North Carolina Nutrient Criteria Development Plan

Version 2.0

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by the

North Carolina Department of Environment and Natural Resources

Division of Water Resources

Raleigh, North Carolina

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Introduction

Nutrient criteria management plans were strongly encouraged by the Environmental Protection Agency (EPA) for all states through a Federal Register notice issued in 2001 and by subsequent EPA memoranda and actions. In 2004, North Carolina (NC) developed a nutrient criteria plan in response to the 2001 register notice, which was mutually agreed upon in 2004. In order to re-establish mutual agreement with the EPA, the 2004 plan has been updated and amended to reflect commitment and a schedule of progress toward the adoption of numeric nutrient criteria for all State waters. Thus, this North Carolina Nutrient Criteria Development Plan (NCDP) is a revision of the 2004 Nutrient Criteria Implementation Plan (NCIP).

Historically, North Carolina had established itself as a leader in the field of site-specific, flexible nutrient control strategies through the implementation of a chlorophyll-*a* standard and the development of an innovative supplemental classification of 'Nutrient Sensitive Waters' (NSW). Although these strategies have been noteworthy, nutrients continue to affect water quality and have the potential of impacting aquatic life, the public's use of surface waters for recreation, and drinking water supplies. Therefore, additional nutrient management strategies, including water body specific numeric nutrient criteria as appropriate, must be developed.

The North Carolina Division of Water Resources (DWR) developed its NCDP after holding a Nutrient Forum in 2010 and ongoing input of stakeholders expressed during four public forums and from written comments obtained from December 2012 through February 2014. Comments reflected the need for:

1. Establishing a scientific advisory council.
2. Flexible (i.e. site-specific or water body specific) nutrient criteria.
3. Stakeholder involvement.
4. Allowing all existing nutrient management rules and TMDLs to proceed as currently written.
5. Establishing a balance between the best science on nutrient management and the cost-effectiveness of any proposed management strategy.

Based upon that input, this revised plan:

1. Outlines the creation of a Scientific Advisory Council (SAC)
2. Identifies a process through which the DWR will evaluate nutrients throughout NC.
3. Identifies three areas for the development of nutrient criteria and implementation strategies in the near future:
    a) High Rock Lake (Figure 1, page 6)
    b) Central portion of the Cape Fear River (Figure 2, page 9)
    c) Albemarle Sound (Figure 3, page 11)
4. Affirms DWR commitments in implementing the NCDP.

Nutrient Criteria - Definition

For the purposes of this document, "nutrient criteria" are defined as either of the following:

- Response and/or causal variables expressed as numerical concentrations and/or mass quantities or loadings.
- Response and/or causal variables expressed as narrative statements with a scientifically defensible translator mechanism to derive or calculate numerical concentrations and/or mass quantities or loadings.

When developing criteria, the use of biological confirmation will be considered and implementation strategies will be developed

Priority parameters for consideration are provided in Table 1.

Table 1. Response and causal variables for consideration. (Others may be considered)

Response variables	**Causal variables**
Chlorophyll-*a*	Nitrogen
Phytoplankton	Phosphorus
Periphyton	
Macrophytes	
Diurnal dissolved oxygen (DO) range	
Minimum DO	
Diurnal pH range	

Timelines

Implementing this NCDP will require collaborative work among the DWR, EPA, SAC, other agencies, local governments and universities. The estimated timelines may need to be modified in future revisions of the NCDP, given research, resource changes or unforeseen delays. The DWR will keep the EPA informed of any delays and will negotiate new timelines if the need arises.

1. Scientific Advisory Council

A Scientific Advisory Council (SAC) will be established to assist the DWR and stakeholder groups with the development of nutrient criteria. Members will be individuals with expertise in areas related specifically to water quality, nutrient response variables, management and point and non-point source nutrient abatement. The SAC will represent a variety of sectors of interest, including, but not limited to, agriculture and permitted dischargers. The EPA will be asked to participate on the SAC. Nominations will be solicited, among various sectors of interest, for individuals who meet these criteria.

The DWR recognizes that the composition of the SAC is essential to the successful development of nutrient criteria. DWR staff consulted with the EPA-Region 4 and the Albemarle Pamlico National Estuary Partnership (APNEP) regarding the creation of effective advisory groups such as a SAC. Further consultation will occur as the DWR develops the SAC. The DWR Director will select members based on the nominations and recommendations from staff.

