

**STATE OF NORTH CAROLINA  
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES**

**REPORT OF PROCEEDINGS ON THE PROPOSED RECLASSIFICATION  
OF A  
CAPE FEAR RIVER SEGMENT,  
IN BRUNSWICK AND NEW HANOVER COUNTIES  
(BROAD RIVER BASIN)  
FROM SC TO SC Sw  
WITH A WATER QUALITY MANAGEMENT PLAN**

**PUBLIC HEARING  
FEBRUARY 5, 2015  
WILMINGTON, NORTH CAROLINA**

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## **SUMMARY AND RECOMMENDATION**

### **SUMMARY**

The Lower Cape Fear River Program requested that a Cape Fear River segment in Brunswick and New Hanover Counties be reclassified in order to receive the supplemental Class Swamp (Sw) designation (request package attached as pages a-2 through a-64). The reclassification request for these waters states that "... the DO standard of 5 mg/L for the LCFRE [Lower Cape Fear River Estuary] is not appropriate since it is not achieved a significant portion of the time as a result of natural drainage from riverine wetlands and salt marshes." In addition, the request states that "from a regulatory standpoint, a straightforward way to deal with this issue is to reclassify the area with the supplemental Sw classification."

The subject waters are proposed to be reclassified from Class SC to Class SC Sw with a water quality management plan. The SC classification is a primary classification whereas the Sw classification is a supplemental classification that can accompany a primary classification. The standards that must be met before tidal salt waters can be classified to Sw are outlined in Rule 15A NCAC 2B .0220, Tidal Salt Water Quality Standards for Class SC Waters (rule attached as pages a-65 through a-67). These standards include, for Sw waters, dissolved oxygen levels of less than 5.0 mg/l if caused by natural conditions and pH levels of as low as 4.3 if resulting from natural conditions. The conditions to be met before waters can receive a water quality management plan are outlined in Rule 15A NCAC 02B .0227, Water Quality Management Plans (rule attached as page a-68). 15A NCAC 02B .0227 states that "In implementing the water quality standards to protect the existing uses...of the waters of the state or the water quality which supports those uses, the Commission shall develop water quality management plans on a priority basis to attain, maintain or enhance water quality throughout the state. Additional specific actions deemed necessary by the Commission to protect the water quality or the existing uses of the waters of the state shall be specified in...this Rule. These actions may include anything within the powers of the Commission." The actions proposed within 15A NCAC 02B .0227 for the subject waters codify the current permitting policy already in place for new individual NPDES wastewater discharges and expansion of existing individual NPDES wastewater discharges to the subject waters, which is designed to address water quality and existing uses of these waters.

This proposal concerns the portion of the Cape Fear River from the mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut, where the Intracoastal Waterway (ICW) meets the river (Figure 1 on Page 2 and Table 1 on Page 3). In these waters as well as adjacent waters, there are several tidal saltwater species, including the federally endangered Shortnose Sturgeon and Atlantic Sturgeon, and the related Marine Fisheries Commission designations of Primary Nursery Area, or PNA, for these species; PNA waters are by definition High Quality Waters, or HQW, per 15A 2B .0101. In addition, the types of land cover occurring adjacent to the proposed river segment are comprised of wetlands, some developed lands, other open waters, forest lands, and shrub/scrub lands. Furthermore, the segments of the Cape Fear River directly above and below the river segment to be reclassified are classified C Sw and SC, respectively. The named tributaries flowing to this river segment are currently classified either SC Sw, SC, Water Supply-IV Critical Area, or C Sw, and the majority of these tributaries carry

the Sw designation. Within the subject waters, there are eight existing individual NPDES wastewater discharges. Lastly, according to the 2014 North Carolina 303(d) list, the river segment has been determined to be impaired for water quality parameters including dissolved oxygen and pH.

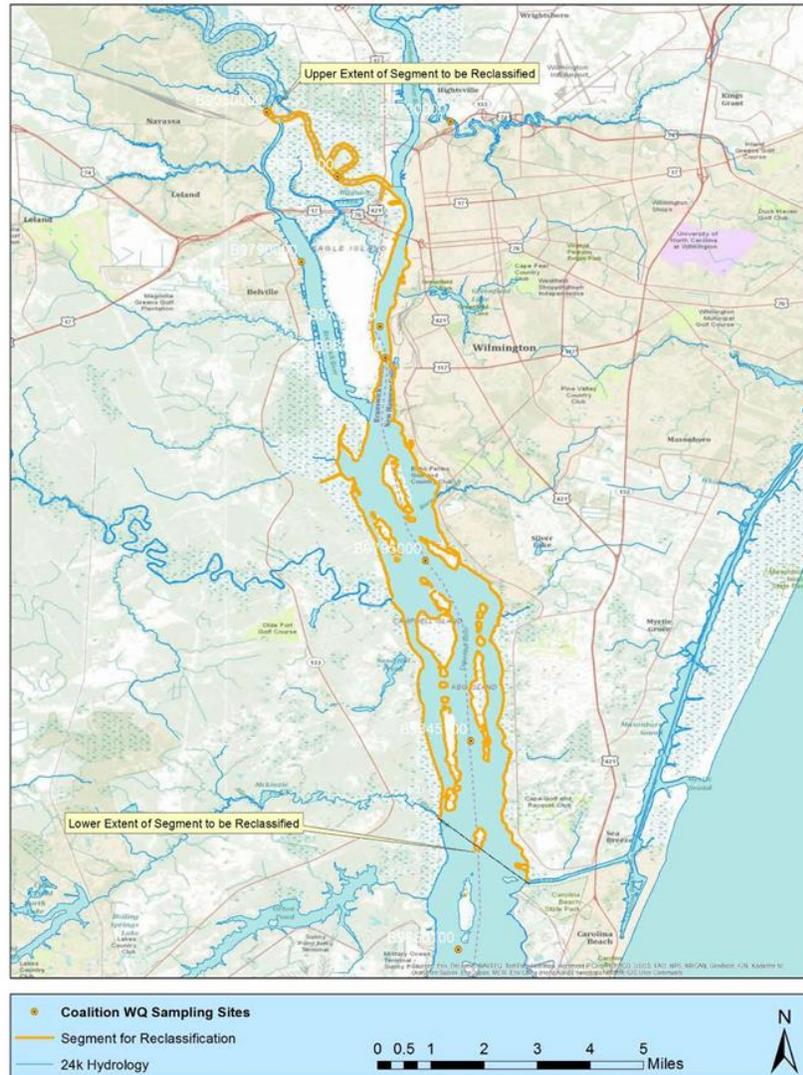


Figure 1.  
Requested portion of Lower Cape Fear River Estuary for Consideration for Supplemental Swamp Classification

<b>TABLE 1. PROPOSED AMENDMENT TO THE CAPE FEAR RIVER BASIN SCHEDULE OF CLASSIFICATIONS</b>				
<b>AS REFERENCED IN TITLE 15A NORTH CAROLINA ADMINISTRATIVE CODE 02B .0311</b>				
<u>Name of Stream</u>	<u>Description</u>	<u>Existing Class</u>	<u>Description of Recommended Segment</u>	<u>Recommended Class</u>
Cape Fear River	From upstream mouth of Toomers Creek to a line across the river from Snows Point (through Snows Marsh) to Federal Point	SC	From upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut	SC Sw
			From a line across the river between Lilliput Creek and Snows Cut to a line across the river from Snows Point (through Snows Marsh) to Federal Point	SC

Standards applicable to Class SC waters, which include the subject segment, provide a base of protection to all of the state's tidal salt waters. The supplemental Sw classification allows lower DO levels, where such levels result from natural conditions, below the 5 mg/l standard for Class SC waters. The Sw supplemental classification also allows pH to reach as low as 4.3, provided it is the result of natural conditions. Standard allowable range for pH in Class SC waters is from 6.8 – 8.5.

The proposed management plan to accompany the proposed Sw designation contains effluent limits that new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges within the river segment would have to meet regarding oxygen consuming wastes. These limits are similar to the limits for High Quality Waters, because as mentioned above, the subject waters are HQW by virtue of being designated as a Primary Nursery Area. The proposed water quality management plan is consistent with and codifies the current permitting policy already in place for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters. The proposed reclassification in partnership with the proposed management plan provides a path forward for these discharges and enables the community to plan accordingly.

There are currently no known planned new individual NPDES wastewater discharges and one planned expansion of an existing individual NPDES wastewater discharge in the subject waters, which already meets the proposal's requirements for expansions of existing individual NPDES wastewater discharges. A fiscal analysis for this proposal was prepared and there was no quantifiable cost or benefit determined to be a result of the proposal. The fiscal analysis with the proposed rules is attached as pages a-69 through a-77.

The estimated effective date of this reclassification is November 1, 2015.

## Implications of the Proposed Reclassification and Water Quality Management Plan

Water quality standards for Class Sw waters as well as specific waters with water quality management plans are outlined in the following rules (pages a-65 through a-68):

- 15A NCAC 2B .0220 Tidal Salt Water Quality Standards for Class SC Waters
- 15A NCAC 2B .0227 Water Quality Management Plans

Rule 15A NCAC 2B .0220 Tidal Salt Water Quality Standards for Class SC Waters, describes regulations pertaining to Class SC waters (rule attached as pages a-65 through a-67). This rule features regulations regarding the best usage of these waters, conditions related to best usage, quality standards applicable to all tidal salt waters (for parameters such as radioactive substances, salinity, temperature and turbidity) and action levels for toxic substances (such as copper, silver, and zinc). This rule also includes DO as well as pH standards for Class SC waters, and allows for deviation from those standards for those two parameters if caused by natural conditions in Class Sw waters. Currently the dissolved oxygen standard is 5 mg/l, and the pH standard is a range of 6.8-8.5 for Class SC waters. The standards associated with the Sw designation are narrative standards, which supplement the SC numeric standards.

The result of a Sw reclassification for the Lower Cape Fear segment of interest, per the portions of this rule that address standards in Sw waters, will be the allowance, if caused by natural conditions, for the pH of the subject waters to reach as low as 4.3 and, if caused by natural conditions, the DO to be lower than 5 mg/l. Thus, if reclassified, additional ambient DO & pH standards will apply in the subject waters under natural conditions. Table 2 summarizes and compares the requirements of the existing and proposed classifications.

