencies in EPA's analysis and projected costs ranging from approximately \$2 to \$8 billion annually for 30 years (Cardno ENTRIX, 2010).

Adding a level of complexity to the already controversial nutrient concentrations established by EPA, the criteria are to be implemented as an annual geometric mean concentration that is not to be exceeded more than once in any three year period. Since the FDEP administers the NPDES program for Florida, the state now has the responsibility for implementing the criteria for regulated point and non-point source dischargers with no significant guidance as yet from EPA on how to do so. A crucial question concerning implementation is whether the criteria will be applied as "end of pipe" limits in permits or as Best Management Practices (BMP) or Limit of Technology (LOT) goals. FDEP, along with many regulated stakeholders have expressed concern over this issue, with no resolution yet.

In what has been perceived as an attempt to quell the onslaught of criticism for the criteria, the EPA rule emphasizes the use of Site Specific Alternative Criteria (SSAC) and Variances to gain relief from the criteria in deserving waterbodies. Although the scientific methodology for obtaining a federal nutrient SSAC is not clearly defined, the NNC rule does state that the entity submitting the SSAC application must provide adequate biological, chemical, and physical evidence that designated uses are being met and that downstream waterbodies will be protected. Any public or private entity can submit an application for a SSAC that can be targeted for application on a watershed, area-wide, or waterbody-specific basis; a point that is currently being challenged in federal court by environmental advocacy groups concerned that SSACs could

be established to allow nutrient enrichment to continue in spite of the statewide NNC. While the ability to apply for a SSAC seems desirable, the cost of data collection and analysis, along with the time required to complete the study and negotiate state and federal approval, may prove to be prohibitive, especially for smaller local governments, small businesses and agricultural operations. In addition, there is no guarantee EPA will accept a given SSAC, and there is always the threat of third party challenges, which can complicate the process and further drive up the cost and extend the time to approval. While the SSAC process may be desirable in certain cases, it should certainly not be used as a solution to poorly developed criteria.

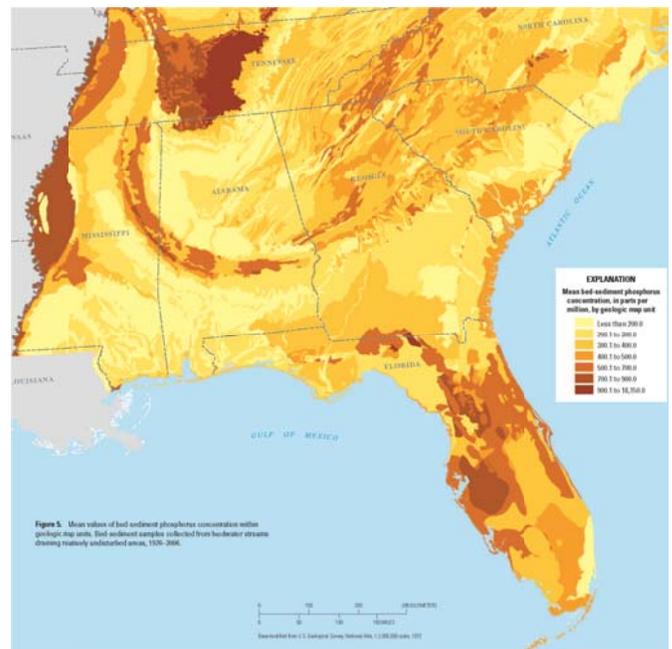
In deriving the stream criteria, the EPA's use of the reference approach in lieu of a dose/response approach has been the major source of criticism and technical discomfort. This is especially true given EPA's admission that it found no reliable link between stream biological health and nutrient concentrations, and then used only streams that exhibited healthy biology to represent "healthy" nutrient concentrations in the reference approach.

EPA did not adequately explore all potential ecological factors and response variables when pursuing the dose/response approach to criteria development. One example of this oversight is failure to consider the diversity of geomorphologic stream types and sizes in the state, even though classification systems exist to facilitate such consideration (e.g., Kiefer 2010). A large proportion of streams in Florida have been altered by human activities, resulting in either hydrologic impacts or physical changes to stream morphometry, both of which can affect the ecological expression of nutrients and/or cause biological impacts that may be incorrectly interpreted as resulting from nutrient enrichment. Another prime example is the omission of dissolved oxygen from consideration. The FDEP maintains the state's most comprehensive dissolved oxygen database, covering hundreds of streams statewide, and unfortunately, that data set was not considered during criteria development. Hammond (2009) explored relationships between continuously recorded dissolved oxygen data, nutrient levels and biological integrity and found patterns not considered by EPA in its process. Further analysis of dissolved oxygen data, with concurrently collected nutrient and biological data, along with consideration of the physical classification of streams may well show statistically significant relationships between nutrient concentrations, dissolved oxygen, and stream biological integrity that could be used to support dose/response based criteria. We are currently exploring this approach to provide a scientifically defensible basis for SSAC development, but it should have been part of EPA's NNC development process, rather than a tool for after-the-fact corrections.

## IMPLICATIONS FOR GEORGIA

These issues in Florida are directly relevant to Georgia for several reasons. Georgia has already developed about 100 TMDLs for both nitrogen and phosphorus, indicating the State has already recognized it has nutrient enrichment issues. EPA has made it clear that other states will have numeric nutrient criteria, and it has now shown it lacks patience and tolerance with prolonged criteria development, particularly in the face of litigation by environmental interests. Staying abreast of the issues and concerns over criteria development in other states can provide Georgia stakeholders advanced knowledge and opportunities to address scientifically defensible criteria prior to EPA involvement.

Georgia's large agricultural community represents a minimally regulated cumulative source of abundant nutrients affecting many watersheds across the state. The U.S. Geological Survey published a report indicating the variability in geological abundance of phosphorus across the U.S. (Terziotti et al 2010). Figure 2 shows that sediment bed phosphorus concentrations vary across Georgia, and this should be given ample consideration in deriving NNC for Georgia. Like Florida, many of Georgia's streams and waterways have seen significant physical impacts, which should be explicitly accounted for as NNC are contemplated.



**Figure 2. Mean Sediment Bed Phosphorus Concentrations (from Terziotti et al 2010).**

Georgia has several watersheds that drain through north-western Florida on their way to the Gulf of Mexico, and thus represent systems which now have Federal NNC in

force for their lower segments, but no such criteria for their upper portions. There have already been many years of tension and litigation over water quantity concerns in the Apalachicola-Flint-Chipola system. Nutrient criteria may add a new and even more challenging facet to that interstate issue.

Above all, the State of Georgia and all concerned stakeholders should remain alert, well-informed and proactive to help achieve the best outcome in this inevitable process of balancing science, regulatory policy, and economics to optimize water quality management.

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