The SAC will be responsible for:

- Reviewing the quality and relevance of the scientific and technical information being used or proposed as the basis for DWR nutrient related regulations.
- Reviewing generic approaches to nutrient regulatory science, including guidelines governing the use of scientific and technical information in regulatory decisions.
- Advising the DWR on nutrient related matters in science, technology, social and economic issues.

Timeline:

Establishment of the SAC will begin once the EPA and the DWR mutually agree on the NCDP. Establishment of the SAC is estimated take four months.

2. Evaluating Nutrients throughout North Carolina

The DWR is committed to evaluating nutrients and developing nutrient criteria throughout North Carolina. Initial nutrient criteria development efforts will be directed to the three specific areas (High Rock Lake, Central Portion of the Cape Fear River, and Albemarle Sound). The SAC will provide guidance on the development of nutrient criteria for High Rock Lake, the Central Portion of the Cape Fear River, and other areas throughout NC. The SAC and the APNEP technical groups will interact, but those groups already in place with the APNEP will provide guidance on the development of nutrient criteria for Albemarle Sound..

Timeline:

The processes and timeframes though which nutrients will be evaluated throughout NC will be determined after the formation of the SAC.

3. Site-Specific Approach and Priority Sites

North Carolina will take a water body specific approach for developing and implementing nutrient criteria based upon stakeholder comments. In an effort to optimize limited resources and to allow for planning by municipalities and industries, the DWR identified the three specific water bodies for nutrient criteria development based on any of the following criteria:

- *The current stage of nutrient management strategy development and stakeholder engagement.* Each of the three areas already has nutrient management strategies under consideration or development and/or high stakeholder engagement.
- *Identified nutrient impairment or high risk for nutrient impairment – using 303(d) list.*
- *Not already designated as a Nutrient Sensitive Water (NSW) or having a TMDL*.
- *Opportunity to cost-share in efforts to develop site-specific nutrient criteria*.

- *Water supply* – Incorporates the intent of the 2005 Drinking Water Reservoir Protection Act (Session Law 2005-190[1]).

Based on these criteria, the DWR will begin nutrient criteria development with High Rock Lake in the Yadkin River Basin, the middle Cape Fear River in the Cape Fear River Basin and the Albemarle Sound in the Pasquotank River Basin. As these waters are addressed, additional areas for nutrient criteria development will be identified.

3a. High Rock Lake

High Rock Lake is a 15,180-acre reservoir with a 3,974 mi^2 drainage area located on the Yadkin River near Lexington and Salisbury, NC (Figure 1). It is in the Southern Outer Piedmont (45b) and Carolina Slate Belt (45c) Level-4 ecoregions of NC.

Nutrient impact concerns have been documented in High Rock Lake going back to the mid-1970s when the EPA conducted the National Eutrophication Survey and found that it was the most eutrophic of the 16 North Carolina lakes studied. The DWR has been working with a Technical Advisory Committee (TAC) comprised of stakeholders since 2005 to develop tools to evaluate sources of nutrient loading to High Rock Lake and the resulting impact, as expressed by chlorophyll-*a* concentrations in the lake. The TAC is comprised of local stakeholders and DWR staff and is charged with developing the tools that will be used to develop the Nutrient Management Strategy for High Rock Lake. Table 2 provides a summary of past nutrient management efforts and future steps. New tasks and their schedule will be modified based upon a stakeholder process.

Impairments: The entire lake is currently impaired for chlorophyll-*a* and parts of the lake are impaired for pH.