<b><u>TABLE 2. SUMMARY AND COMPARISON OF EXISTING AND PROPOSED CLASSIFICATIONS' STANDARDS</u></b>		
<b>Classification</b>	<b>pH</b>	<b>Dissolved Oxygen (DO)</b>
<b>Class SC (Existing)</b>	6.8 – 8.5	5.0 mg/l
<b>Class SC Sw (Proposed)</b>	6.8 – 8.5, but as low as 4.3 if result of natural conditions	5.0 mg/l, but lower than 5.0 mg/l if caused by natural conditions

Rule 15A NCAC 2B .0227 Water Quality Management Plans, allows the Environmental Management Commission to develop water quality management plans tailored to protection of existing uses or quality of waters in specific waters (rule attached as page a-68). Specific additional actions that the EMC considers necessary to protect the existing quality or uses of specific waterbodies are described in this rule, and can include any actions within the Commission's powers. Currently there is one management plan within this rule, and it is for the Lockwoods Folly River Area within the Lumber River Basin.

The proposed management plan to accompany the proposed Sw supplemental classification contains effluent limits that new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges within the river segment would have to meet regarding oxygen consuming wastes. These limits are more stringent than the standards regarding oxygen consuming wastes for Class SC or Class Sw waters, and in fact, are very similar to the limits for one of the state's most restrictive supplemental classifications, High Quality Waters, because as mentioned above, the subject waters are HQW by virtue of being designated as a Primary Nursery Area.

For non-industrial facilities, effluent limits of 5 mg/l for Biological Oxygen Demand (BOD)<sub>5</sub>, 1 mg/l for Ammonia, and 6 mg/l for dissolved oxygen would apply according to the proposed management plan. For industrial discharges, site-specific best available technology on a case-by-case basis would be utilized to determine the limits for BOD<sub>5</sub>, Ammonia and DO according to 15A NCAC 02B .0404 and .0406.

For new and expanded individual NPDES wastewater facilities, the management plan includes consideration of seasonal effluent limits on a case-by-case basis, and also includes the following stipulation: Any new or expanded permitted pollutant discharge of oxygen consuming waste shall not cause the dissolved oxygen of the receiving water to drop more than 0.1 mg/l below the modeled in-stream dissolved oxygen at total permitted capacity.

Please note that the proposed management plan just described is consistent with and codifies the current permitting policy already in place for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters. Furthermore, there are currently no known planned new individual NPDES wastewater discharges and one planned expansion of an existing individual NPDES wastewater discharge in the subject waters, which already meets the proposal's requirements. Existing & future communities in this area and above-mentioned facilities also would be affected by this proposal from the perspective that the proposal would aid them in planning for the future, because it would let them know what to expect in terms of permitting.

The proposed reclassification and water quality management plan would not impact the following activities: forestry practices, docks and other water dependent structures, development activities, recreational use, agricultural activities, animal operations, land application activities, landfill operations, and dam and water resource projects. Lastly, it is unknown if and/or to what extent the Sw supplemental standards and water quality management plan would affect the subject water's ambient dissolved oxygen and pH levels; future water quality monitoring and analysis would help address this issue.

### **Public Hearing Process and Comments Received**

In accordance with North Carolina General Statutes, a public hearing was held on February 5th, 2015, in Wilmington, North Carolina (New Hanover County). Notice of the proposal and hearing, including the proposed rule amendment, was published in the January 2nd, 2015, *North Carolina Register* (Volume 29, Issue 13) (proposed rule amendment attached as pages a-73 through a-77).

Announcements of the public hearing (announcement attached as pages a-78 and a-79) were sent to the Water Resources Rule-Making Announcements mailing list, the Division of Water Resources Rules e-mail list, staff (including library staff) of the local governments with jurisdiction over land adjacent to the subject waters, wastewater facilities discharging directly to the subject waters, and to other persons potentially interested in the proposal, including staff of interest groups such as The Nature Conservancy, Cape Fear River Watch, Waterkeeper Alliance, and Cape Fear River Assembly, staff of federal and state agencies, and legislators within North Carolina. The public announcement and request for publication were submitted on January 9, 2015 to five local newspapers, *Coastal Review Online*, *Brunswick Beacon*, *Star News*, *Wilmington Journal*, and *Port City Daily* (newspaper request for publication attached as page a-80).

Julie Wilsey, a member of the Environmental Management Commission, served as hearing officer (hearing officer designation letter attached as page a-81). Twenty-four people registered at the public hearing (list of attendees attached as page a-82). Of those 24 people, all but two people were representing themselves or provided the organization they were representing on their registration forms: Aqua NC, Cape Fear River Partnership, Cape Fear River Watch, Cape Fear Public Utility Authority (CFPUA), CH2M Hill, City of Wilmington, Duke Environmental Policy Clinic, General Electric Company, International Paper, New Hanover County, University of North Carolina – Wilmington and Vopak Terminals.

Opening comments and slides were presented by DWR staff to provide a brief overview of the DWR classification program and detailed information about the proposed reclassification and water quality management plan. Then public comments on the proposal were taken.

Ten individuals registered to make comments at the hearing and all 10 people did provide oral comments. The speakers stated that they represented Cape Fear River Watch, CFPUA, Cape Fear Riverkeeper, CH2M Hill, Duke Environmental Policy Clinic, Lower Cape Fear River Program (LCFRP), themselves, and Waterkeeper Alliance. Four of the 10 speakers supported the proposal, and the remaining speakers were against the proposal.

Written comments were accepted for the proposal from January 2, 2015 through March 3, 2015, and a total of 312 written comments were received. Seven distinct letters providing a positive position were received from representatives of the CFPUA, LCFRP, City of Wilmington, and NC Farm Bureau Federation, Inc. (letters providing a positive position attached as pages a-83 through a-98). Two of these positive comments were written by one person who, along with three others who provided a positive position in their written comments, spoke at the hearing. In addition, two letters providing a neutral position from the U.S. EPA and U.S. Fish and Wildlife Service were received (letters providing a neutral stance attached as pages a-99 through a-103). Lastly, 303 letters providing a negative position were received (letters providing a negative stance attached as pages a-104 through a-217). Within the 303 letters were four template letters utilized by citizens. More specifically, 69 copies of one template letter and eight variations of it, 55 copies of a second template letter and 13 variations of it, 71 copies of a third template letter and 12 variations of it, and 66 copies of a fourth template letter and three variations of it were received for a total of 297 letters; 12 people each submitted two of these letters, and one person submitted four of these letters. The remaining six distinct letters providing a negative position were received from parties representing Waterkeeper Alliance, Cape Fear River Watch, Cape Fear Riverkeeper, NC Conservation Network, American Rivers, NC Division of Coastal Management, and two citizens; two of these comments were from people who spoke at the

hearing. (The six distinct letters are attached as pages a-104 through a-176, one copy of the first template letter is attached as page a-177 followed by the eight variations of it on pages a-178 through a-186, one copy of the second template letter is attached as page a-187 followed by the 13 variations of it on pages a-188 through a-200, one copy of the third template letter is attached as page a-201 followed by the 12 variations of it on page a-202 through a-213, and one copy of the fourth template is attached as page a-214 followed by three variations of it on page a-215 through a-217.) DWR has retained and will continue to retain all comment letters received during the comment period.

## Summary of Concerns & Staff Responses

The comments received did contain several issues of concern. Each issue of concern (in *italics*), with a few comments demonstrating that concern, is provided below, and is followed by a DWR response:

1. **Concern:** *Purpose of proposal is flawed*
  - *Proposal is trying to sweep away the acts of big corporations.*
  - *DWR is proposing to reclassify because its efforts to control pollution from point sources will not allow segment to meet present DO standard.*
  - *Petitioners do not want to implement pollution controls.*
  - *Proposal is attempt to save money and factory farms.*

**Response:** The purpose of the reclassification and water quality management plan is three-fold: (1) to add ambient DO and pH standards applicable under natural conditions to the subject waters, (2) to codify current permitting policy already in existence for new individual NPDES wastewater discharges and expansions of individual NPDES wastewater discharges; and (3) to provide a path forward for dischargers' and communities' planning efforts.

2. **Concern:** *Request lacks scientific support to show low DO due to natural conditions*
  - *Major sources of oxygen-demanding materials are due to pollution from human activities consisting of point sources including CAFOs, especially swine livestock waste.*
  - *Non-Point Sources of oxygen-demanding materials are large & reduce DO levels.*
  - *Bowen Model does not support that natural conditions cause low DO, & shows 70% load reduction of oxygen-demanding materials leads to 1% summer DO violations.*

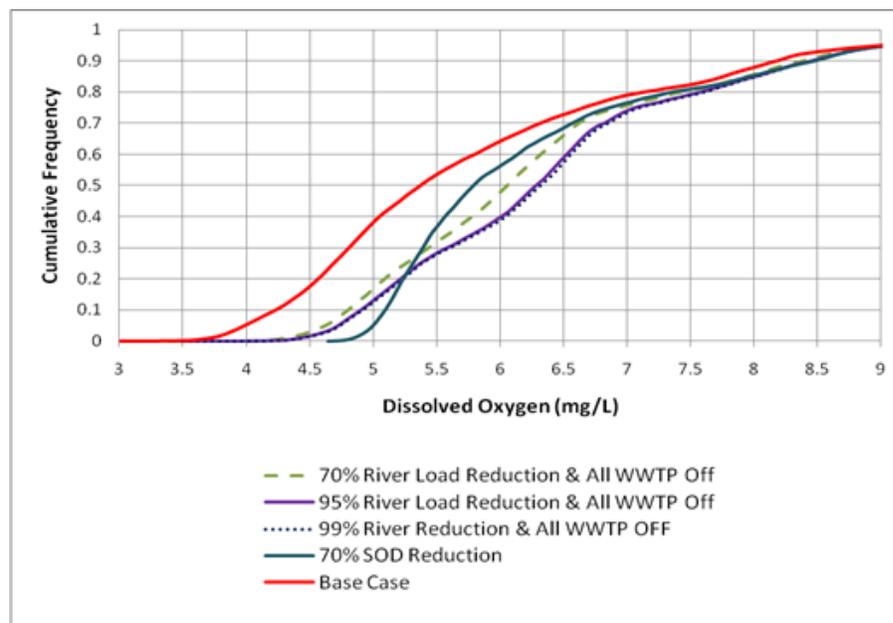
**Response:** The following DWR comments are based on a model sensitivity test described in the Lower Cape Fear Modeling Report\* that reduced both river loading and sediment oxygen demand (SOD) by the same percentage (70%). It is important to note that SOD is not predicted by the model, but rather is set by the user based on limited data. The report recognizes that "reductions in river loading would probably also reduce sediment oxygen demand in the long-term but with prescribed SOD there was no way to predict the

magnitude of the changes in SOD, or the time scale of those changes.” Therefore, the model is not an appropriate tool to evaluate the impact of upstream load reduction on SOD.

The DWR Modeling and Assessment Branch has run model scenarios reducing only loading from the upstream boundary conditions as well as wastewater treatment plants (WWTPs) within the model domain to evaluate the impact of loading without changing SOD. Results are included in the figure below.

As can be seen in the figure, reducing upstream loading by 95% or even 99% and turning loading from WWTPs within the model domain completely off, there is still more than a 10% exceedance in the DO standard of 5 mg/L. This underscores the significant impact SOD has on DO in this system.

\* Development and Use of a Three-Dimensional Water Quality Model to Predict Dissolved Oxygen Concentrations in the Lower Cape Fear River Estuary, North Carolina. James D. Bowen, et al. Oct 2009.



*Percentile Plot of Model Predicted Dissolved Oxygen Concentrations During the Summer 2004 for the Base Case and Four River Load Reduction Scenarios. The y-axis indicates the fraction of values below the corresponding DO concentration (mg/L) indicated on the x-axis.*

3. **Concern:** *Not meeting regulatory requirements to reclassify*
  - *Waters are not swamp waters per state’s definition (velocity, pH, and adjacent stream characteristics).*
  - *Best uses will not be attained via the proposal and required UAA (Use Attainability Analysis) would show uses can be met.*

- *Proposal will reduce water quality standards, leading to discharges eliminating protections, and more pollution, water quality standard violations, degradation, and jeopardization of uses.*
- *Fiscal Analysis contains inaccuracies and does not address all costs and benefits.*
- *Commission has not considered all pertinent matters prior to granting reclassification request.*
- *Proposal does not fulfill duties entrusted to Commission by the state's laws and violates those laws to protect and conserve waters.*

**Response:** It is important to note that the majority of the tributaries to the subject waters as well as the part of the Cape Fear River upstream and adjacent to the subject waters carry the Sw supplemental classification, and that other segments of large rivers in coastal North Carolina and the tributaries associated with those river segments carry the Sw supplemental classification. Just because these waters carry the Sw classification does not mean that the pH of these waters is 4.3 or that the DO is less than 5.0 mg/l. As a reminder, in Sw waters, dissolved oxygen levels of less than 5.0 mg/l are only allowed if caused by natural conditions and pH levels as low as 4.3 are only allowed if caused by natural conditions.

A UAA is required when a state proposes to remove a use and associated protections, including standards, from a waterbody. This proposal will not remove a use or associated protections from the subject waters; it will provide supplemental water quality standards that will be applicable if caused by natural conditions. Therefore, a UAA is not required for this proposal, the proposal is not violating state laws that govern the duties of the Commission regarding protection of waters, and the Commission has been provided all needed information that is typically provided for reclassification rule-making requests. This information includes a fiscal analysis, which was completed according to state requirements using available fiscal information to assess costs and benefits to potentially impacted parties using the subject waters.

4. **Concern:** *Proposal does not correct or reduce pollution*

- *Proposal is an attempt to evade CWA charge to correct water quality problems through TMDL.*
- *Proposal fails to correct water pollution created by upstream animal operations causing the DO impairments and does not address hogs in upper watershed and manure that's been brought here.*
- *Reclassification would cover failure of DENR regarding animal farms.*
- *The reclassification does not adequately address non-point contributions of BOD or nutrients; the plan does not address non-point sources. Any reclassification must include language aimed at reducing non-point pollution sources.*
- *It would be helpful if the management plan included a path forward on how to improve lower Cape Fear River DO concentrations through watershed-wide waste load modeling, land use planning, and permitting.*
- *The plan includes no reduction of the effects of pollutant loading by existing point sources or nonpoint sources.*

**Response:** There are on-going efforts in the Cape Fear River Basin to assess pollution sources and investigate ways to address pollution sources, i.e. as discussed in the Cape Fear Basinwide Plan and Nutrient Criteria Development Plan (NCDP). The proposed reclassification and water quality management plan are designed to add supplemental ambient DO and pH standards that will be applicable if caused by natural conditions, and codify permitting requirements for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters for planning purposes, respectively. The proposal does not include language about correcting or reducing pollution as it is not designed to be a water quality restoration plan.

5. **Concern:** *Dredging may impact DO conditions*

- *The reclassification request mentions that further channel dredging “also showed a significant impact [on DO conditions.]” Can the State provide additional information on this analysis and how it was considered?*

**Response:** The statement cited in the request was a typo and should have stated that the impact of further channel dredging on DO conditions was evaluated and considered insignificant. Furthermore, the proposed Sw reclassification and water quality management plan would have no impact on dredging.

6. **Concern:** *Removal of Sw reclassification in 1980’s was done correctly*

- *The state removed the Sw class as it was immediately upstream of SA waters and admitted the original Sw designation was due to inadequate consideration of uses.*
- *In the October 6, 1981 report of proceedings, a staff representative indicated that the streams “had improved enough so that [the streams can] meet the C standard without being allowed the designated exception.” It is recommended that the state further address this previous change which removed the swamp classification as it relates to the proposed change, reverting it back to a swamp classification.*

**Response:** The above-mentioned October 6, 1981 document addresses specific waters in the Cape Fear River Basin, but those waters do not include any portion of the Cape Fear River, and those waters are located in counties within the Piedmont portion of the state. Furthermore, in an April 7, 1981 report of proceedings, several waters were proposed to be reclassified to remove the Sw designation from waters that also had the SA designation because of the difference between the pH standards for SA waters and Sw waters. Some waters that were included in this process, including the subject waters, were classified as SC Sw, rather than SA Sw, before this process yet their Sw classification was removed due to this process. No information regarding why the Sw class was removed from the subject waters is available in the April 7, 1981 report of proceedings or has been found by DWR staff who researched this issue.

7. **Concern:** Questions and suggestions for proposed language regarding implementation

- *Natural Conditions and DO Bound*
  - i. *Who decides what are natural conditions and by what criteria?*
  - ii. *The management plan should discuss how DO use support determinations will be made. In short, some way to define a new floor with which to evaluate monitoring and compliance data should be established.*
  - iii. *Is there any limitation on the duration or frequency by which a measured DO level can be below the 5 mg/L criterion? How will the assessment of the exceedances below 5 mg/L be determined to be based on natural conditions? Consider providing clarity through the adopted revisions.*
  - iv. *The State could consider a specific lower bound for DO, or alternatively a seasonally, or specific month(s), based lower bound for DO. The State could consider revising the DO and pH language indicating that sources which are not natural will still need to be considered and addressed during activities which consider in-stream and downstream water quality, like permitting or future criteria development efforts.*
- **Response:** The state's current use assessment methodology is not contained within the state's rules, and thus, language to address this methodology is not included in the proposed rules. In order to do a use support assessment of these waters, a method would need to be developed that accounts for management strategy targets and the Sw reclassification. As a reminder, in Sw waters, dissolved oxygen levels of less than 5.0 mg/l are only allowed if caused by natural conditions and pH levels as low as 4.3 are only allowed if caused by natural conditions. In addition, as a reminder, the purpose of the management plan is to codify current permitting policy already in existence for new individual NPDES wastewater discharges and expansions of individual NPDES wastewater discharges and to provide a path forward for dischargers' and communities' planning efforts.
- *Monitoring*
  - i. *How frequently will water be monitored? The plan includes no monitoring.*
  - ii. *The State could clarify whether the 4.3 (for pH) represents an instantaneous measurement; if something different is intended that should also be documented and supported.*
  - iii. *Ensure that the influence from anthropogenic sources is still addressed and continues to be monitored.*
  - iv. *How will the state identify the cause of potential future decreases of DO levels?*
- **Response:** No changes to the current monitoring strategy as well as the current permitting and compliance strategies for the subject waters will occur due to this proposal; thus, pH will continue to be measured in an instantaneous manner. As mentioned above, there are on-going efforts in the Cape Fear River Basin to assess pollution sources and investigate ways to address pollution sources, i.e. as

discussed in the Cape Fear Basinwide Plan and Nutrient Criteria Development Plan (NCDP).

- *Point Sources*
  - i. *The petition seems to indicate that point sources will have waste load allocations developed for them.*
  - ii. *The management plan should include the means by which the 0.1 mg/L cap on lowered DO will be determined. Important details to establish and get reviewed by stakeholders include the model to be used, input parameters, season to be modeled, location of compliance, and whether compliance is to be based on instantaneous versus average conditions.*
  - iii. *How will prohibition against causing DO decreases be enforced it at all?*
  - iv. *Replace “Any” with “All” (at the start of the last sentence of the proposed management plan) so that the cumulative impact of all additional permitted oxygen consuming waste is a diminishment of less than 0.1 mg/L.*
  - v. *Shouldn’t allow any discharges to drop the DO levels; require whatever necessary to prevent that. 10 discharges could drop it 1 mg/l.*
  - vi. *Need to set limits on industrial facilities’ discharges as with non-industrial discharges.*
- **Response:** The language within the following response is not proposed to be incorporated into the rule, but to provide information on how the dissolved oxygen impact from new or expanding discharges will most likely be assessed by the Division.

The model to be used will be the most currently available three dimensional water quality model, which at this time, is the Lower Cape Fear dissolved oxygen model, [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=a84477db-4d83-4cc0-a9b9-f7da7a6a51f9&groupId=38364](http://portal.ncdenr.org/c/document_library/get_file?uuid=a84477db-4d83-4cc0-a9b9-f7da7a6a51f9&groupId=38364). The model was finalized on October 2009 by the Division of Water Quality (now known as the Division of Water Resources). The model is calibrated to 2004 observed data and meteorological conditions. Model inputs are described in the report. The most critical season when dissolved oxygen is expected to be impacted is April-October, and this season will be the focus for model comparison.