[1] http://www.ncleg.net/Sessions/2005/Bills/Senate/PDF/S981v5.pdf

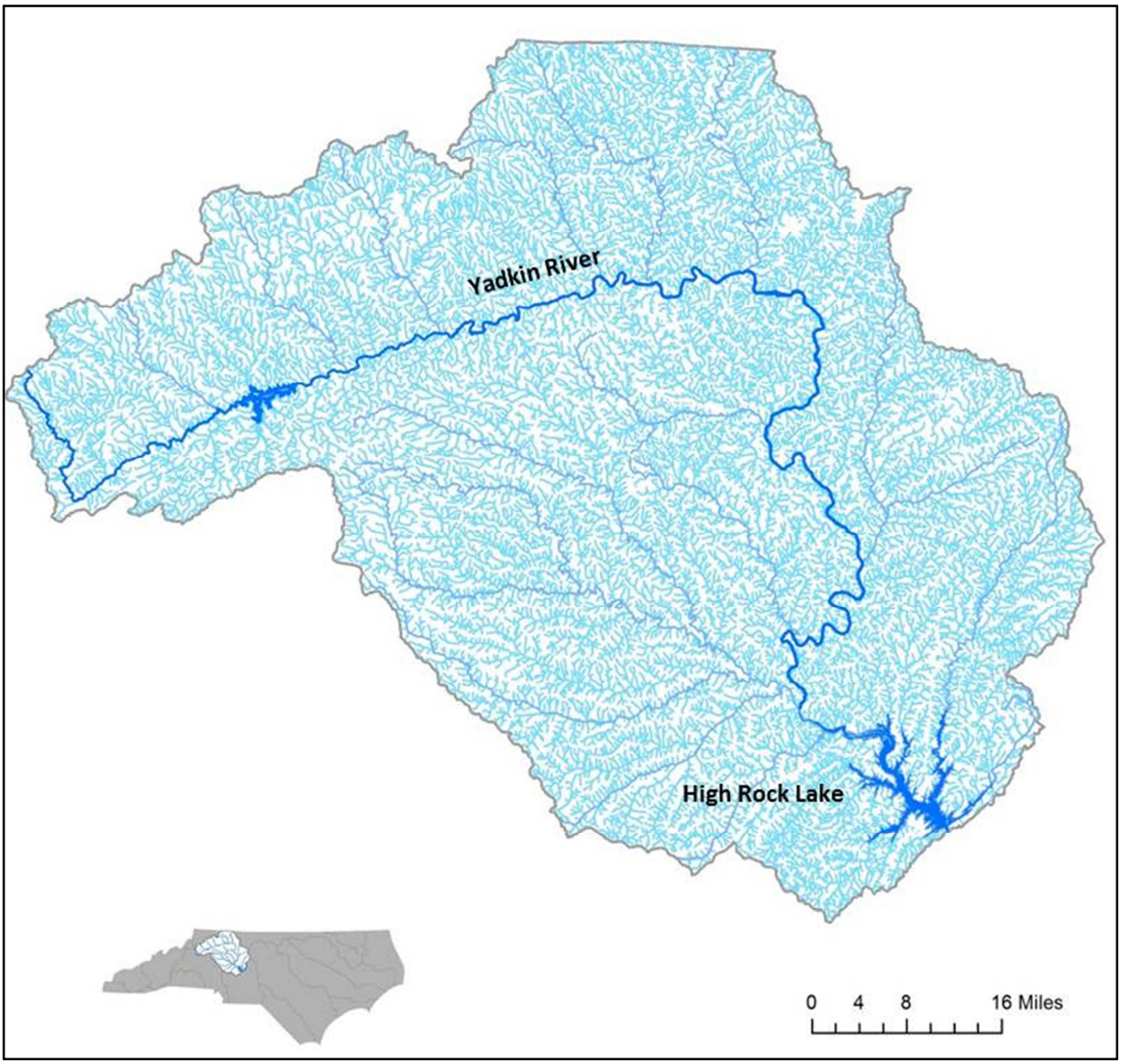

Figure 1. High Rock Lake watershed.

Timelines

Table 2. Brief history of past events and future efforts.

When task is/was initiated	Task	Notes
2004	High Rock Lake – Impaired for chlorophyll-*a*	Ongoing eutrophication concerns led to recommendations for a nutrient management strategy for High Rock Lake in the early 1990s. High Rock Lake was first listed as impaired for chlorophyll-a in 2004.
2005	Technical Advisory Committee	The TAC was established in 2005, and continues to meet. TAC is comprised of local stakeholders and DWR staff.
2007	319 Project - *Updated Land Cover*	Contract awarded CGIA to update land cover for the HRL watershed.
2008	319 Project - *Intensive Monitoring*	Contract awarded to Yadkin Pee Dee River Basin Association. Data collection was conducted from April 2008-April 2010. Samples were collected on a routine basis in the lake and watershed, as well as in response to high flow events in the watershed. Data were used to characterize both the lake and watershed responses to various stimuli, including seasonal weather changes.
2010	Intensive Monitoring-Report	Final Report on intensive monitoring.
	HRL Watershed Model Development	The watershed model links conditions and activities on the land surface to responses in the streams and delivery to the lake.
2012	HRL Watershed Model Report	Final report issued August 12, 2012.
Ongoing	HRL Nutrient Response Model Development	Currently being finalized by EPA in response to TAC model review comments. The nutrient response model provides information on the responses of the receiving water body (i.e. High Rock Lake) to nutrient loading.
Ongoing	HRL Nutrient Response Model Report	Under development, expected completion date is Spring 2014.