The model will first be run with all existing discharges at full permitted capacity. This run will establish a baseline model for comparison. The baseline model will then be run with the addition of the proposed new or expanding discharge. Results from the two model runs will then be evaluated to determine the impact of a new or expanding discharge, and the entire area that is impacted by the discharge will be evaluated. If at any time there is a difference between these two model runs greater than 0.1 mg/L, the discharge will not be allowed. So, this approach will basically be a time-series comparison based on model output, and prohibition against causing DO decreases will be enforced via permit requirements stated in the proposed water quality management plan.

When modeling is conducted for a new or expanded discharge (as described directly above), the term “total permitted capacity” as stated in the proposed water quality management plan is to include all existing discharges as operating at their full permit limits plus the new or expanded discharge operating at its full permit limits. Rather than making the suggested language replacement as noted in the above fourth comment regarding point sources, DWR proposes to provide clarity to this issue by adding the following phrase to the end of the last sentence of the management plan: “for all discharges.” Thus, the final sentence of the management plan would read as follows: “Any new or expanded permitted pollutant discharge of oxygen consuming waste shall not cause the DO of the receiving water to drop more than 0.1 mg/l below the modeled in-stream DO at total permitted capacity for all discharges.”

### **RECOMMENDATION**

It is the recommendation of the Hearing Officer that the reclassification of the segment of the Cape Fear River and associated water quality management plan, as proposed herein, be approved by the Environmental Management Commission in its entirety along with the above-mentioned additional language shown below in green. In making this recommendation, the Hearing Officer has considered the requirements of General Statutes 150B-21.2, 143-214.1, 143-215, and 143-215.3(a)(1), and Rules 15A NCAC 2B .0100 Procedures for Assignment of Water Quality Standards, 15A NCAC 2B .0220 Tidal Salt Water Quality Standards for Class SC Waters, and 15A NCAC 2B .0227 Water Quality Management Plans. In addition, the existing water quality conditions, the need to codify the current permitting policy already in existence for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters, the desire for a path forward for these discharges and associated local communities to plan for the future, and all comments received by DWR were considered.

In taking this action, Rule 15A NCAC 2B .0311, which references the Schedule of Classifications for the Cape Fear River Basin, will show that the Environmental Management Commission has revised the schedule for a portion of the Cape Fear River [Index No. 18-(71)] from upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut from Class SC to Class SC Sw. A site-specific management strategy is outlined in 15A NCAC 02B .0227.

In addition, in taking this action, Rule 15A NCAC 2B .0227, which references Water Quality Management Plans, will show that the Environmental Management Commission has added to this rule a site-specific management strategy for a part of the Cape Fear River [Index No. 18-(71)] from upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut, which is described as follows:

All new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges shall be required to provide treatment for oxygen consuming wastes as described in Parts (A) through (C) of this Subparagraph.

- (A) Effluent limitations shall be as follows: BOD<sub>5</sub> = 5 mg/l, NH<sub>3</sub>-N = 1 mg/l and DO = 6 mg/l, or site-specific best available technology on a case-by-case basis for industrial discharges.
- (B) Seasonal effluent limits for oxygen consuming wastes will be considered on a case-by-case basis in accordance with Rule .0404 of this Subchapter.
- (C) Any new or expanded permitted pollutant discharge of oxygen consuming waste shall not cause the dissolved oxygen of the receiving water to drop more than 0.1 mg/l below the modeled in-stream dissolved oxygen at total permitted capacity **for all discharges.**

The proposed effective date of this reclassification is November 1, 2015.

**APPENDICES**

**ADVISORY BOARD**

*BLADEN COUNTY*

*BRUNSWICK COUNTY*

*CAPE FEAR COAST CONVENTION AND VISITORS BUREAU*

*CAPE FEAR COUNCIL OF GOVERNMENTS*

*CAPE FEAR PUBLIC UTILITY AUTHORITY*

*CAPE FEAR RIVER ASSEMBLY*

*CITY OF CLINTON*

*CITY OF WILMINGTON*

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*GREATER WILMINGTON CHAMBER OF COMMERCE*

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*UNIVERSITY OF NORTH CAROLINA WILMINGTON*

*WILMINGTON INDUSTRIAL DEVELOPMENT, INC.*

**EX-OFFICIO MEMBERS**

*CHAIR, TECHNICAL COMMITTEE, LOWER CAPE FEAR RIVER PROGRAM*

*NC REGULATORY AGENCIES*

*US ARMY CORPS OF ENGINEERS*

March 5, 2014

Mr. Tom Reeder  
 Director, Division of Water Resources  
 NC Department of Environment and Natural Resources  
 1611 Mail Service Center  
 Raleigh, NC 27699-1611

Subject: Request for Reclassification of a Portion of the Lower Cape Fear River with the Supplemental Swamp Classification

Dear Mr. Reeder:

The purpose of this letter is to formally request that the Division of Water Resources (DWR) recommend to the Environmental Management Commission (EMC) that portions of the Lower Cape Fear River Estuary (LCFRE) that are currently classified as Class SC Waters be reclassified to include the supplemental Swamp (Sw) classification. This would recognize the influence of natural drainage from riverine wetland and salt marsh systems that are ubiquitous throughout the Lower Cape Fear River, Northeast Cape Fear River and Black River watersheds on water quality conditions in the river. This would be consistent with the classifications of immediate upstream segment of the Cape Fear River and the tributaries which all currently carry the supplemental Sw classification.

Information typically requested by DWR for reclassification requests is included in Table 1 and a map showing the area being requested for consideration for the Sw supplemental classification is included as Figure 1. An additional map based on the US Geological Survey 7.5 minute topographic maps will be included in the hard copy of this letter and attachments.

Information typically requested by DWR for reclassification requests is included in Table 1 and a map showing the area being requested for consideration for the Sw supplemental classification is included as Figure 1. An additional map based on the US Geological Survey 7.5 minute topographic maps will be included in the hard copy of this letter and attachments.

This letter provides additional background on the Lower Cape Fear River Program (LCFRP) and this specific request and a summary of supporting technical papers that have been prepared.

## **Background on LCFRP and LCFRE**

The Lower Cape Fear River Program is an integrative effort which brings together a coalition of citizens groups, industry, business, local, regional, and state government, and the university community. The Lower Cape Fear River Program (LCFRP) was formed in May, 1994 to develop an understanding of the fundamental scientific processes shaping and controlling the Cape Fear River Estuary and provide a mechanism for information exchange and public education. It is administered in cooperation with the University of North Carolina Wilmington's Center for Marine Science.

Since the group was formed, comprehensive data to assess ecological conditions in the river has been collected. The LCFRP was one of the first coalition monitoring groups established through a memorandum of agreement (MOA) with NC Department of Environment and Natural Resources (DENR) that relieves NPDES permit holders of individual requirements to perform instream monitoring and replaces that with a comprehensive and coordinated monitoring program. Currently, there are 17 NPDES permit holders that are party to the MOA, but many other advisory board members from throughout the lower basin as listed on the border on the first page of this letter. All of the monitoring data is submitted to DENR in accordance with the MOA. The program also has an interactive data base available on the internet where the LCFRP data can be accessed. This site also includes data from the Middle and Upper Cape Fear River Basin coalition groups for a comprehensive tool to review water quality conditions for the entire river basin.

Beginning in 1998, the section of the LCFRE from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been listed on the State of North Carolina's 303d List as impaired for DO. In 2006, DENR added pH as impaired for this segment, and in 2008, DENR added copper and turbidity to the listing, as well. The draft 2014 303d List maintains these impairments despite some changes to the listing methodology (DENR, 2014).

Until recently, DENR had been pursuing development of a total maximum daily load (TMDL) to establish what were originally believed to be reduction needs for oxygen-

demanding pollutants, including biochemical oxygen demand (BOD) and ammonia nitrogen (NH<sub>3</sub>-N). An extensive effort had gone into developing a three-dimensional hydrodynamic and water quality model (using the Environmental Fluid Dynamics Code, or EFDC, model) between 2000 and 2009. This model provides an excellent tool for evaluating water quality conditions in the LCFRE. Based on the modeling analysis, the DENR determined that developing a TMDL using the existing standard for the Class SC portion of the LCFRE of 5 milligrams per liter (mg/L) (at all times) would not be appropriate because the modeling results indicate that point-source discharges have a relatively minor impact on DO levels, and that even significant reductions in background (both natural and nonpoint source) loads would not result in attainment of the current standard for considerable periods of time during the summer. Recently, DENR indicated that changes to the classification of the LCFRE might be appropriate to recognize the influence of natural drainage from riverine and saltwater marsh systems in the watershed on DO concentrations. A reclassification with the supplemental Sw classification would allow the water quality standards for DO and pH to be interpreted with narrative portion of the standard [from 15A NCAC 2B .0220 (3)]:

*(b) Dissolved oxygen: not less than 5.0 mg/l, except that swamp waters, poorly flushed tidally influenced streams or embayments, or estuarine bottom waters may have lower values if caused by natural conditions;*

*(g) pH: shall be normal for the waters in the area, which generally shall range between 6.8 and 8.5 except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions;*

It is recognized that with this classification change, DWR will still require the development of implementation procedures for determining allowable waste load allocations for point source discharges.

## **Supporting Information**

There is a wealth of research and technical assessment studies that have been conducted on the LCFRE since the formation of the LCFRP in 1995, as well as during the 40 years prior to that time. In discussing this reclassification request with DWR staff, it was suggested that a summary of information be prepared to support the reclassification request. Four Technical Memoranda (TM) have been prepared in support of this reclassification request and are included as Attachments to this letter. The following is a brief summary of each TM.

## **TM 1 - Summary of Background Information and Previous Studies for the Lower Cape Fear River**

This TM served to review available background information for the LCFRE dating back to original studies in the 1950s where water quality and pollutions sources were assessed and initial recommendations on stream classifications were made. Key studies and assessments up to the present time were also reviewed and a bibliography of studies and research papers was also included. A several of the key points from this TM include:

- Swamp influences were identified even during the early studies and the entire LCFRE and tributaries were recommended and subsequently classified with the supplemental Sw classification
- The supplemental Sw classification was removed from the Class SC portion of the Cape Fear River in 1981 without extensive evaluation for the basis of this change
- LCFRP monitoring in the mid to late 1990s documented the impact of swamp drainage following hurricanes, similar to what was documented during the 1990s
- The EFDC hydrodynamic and water quality model completed in 2009 demonstrated that the point sources had a minor contribution to the DO deficit and that even with 30 to 70 percent reductions in loadings of oxygen demanding materials from tributaries and wetlands/marsh systems (a combination of anthropogenic and natural sources), the DO standard of 5 mg/L could not be achieved between 20 and 30 percent of the time.

## **TM 2 - Updated Trend Analysis of DO Conditions and Pollutant Loading from Point Sources**

This TM was an update of an analysis done in 2003. The previous DO trend analysis found no statistically significant trend for DO for the period of 1984 through 2002 for DO conditions at several stations within or immediately adjacent to the 303(d) listed portion of the LCFRE. The same conclusion was drawn for the period of 1991 through 2002, despite a statistically significant reduction in major point source ultimate biochemical oxygen demand (BOD<sub>u</sub>) load of approximately 25 percent for that period. The updated analysis used monitoring data and information on point source loading from 1994 through 2013. The updated point source analysis focused on International Paper and Cape Fear Public Utilities Authority (CFPUA) Northside and Southside discharges since these facilities comprise over 90 percent of the point source loading to the local watershed. This analysis also showed no significant trend in DO levels in the LCFRE over the 20 year period while the loading of BOD<sub>u</sub> from these three facilities declined by 23 percent over the same time period. This analysis confirms model results indicating that point sources are having a minor impact on DO levels in the LCFRE.

### **TM 3 - Analysis of Long-term Data near the Limits of the Tidal Influence for the Cape Fear River, Black River, and NE Cape Fear River**

This TM presents an analysis of water quality parameters at the sampling stations representative of inflows to the system, with the purpose of examining issues related to a supplemental Sw classification for the estuary. Data was examined for several key parameters, including nutrients, pH, and DO, that are related to the occurrence of low DO in the Cape Fear River. The evaluation of water quality data at the boundary conditions supports the concept that inflows from the swamp areas have a significant impact on water quality in the Cape Fear River. The levels of nutrients, DO, and pH are consistently different between the station at Lock & Dam 1 (L&D1) on the main stem of the Cape Fear River, and in the major blackwater tributaries – the Black River and the NE Cape Fear River. A distinct response from these inflows can be seen in the levels for these parameters in the portion of the Cape Fear River near Navassa, providing additional supporting evidence that water quality in the Cape Fear River is significantly influenced by the conditions found in the swamp areas tributary to the river downstream of L&D1.

### **TM 4 - An Analysis of Model Results to Assess the Relative Impact of Riparian Wetlands and Salt Marshes versus other Tributary Loadings**

This TM used the results of the two modeling efforts with the EFDC model in the 2000s to examine the technical basis for a supplemental Sw classification for the LCFRE. The two modeling studies included the initial EFDC model developments by Tetra Tech on behalf of the City of Wilmington and New Hanover County and the follow up work by the University of North Carolina – Charlotte on behalf of NC DENR. Both modeling efforts demonstrated that the impact from point source loads in the LCFRE contributes to less than 10 percent of the DO deficit in the LCFRE. The 2001 modeling effort demonstrated that an accurate calibration could not be achieved without representing the wetting and drying of adjacent low elevation wetland and salt marsh areas. That modeling estimated that wetland/marsh and sediment oxygen demand (SOD) sources accounted for between 75 and 80 percent of all oxygen demand in the LCFRE. The 2009 modeling effort validated and expanded the influence of adjacent marshland based on more detailed analysis. Further, application of the 2009 model that simulated up to 70 percent of nonpoint source load reduction demonstrated that even with such large pollutant loading reductions, DO concentrations would be expected to be below 5 mg/L approximately 20 percent of the time in the LCFRE during the summer. Therefore, the 2001 and 2009 modeling analyses provide further weight of evidence collectively that flow and oxygen-demanding loads from wetlands/marsh systems SOD are driving low DO during the summer period and suggest that reinstatement of the supplemental Sw designation for the LCFRE should be considered by DENR and the EMC.

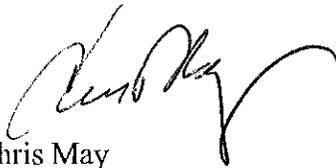
MR. TOM REEDER  
PAGE 6  
MARCH 5, 2014

## Summary

It is clear from the data collection, modeling and technical analyses that the DO standard of 5 mg/L for the LCFRE is not appropriate since it is not achieved a significant portion of the time as a result of natural drainage from riverine wetlands and salt marshes. From a regulatory standpoint, a straightforward way to deal with this issue is to reclassify the area with the supplemental Sw classification. The information summarized in this letter and the attached TMs support this classification action.

Our organization appreciates DENR and the EMC's consideration of this request. We are also willing to provide further information and analysis related to this request as needed.

Sincerely,



Chris May  
Chair Lower Cape Fear River Program Advisory Board and  
Executive Director, Cape Fear River Council of Governments

Reclassification Request Letter\_Final\_03062014.docx

c: LCFRP Advisory Board and Technical Committee Members  
Bill Kreutzberger/CH2M HILL  
Trevor Clements/Tetra Tech

Table 1.  
**DWR Requested Information in Support of Reclassification Requests**

<b>Date of Request</b>	March 6, 2014
<b>Requested by</b>	Lower Cape Fear River Program
<b>River Basin and Counties</b>	Cape Fear River Basin New Hanover and Brunswick Counties
<b>Water bodies requested for Reclassification</b>	Water Body: <i>Cape Fear River</i> Description: <i>From a point upstream Toomers creek to a line across the river from Snows Point (through Snows Marsh) to Federal Point</i> Index No.: <i>18-(71)</i> Current Classification: <i>SC</i> Requested Classification: <i>SC Sw</i>
<b>Map</b>	See Figure 1 from 7.5 minute USGS GIS Information
<b>Rationale for Request</b>	See text of letter and attached Technical Memoranda
<b>Local Champions for Request</b>	Lower Cape Fear River Program Members

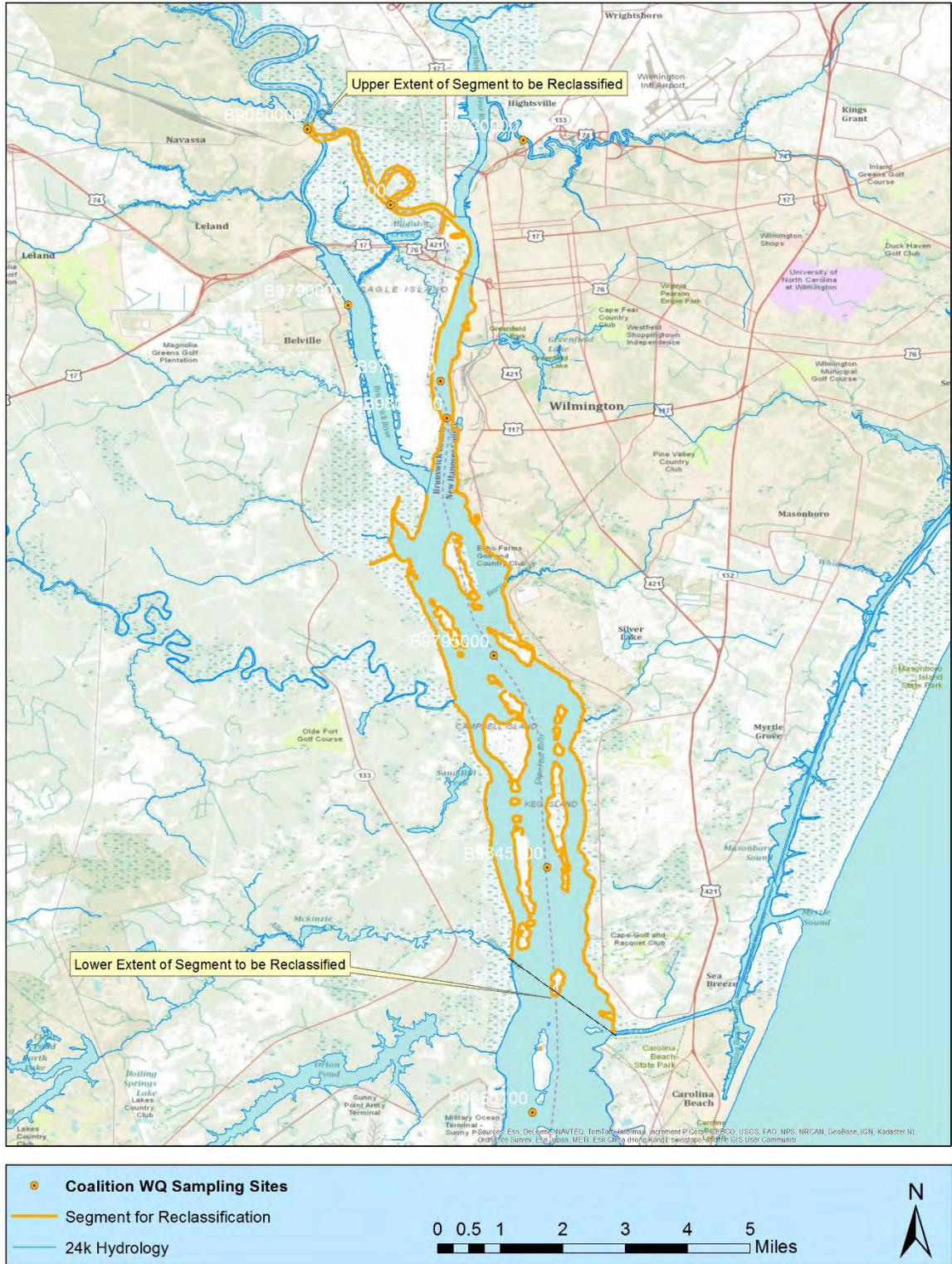


Figure 1. Requested portion of Lower Cape Fear River Estuary for Consideration for Supplemental Swamp Classification

## **Attachments**

**TM 1 - Summary of Background Information and Previous Studies for the Lower Cape Fear River**

**TM 2 - Updated Trend Analysis of DO Conditions and Pollutant Loading from Point Sources**

**TM 3 - Analysis of Long-term Data near the Limits of the Tidal Influence for the Cape Fear River, Black River, and NE Cape Fear River**

**TM 4 - An Analysis of Model Results to Assess the Relative Impact of Riparian Wetlands and Salt Marshes versus other Tributary Loadings**

# **Technical Memo: Task 1 – Summary of Background Information and Previous Studies for the Lower Cape Fear River**

Prepared for

## **Lower Cape Fear River Program**

Prepared by

**CH2MHILL®**

**February 25, 2014**



# 1 Introduction

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The purpose of this technical memorandum (TM) is to identify available data and studies pertaining to the Lower Cape Fear River Estuary (LCFRE), and highlight key information pertaining to the influence of natural drainage from riverine and saltwater marsh systems in the watershed on dissolved oxygen (DO) conditions. This information is being summarized at a high level, for further consideration as the North Carolina Department of Environment and Natural Resources (DENR) and Environmental Management Commission consider appropriate stream classification and associated water quality criteria for the Cape Fear River.