When task is/was initiated	Task	Notes
	Final model approved by EMC	Upon completion of nutrient response model.
2014 or 2015	Criteria and management strategy development	The DWR will begin a stakeholder process to develop the Nutrient Management Strategy and resulting nutrient criteria. Target-setting if phased approach is necessary and source allocation will be considered as part of the strategy development. The stakeholder process will begin after the EMC has approved the nutrient response model. The stakeholder process is expected to last for 12-18 months.
2014 or 2015	HRL Stakeholder establishment	This process is not expected to begin until sometime in 2014 or early 2015
2014 or 2015	Coordination with SAC	Concurrent to the stakeholder process.
Future	Rulemaking	This process is expected to take up to 36 months.

3b. <u>Central portion of Cape Fear River basin</u>

This area is defined from below the B. Everett Jordan Reservoir dam along the Haw River, and below the Randleman Lake dam along the Deep River to Lock and Dam #1 (Figure 2). This area has been identified as a priority for nutrient management since the early 2000s. This area is one of the fastest growing regions of the state and there will be a need to determine allocations for waste assimilation, assess the effects and management of nutrients discharged from point and non-point sources, and develop new drinking water sources in this region.

The central portion of the Cape Fear River has a history of high nutrients. Algal blooms and high chlorophyll-*a* concentrations occur behind Buckhorn dam, and Lock and Dams 1, 2 and 3, particularly during years with low precipitation. Nutrients have been an item of discussion within each of the three monitoring coalitions in the Cape Fear basin: the Upper Cape Fear River Basin Association, the Middle Cape Fear Basin Association and the Lower Cape Fear River Program. Additionally, the Rocky River Heritage Foundation[2,3], The Nature Conservancy, North Carolina State University and the University of North Carolina – Wilmington have expressed interest in nutrients.

[2] http://www.rockyriverchatham.org

[3] http://www.rockyriverchatham.org/files/RRPost_Mar3_2013-2.pdf

Figure 2. Cape Fear River Basin. (Areas in color represent the Central portion of the Cape Fear River Basin for which nutrient criteria are proposed)

Notes: The subwatersheds in gray either have nutrient management plans (i.e. Jordan Lake, and Randleman Lake) or are areas that have streams draining to the portion of the Cape Fear River downstream of Lock and Dam 1 (i.e. Lower Cape Fear). Thus, the areas in gray are not in the area designated as the Central portion of the Cape Fear River. The subwatersheds in color are either listed as impaired for chlorophyll-*a* or are of concern for nutrient over enrichment and comprise the "central portion of the Cape Fear River basin."

Several municipalities have water supply intakes on this portion of the river. Algal blooms have increased drinking water treatment costs for the city of Wilmington; hence, there is a high level of stakeholder interest in this region. The Nature Conservancy (TNC) is trying to start a process for addressing nutrients and is developing an InVEST[4] nutrient model for the middle and lower Cape Fear River. (Note that the InVEST model is being developed independently by TNC and not by the DWR. Questions regarding its use should be directed to North Carolina TNC). Additionally, the Middle Cape Fear Basin Association has expressed interest in working with the DWR on nutrient issues. Researchers from the University of North Carolina – Wilmington have also been studying the algal blooms and algal toxins along portions of the middle and lower Cape Fear River[5]. These events have stimulated considerable stakeholder interest regarding the effects of nutrients and nutrient management.

Impairments: Portions of the Rocky River are listed as impaired for chlorophyll-*a*

Tasks and Timeline:

Task development will depend on when a stakeholder group for the central portion of the Cape Fear River can be established. Activities will be initiated once the DWR and EPA mutually agree upon the NCDP.

Table 3. Task list for the central portion of the Cape Fear River basin.

When task is initiated	**Task**	**Notes**
Upon mutual agreement of the NCDP with EPA	Data review	6 months to complete
2015	Stakeholder group development	3 months to complete
To be determined	Modeling, criteria and management strategy development with SAC involvement: 1) Rocky River 2) Deep River 3) Cape Fear River to Lock and Dam 1	Estimated time to complete: 24 months per watershed
To be determined	Rule making	36 months

[4] http://naturalcapitalproject.org/InVEST.html

[5] Isaacs, J.D. et al. 2014. Microcystins and two new micropeptin cyanopeptides produced by unprecedented *Microcystis aeruginosa* blooms in North Carolina's Cape Fear River. Harmful Algae 31:82-86 http://www.sciencedirect.com/science/article/pii/S156898831300139X

3c. Albemarle Sound

The Albemarle Sound (Fig.3) is part of the Albemarle-Pamlico Estuarine System, one of the largest and most important estuarine systems in the United States. The Sound and a significant portion of its basin are within the programmatic areas of the Albemarle-Pamlico National Estuary Partnership (APNEP). As is required for all units of US EPA's National Estuary Program, APNEP's activities are guided by a Comprehensive Conservation Management Plan (CCMP). One of the three goals within APNEP's 2012-2022 CCMP is "*a region where water quantity and quality maintain ecological integrity*" with one of this goals outcomes being "*nutrients and pathogens do not harm species that depend on the waters*" as a priority for the next 18 years.