## 1.1 BACKGROUND

The Lower Cape Fear River Program (LCFRP) was established in 1995 as a collaborative effort by public, private, and academic interests to collect data and research information on the LCFRE and its coastal watershed. Since the group was formed, comprehensive data to assess environmental conditions in the river has been collected.

Beginning in 1998, the section of the LCFRE from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been listed on the State of North Carolina's 303d List as impaired for DO. In 2006, DENR added pH as impaired for this segment, and in 2008, DENR added copper and turbidity to the listing, as well. The draft 2014 303d List maintains these impairments despite some changes to the listing methodology (DENR, 2014).

Until recently, DENR had been pursuing development of a total maximum daily load (TMDL) to establish what were originally believed to be reduction needs for oxygen-demanding pollutants, including biochemical oxygen demand (BOD) and ammonia nitrogen (NH<sub>3</sub>-N). However, the DENR has recently determined that, based on the technical information compiled and assessed to date, developing a TMDL using the existing standard for the LCFRE of 5 milligrams per liter (mg/L) (at all times) would not be appropriate because the modeling results indicate that point-source discharges have a relatively minor impact on DO levels, and that even significant reductions in background (both natural and nonpoint source) loads would not result in attainment of the current standard for considerable periods of time during the summer. Recently, DENR indicated that changes to the classification of the LCFRE might be appropriate to recognize the influence of natural drainage from riverine and saltwater marsh systems in the watershed on DO concentrations.

There is a wealth of research and technical assessment studies that have been conducted on the LCFRE since the formation of the LCFRP in 1995, as well as during the 40 years prior to that time. Over the years, many technical studies of the LCFRE have been conducted by the LCFRP, DENR, other agencies and academic researchers, and consultants. As a result, an extensive technical foundation of knowledge on the LCFRE has been created, including information on physical, chemical, and biological features and processes.

## 1.2 SUMMARY OF AVAILABLE INFORMATION

A comprehensive listing of studies and research related to the LCFR has been included in the Attachment to this TM. In reviewing this information, it was decided to start with the early study of the river used to determine the stream classification and water quality standards and then move forward to the present. The following is a summary of this available information related to understanding the LCFRE, especially as it relates to assessing DO concentrations..

### 1.2.1 Original North Carolina State Board of Health Studies

Beginning in the mid-1950s and continuing until the early 1960s, the Division of Water Pollution Control of the State Board of Health conducted sanitary surveys of all the river basins in North Carolina, and made recommendations for stream classifications to be included in state water quality standards. The Cape Fear River Basin was sampled in 1955 and 1956, and the study report was published in 1957 (State Stream Sanitation Committee, 1957). This report includes analytical results from stream sampling and documented pollution loads from major sources of pollution.

The setting at the time of this study was that many towns and cities did not have any treatment, and industries varied from having no treatment to primary treatment facilities. There were no major impoundments in the Cape Fear Basin, so the basin experienced extreme ranges in flow conditions, depending on precipitation and hurricane conditions, which were apparent during 1955 when three hurricanes impacted eastern North Carolina.

In the lower river, there were two principal sources of pollution identified, the Riegel Paper Corporation (Riegel) and the City of Wilmington, plus numerous other smaller communities and industrial facilities. The following table summarizes the treatment and loads from the primary facilities.

**Table 1. Primary Facility Treatment and Load Summary**

Facility	Type of Treatment	Estimated Load (PE)
Riegel	Primary (13% efficient)	330,000
City of Wilmington	None	44,700
Timmie Manufacturing	Lagoon (20% efficient)	1,144
Wilmington Packing	Grease removal (20% efficient)	3,850
Wanet Sausage Co.	Grease removal (20% efficient)	3,200

Note:

PE - population equivalent

These loads cannot be directly transferred to the way oxygen-demanding loads are measured today. However, assuming 0.17 pounds per day (lb/d) of CBOD<sub>5</sub> per PE, this translates to about 65,000 lb/d of CBOD<sub>5</sub> discharged as highly reactive raw or primary treated waste. No information was presented in the study to estimate the nitrogenous (organic nitrogen and ammonia) oxygen demand load. This is estimated to be about 10 times greater than the current loading of CBOD<sub>5</sub> based on comparison with current discharger monitoring data. The water quality data demonstrated impacts on DO conditions in the river. Summertime DO levels from downstream of Riegel to downstream of Wilmington typically ranged from 2 to 3 mg/L, with some values considerably less than that. The highly reactive wastewater resulted in a double DO sag beginning just a few miles below the Riegel discharge to downstream of Wilmington.

Despite the significant impacts from untreated and poorly treated wastewater under low to moderate flow conditions in the river, two different situations influencing DO condition were also described in the report:

1. High flows from the Black and NE Cape Fear Rivers, and moderate flow from the Cape Fear River (data from August 30, 1955):
  - Low DO (1.3 to 2 mg/L) and low pH (5 to 6) coming from NE Cape Fear and Black Rivers
  - Resulting in low DO (1.3 to 2.2 mg/L) and low pH (5.8 to 6) in the typically brackish area below Wilmington
2. High flows from the Cape Fear River, and moderate flows from the NE Cape Fear and Black Rivers (data from July 23-24, 1956):
  - DO (2.8 to 4.9 mg/L and pH 6.8 to 7.2) conditions in lower river were moderate

They concluded that under some situations, swamp drainage conditions could significantly influence DO and pH conditions in the river, and recommended that the freshwater portion of the Lower Cape Fear River (LCFR) be Class C-Swamp (C-Sw) from the Riegel water intake to Toomers Creek, and Class SC-Swamp (SC-Sw) from Toomers Creek to the mouth of the Cape Fear River. These recommendation were adopted in 1962.

## 1.2.2 Reclassification in 1981

In 1981, a rule-making proceeding was initiated to remove the “Swamp” designation from waters classified as Class SA (for shellfishing). The record includes little basis for the removal of the Swamp designation from

tidal saltwater classes other than statements that the designation is inconsistent with a shellfishing designation. There was little other discussion of the changes and nothing specific to Class SC waters. Based on the lack of objection, the Swamp designation was removed from a substantial portion of all tidal saltwaters in North Carolina in 1981 in conjunction with some other stream/coastal water classification changes (DEM, 1981). This action changed the classification of the Cape Fear River from “upstream of the mouth of Toomers creek to Atlantic Ocean” from Class SC Sw to Class SC. However, the Sw designation was not removed from the Class SC portion of the NE Cape Fear River by this action. As a result of this reclassification, the DO standard of not less than 5 mg/L at all times and pH standard not less than 6.8 became effective for the Class SC portion of the Cape Fear River, with no recognition of the potential influence of natural conditions.

### **1.2.3 Initial Water Quality Modeling**

Despite significant improvement in wastewater treatment throughout the basin since the initial studies in the 1950s, there was a recognition that water quality conditions in the Cape Fear River might limit future industrial and urban growth. In addition, hydrological conditions in the basin had changed with the filling of Jordan Lake in 1981. This lake has a watershed of approximately 1,700 square miles (mi<sup>2</sup>), and has authorized purposes of flood damage reduction, water supply, water quality control, fish and wildlife conservation, and outdoor recreation. With this changed hydrology, and significant urban and industrial growth in the Wilmington area, the Division of Environmental Management (DEM) initiated the development of a water quality model using a program called the Georgia Estuary Model (DEM, 1984). The U.S. Environmental Protection Agency (USEPA) and Georgia Environmental Protection Division had been promoting the model as a useful tool for coastal river/estuary systems and were in the process of applying the model to the Lower Savannah River along the Georgia-South Carolina border. Although the report was finalized in 1984, the model was not apparently used for any major permitting decisions for the river.

### **1.2.4 Federal Paperboard Co. Studies**

In 1990, Federal Paperboard Co., the current owner of the facility formerly called the Riegel Paper Corporation, conducted a series of studies in order to resolve a long-time permit dispute. While the facility had greatly expanded treatment with the installation of an aerated stabilization basin (ASB) system, the facility and DEM could not agree on appropriate permit limits for the facility. This included development of a water quality model for the LCFR (Hydroscience, 1990) and extensive biological surveys on the LCFRE, as well as lower portions of the Black River and NE Cape Fear River (CH2M HILL, 1992).

The water quality model was developed as a slack-tide calibrated QUAL 2E model, recognizing that this was a conservative approach for modeling the impacts of the Federal Paperboard Co. discharge, since it did not consider dilution provided by tidal exchange. The DEM developed a similar model of the river, and both models indicated that there was only a small DO sag resulting from the Federal Paperboard Co. discharge under this conservative modeling approach (Kreutzberger and Wakild, 1993).

Biological investigations of the river, including habitat characteristics, benthic macroinvertebrates, and fisheries, indicated that the aquatic life uses of the river were not impaired as a result of wastewater discharges. Habitat characteristics of the Cape Fear River related to basin hydrology and historical dredging were determined to be primary factors affecting variability in biological characteristics in the river (CH2M HILL, 1992; Kreutzberger and Wakild, 1993; Sacco et al., 1993).

Information provided by these studies allowed the National Pollutant Discharge Elimination System (NPDES) permit issues for Federal Paperboard Co. to be resolved with a permit issued and a Special Order by Consent (SOC) to achieve those limits by 1999. International Paper purchased the mill in 1996 and continues to operate this facility today.

### **1.2.5 1996 Cape Fear River Basinwide Water Quality Management Plan**

In the mid-1990s, the DENR began development of basinwide water quality management plans for each of the river basins in the state, with plans to update them every 5 years. They also rearranged permit expiration schedules so that these plans could then guide all of the permitting in each basin. In the 1996 Plan, the LCFRE was not considered impaired, and there was no specific water quality management strategy presented. However, because portions of the estuary were designated as Primary Nursery Areas (PNA) by the Division of Marine Fisheries, this area was subject to High Quality Waters (HQW) requirements according to the plan.

This actually includes significant portions of the currently impaired areas. Based on this requirement, all new and expanding dischargers were required to meet advanced treatment requirements for oxygen-consuming wastes for which the specific limitations have evolved over the years (DENR, 1996).

### 1.2.6 Lower Cape Fear River Program Studies

As noted in the background, the LCFRP was established in 1995 and has been providing excellent data on ambient conditions in the river, as well as a wide variety of targeted research efforts. The annual and special reports, as well as published research papers, are listed in the attachment. A comprehensive review of the efforts is beyond the scope of this TM. The following provides a brief overview of the consistent findings over the years and a few highlighted observations that seem pertinent to consideration of the appropriate classification for the LCFRE.

In reviewing annual reports over the nearly 20 years of monitoring, the characterization of the LCFRE and tributaries has been fairly consistent. The LCFR has been characterized as experiencing periodically high turbidity with moderate to high levels of inorganic nutrients. The estuary also has two major blackwater tributaries (the Black and Northeast Cape Fear Rivers) that generally exhibit low levels of turbidity, lower levels of inorganic nutrients, and high levels of color. Despite the high levels of nutrients, algal blooms are typically limited in the rivers due to a combination of limited light as a result of turbidity and flushing in the Cape Fear River, or limited light because of the highly colored waters in the tributaries. During periods of low flow, discussed later in this section, chlorophyll *a* levels increase because water clarity increases and flushing decreases, allowing more time for algal populations to develop. Some major algal blooms have been observed in tributaries where point-source influences have been noted. Blackwater swamps and agricultural areas have been characterized as periodically having high pollutant levels (Mallin et al., 2013).

In addition to the overall summary of conditions, the LCFRP has documented water quality conditions following major hurricanes and during two extreme droughts. The following summarizes some observations during these periods.

The early years of the monitoring effort allowed for extensive documentation of hurricane effects similar to those observed during the initial water quality surveys in 1955. In the summer of 1996, eastern North Carolina experienced the effects of Hurricane Bertha (July 1996) and Hurricane Fran (September 1996). The ongoing LCFRP was able to document the water quality response from Hurricane Fran in particular, where hurricane-induced flooding resulted in significant inputs from riparian wetlands, especially in the NE Cape Fear River. The DO in the NE Cape Fear River fell to about zero for approximately 3 weeks, and there were also documented fish kills. The DO levels in the mainstem of the Cape Fear River were as low as 2 mg/L but recovered faster due to flushing from flows originating from the upper part of the watershed. It is important to note that while inputs from riparian wetlands were significant contributors to the tremendous loads of oxygen-demanding materials, there were also significant inputs of raw and partially treated sewage as a result of power failures, as well as significant inputs of swine waste from breached lagoon storage systems. Therefore, the natural inputs from wetlands could not be separated from anthropogenically derived inputs, which were concluded to be especially significant in the NE Cape Fear River system based on monitoring results for BOD and ammonia (Mallin et al., 1997).

Much of North Carolina and the Cape Fear River basin, in particular, experienced a severe drought in 2001 and 2002 that ended in 2003. The LCFRP documented higher salinity levels and extended low DO conditions in the main river during the summer of 2002. Several tributaries, Angola Creek, the upper portion of the NE Cape Fear River, and the upper South River were noted to have extremely low DO levels. Turbidity levels were lower than the mean conditions for the period of record in the Cape Fear River and the upper estuary, but algal blooms were not documented in the major rivers but were observed in some small streams (Mallin et al., 2003).

Another severe drought occurred during 2007. Observations were similar for the 2001-2002 drought in terms of low DO levels and lower than typical levels of turbidity in the Cape Fear River. While algal blooms were not observed in the Cape Fear River, some severe blooms were observed in many small tributaries where turbidity levels were also significantly lower than the long-term trend (Mallin et al., 2008).

This is just a brief summary of the extensive assessment efforts conducted by the LCFRP. There has also been a wide variety of published papers. The assessment reports and other publications are listed in the Attachment A.

## 1.2.7 City of Wilmington/New Hanover County Studies

In the period between 2000 and 2001, efforts were made on behalf of the City of Wilmington and New Hanover County to develop an initial application of a three-dimensional hydrodynamic model (the Environmental Fluid Dynamics Code, or EFDC, model), with the intention of meeting several objectives deemed important at the time (Tetra Tech, 2001). This model was an important step in developing an assessment tool for the river. However, DENR and stakeholders determined that more data for development and calibration were required to support development of a model that could be used to determine a TMDL for the impaired portions of the river. This effort is discussed in this section relative to the University of North Carolina (UNC)-Charlotte Water Quality Model.

In addition to the initial EFDC model development, a trend analysis was also conducted of available data to determine whether there was any significant change in DO levels in the impaired portion of the river during a period when significant reductions in point-source loadings of oxygen-consuming wastes occurred (Doll and Clements, 2003). The previous DO trend analysis found no statistically significant trend for DO for the period of 1984 through 2002. The same conclusion was drawn for the period of 1991 through 2002, despite a statistically significant reduction in major point-source ultimate biochemical oxygen demand (BOD<sub>u</sub>) load of approximately 25 percent for that period. This analysis has been updated with recent data and is presented in TM A-2 (Tetra Tech, 2014).

## 1.2.8 UNC-Charlotte Water Quality Model

As an extension of the effort started by consultants to the City of Wilmington and New Hanover County (Tetra Tech, 2001), DENR contracted with UNC-Charlotte to further develop the hydrodynamic model and water quality model using EFDC (Bowen et al., 2009). The objective of the study was to develop a water quality model of the LCFRE that would be suitable for use in developing a TMDL to address DO impairment. This model generally covers the tidally influenced areas of the Cape Fear River, Black River, and NE Cape Fear River, and extends to the mouth of the Cape Fear River with the Atlantic Ocean. The final report documents the details of the model development and calibration.

Analyses were conducted upon completion of model development, and calibration including the following eight scenarios:

1. Eliminating wastewater point-source loadings
2. Reducing river, creek, and wetland loadings
3. Changing wastewater loadings for various values of sediment oxygen demand
4. Reducing river, creek, and wetland loadings, and sediment oxygen demand
5. Eliminating ammonia inputs from wastewater point sources
6. Increasing wastewater inputs to maximum permitted values
7. Deepening of the navigation channel
8. Changing Brunswick County wastewater loadings

The following are a few highlights of major observations for some scenarios based on a simulation period to include April through October during a relatively low flow year – 2004.

### 1.2.8.1 Eliminating Wastewater Point-source Loadings

The sensitivity of the system to point sources was performed by running the model under different point-source conditions, including one with all point sources removed. Results from this analysis are shown in Figure 1 for the impaired portion of the Cape Fear River as a cumulative frequency diagram illustrating the percentage of the time the DO was above a certain level. Key findings include:

- During the period of lowest DO (selected as the 10<sup>th</sup> percentile), turning off all point-source discharges resulted in an increase in the DO from about 4.3 to 4.6 mg/L.

- DO levels were less than the standard of 5 mg/L approximately 32 percent of the time with the point-source discharges, and 27 percent of the time when these loadings were turned off.

### 1.2.8.2 Reducing River, Creek, and Wetland Loadings

Nonpoint-source reduction scenarios were also run by reducing the loading of oxygen-demanding pollutants for the tributaries and wetland cells by 30, 50, and 70 percent. These results indicate the following:

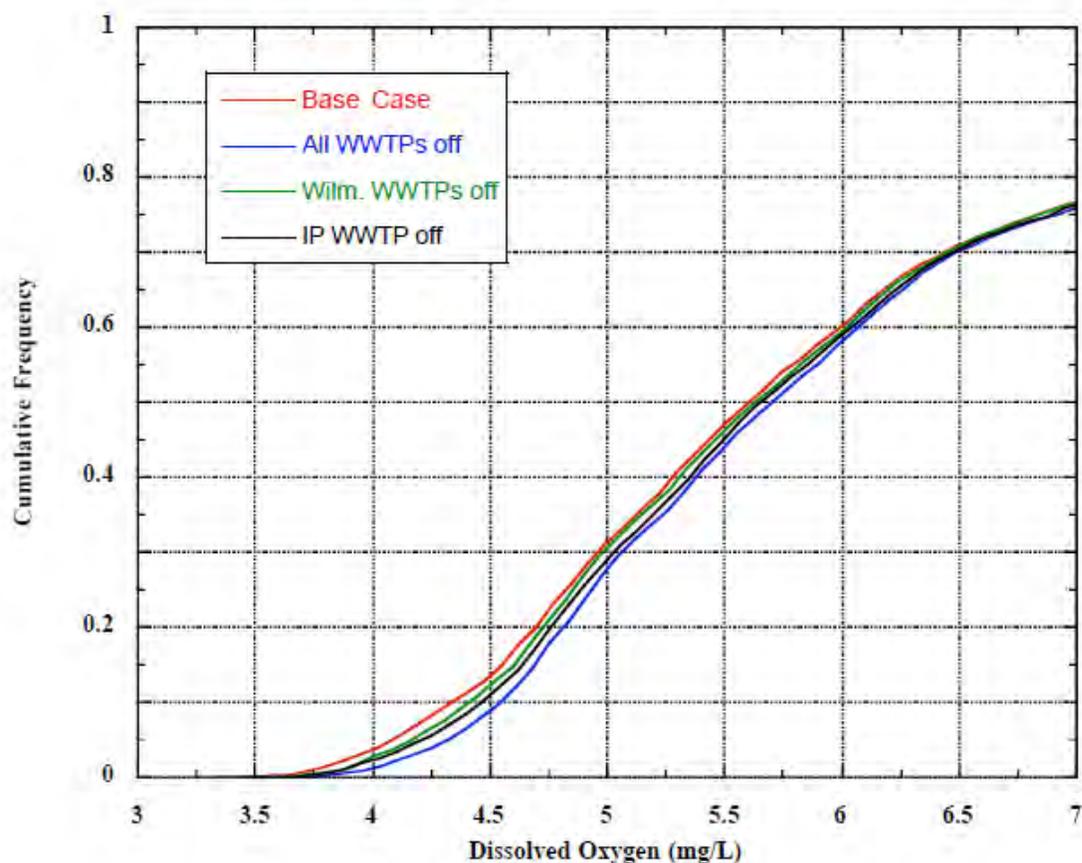
- During the period of lowest DO (selected as the 10<sup>th</sup> percentile), the difference between the base case with all calibrated pollutant loading and a 70 percent reduction in tributary/wetland loading resulted in an increase in DO of about 4.3 to 4.7 mg/L.
- DO levels were less than the standard of 5 mg/L approximately 32 percent of the time for the base case, 24 percent of the time with a 30 percent reduction in tributary/wetland loads, 20 percent of the time with a 50 percent reduction in tributary/wetland loads, and 18 percent of the time with a 70 percent reduction of tributary wetland loads.