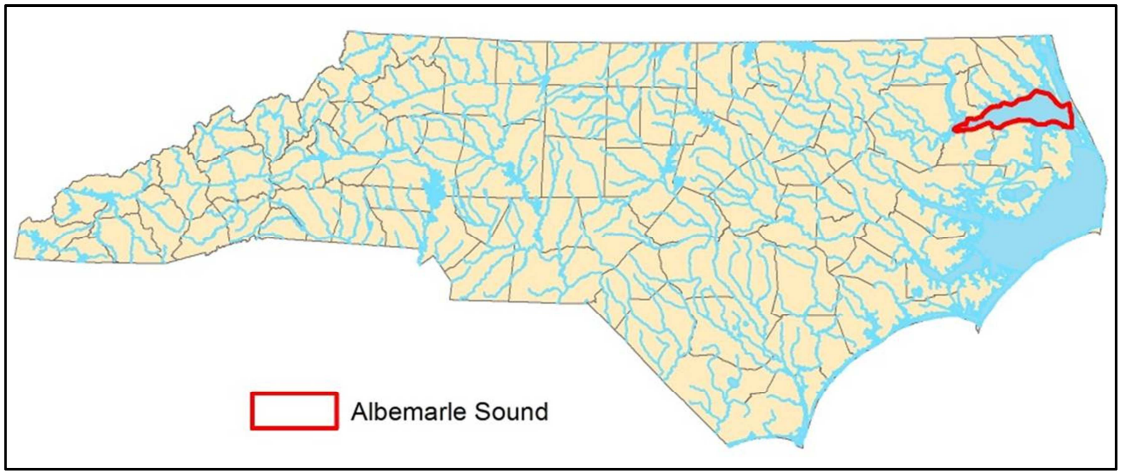

Figure 3. General location of the Albemarle Sound

Stakeholder interest is high in this area based on the APNEP work and associated activities in the region. The United States Geological Survey (USGS) has a monitoring project underway in the Albemarle Sound and is collecting a variety of environmental data including nutrients and phytoplankton. In addition, the DWR is working with APNEP and US EPA Region 4 to obtain funding for the development of nutrient criteria for the Albemarle Sound.

Data reviewed as part of APNEP's Ecosystem Assessment[6] indicated that chlorophyll-*a* concentrations, as reported by the DWR in STORET, do not show trends in the Albemarle Sound between 1980 and 2010; however, sampling by the USGS during 2012 and 2013 indicate the presence of algal blooms throughout the growing season. This data is currently being quality assured and will be reviewed as part of this process.

Tasks and Timelines

Activities related to the Albemarle Sound will be initiated by APNEP once the NCDP is mutually agreed upon by the DWR and EPA and when USGS data are available.

[6] APNEP. 2012/ 2012 Albemarle-Pamlico Ecosystem Assessment. Albemarle-Pamlico National Estuary Partnership. www.apnep.org

Table 4. Task list for the Albemarle Sound.

When task is initiated	Task	Notes
After mutual agreement of the NCDP with EPA	DWR engages Science & Technical Advisory Committee and Policy Board	1 month to complete
Initiated upon release of USGS data	Data review	6 months
To be determined	Funding discussions and obtainment, if necessary	6 months
To be determined	Modeling, criteria and management strategy development; SAC involvement	16 months
To be determined	Public review and comment period on Draft Management Strategy	3 months
To be determined	Rulemaking	36 months

4. DWR Commitments in Implementing the NCDP

The DWR is committing an equivalent of four Full Time Equivalents (FTEs) to the implementation of the NCDP. Staff resources will come from the Water Sciences Section and the Planning Section, with the following anticipated allocation between the sections:

- Water Sciences Section
  - Ecosystems Branch – 1 FTE
- Planning Section
  - Classifications & Standards/Rules Review Branch – 0.5 FTE
  - Modeling & Assessment Branch – 2.0 FTE
  - Nonpoint Source – 0.5 FTE

Input and participation from other DWR sections (e.g. Surface Water Protection) and DWR Branches (e.g. Complex Permitting) will be necessary especially during the discussion of management strategies.