### 1.2.8.3 Eliminating Ammonia Inputs from Wastewater Point Sources

The model results indicated that elimination of ammonia from point sources resulted in an approximate 0.1 mg/L increase in DO for periods when the DO was less than 5 mg/L.

Based on the results of the UNC-Charlotte modeling study, DENR determined that it could not move forward with development of a TMDL because it was apparent that point sources contributed a relatively small portion of the observed DO impairment based on the DO standard of 5 mg/L. DENR also concluded that although natural sources appeared to be a significant contributor to the low DO conditions, they could not differentiate what portion of the DO deficit was due to natural sources versus anthropogenic sources.

**April through October Simulated Dissolved Oxygen Concentrations  
in the Impaired Area, Lower Cape Fear River Estuary**



**Figure 1. Cumulative frequency of model-predicted DO concentrations (April through October 2004) in the impaired portion of the LCFRE for the base case and three reduction scenarios for WWTP loads (reproduced from Bowen et al., 2009)**

The three analyses highlighted above demonstrate the LCFRE lack of sensitivity to changes in point source loads. It should also be pointed out that the modeling also showed a significant impact of further channel dredging on DO conditions in the river.

## 2 Summary

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There is a vast amount of data, research, technical analysis, and modeling for the LCFRE. While discharges from point sources and nonpoint sources appear to have some contribution to the DO deficit, it is also clear that natural drainage from riparian wetlands, salt marshes, and blackwater tributaries are more significant contributors to DO conditions not meeting the assigned standard of 5 mg/L and the pH minimum of 6.8 at all times for Class SC waters (see TM 4 for additional technical details on relative impact of sources on DO deficit) (Tetra Tech, 2014). The supplemental “Swamp” classification appears appropriate for these areas to recognize the natural source contributions to deviations in these parameters.

Other TMs prepared in conjunction with this summary address other aspects of these issues, including:

- TM 2 - Updated trend analysis of DO conditions and pollutant loading from point sources
- TM 3 - Analysis of long-term data near the limits of the tidal influence for the Cape Fear River, Black River, and NE Cape Fear River, which are approximate boundaries in the EFDC model
- TM 4 - An analysis of model results to assess the relative impact of riparian wetlands and salt marshes versus other tributary loadings

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# **Technical Memo: Dissolved Oxygen Trend Analysis for the Lower Cape Fear River Estuary**

Prepared for

## **The Lower Cape Fear River Program**

Prepared by



One Park Drive, Suite 200 • PO Box 14409  
Research Triangle Park, NC 27709

**February 21, 2014**



# 1 Introduction

The Lower Cape Fear River Program (LCFRP) is a large-scale water quality and environmental assessment program covering the Cape Fear River Estuary and a large portion of the lower Cape Fear River watershed. The LCFRP represents a collaboration of academia, government, industry, and the public, which has been coordinating with the North Carolina Department of Environment and Natural Resources (DENR) since 1995. The purpose of this memo is to update a previous (Tetra Tech, 2003) statistical trend analysis performed on dissolved oxygen (DO) data collected in the Lower Cape Fear River Estuary (LCFRE) portion of the basin. The current memo was prepared as part of a joint LCFRP-DENR effort to summarize the existing body of technical evidence for submission to the North Carolina Environmental Management Commission (EMC) requesting reclassification of portions of the LCFRE into a supplemental “Swamp” designation—a designation which had been applied to the LCFRE from the late 1950’s until the early 1980’s.

The previous DO trend analysis found no statistically significant trend for DO for the period of 1984 through 2002. The same conclusion was drawn for the period of 1991 through 2002, despite a statistically significant reduction in major point source ultimate biochemical oxygen demand (BODu) load of approximately 25 percent for that period. For this updated review, advanced statistical analyses were performed to determine if ambient DO data or major point source BODu loads exhibit significant trends over an extended period of time in the LCFRE (i.e., extending the data reviewed out to 2013). Monitoring data compilation, preparation, and analysis methods and results are summarized below.

## 2 Monitoring Data

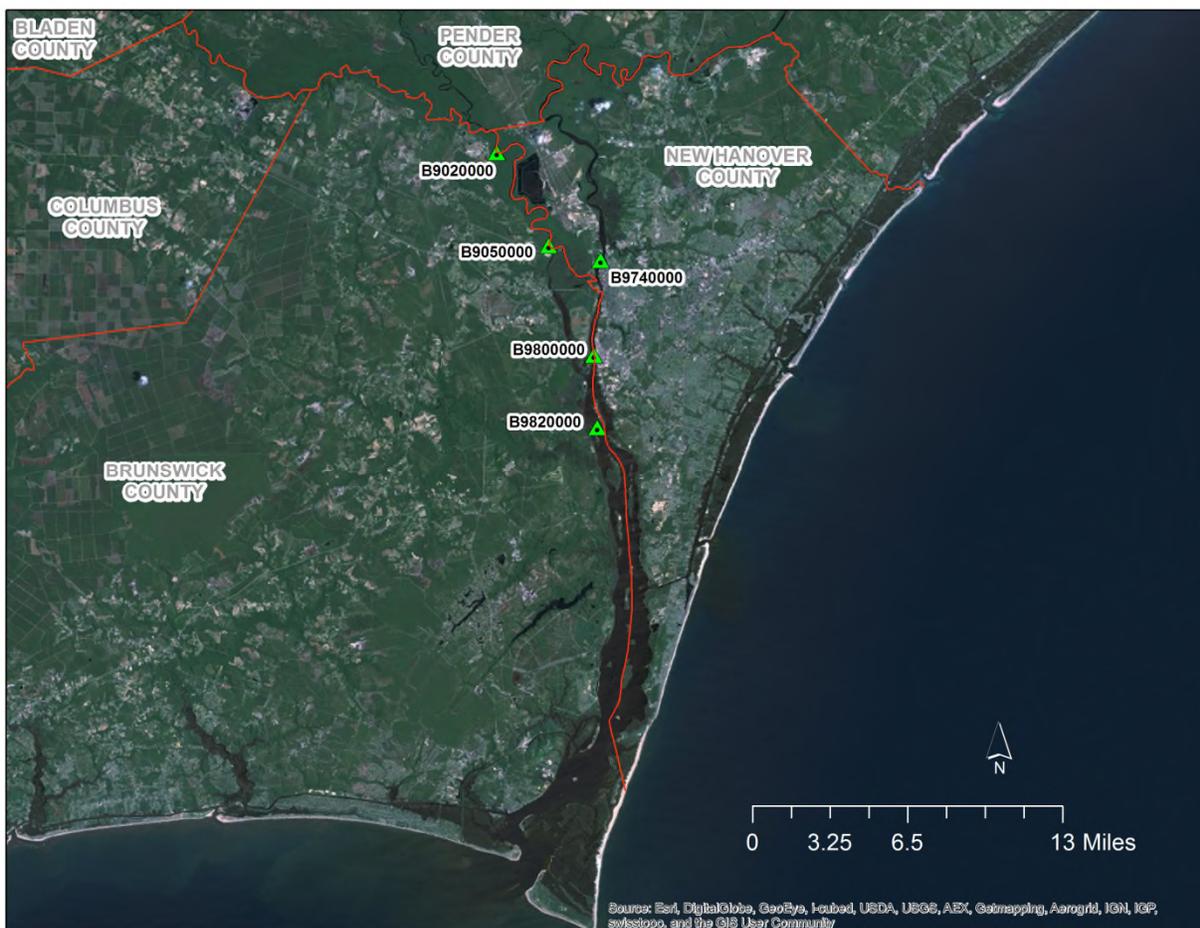
The first step for the extended trend analysis involved obtaining ambient DO data and major point source data relevant for the LCFRE. The following subsections describe what data were compiled and how the data were processed to address outliers and fill gaps in preparation for the statistical tests.

### 2.1 DISSOLVED OXYGEN

DO data were obtained from STORET (EPA’s online data storage and retrieval resource) for five monitoring stations in the Cape Fear Estuary (Table 1 and Figure 1). These stations were chosen for the analysis because they offered the longest available period of monitoring records and because they are each located either directly within or immediately adjacent to the 303(d) listed portion of the Cape Fear Estuary. Note that the names of the last two stations in the table have changed since the first trend analysis memo was produced in 2003, due apparently to renumbering of the channel markers. The station IDs, and thus the locations, are identical.

**Table 1. Ambient Monitoring Stations Used in the DO Trend Analysis**

Station ID	Station Name	Selected Period of Record
B902000	Cape Fear River downstream Hale Point Landing near Phoenix	January 1992 – April 2013
B905000	Cape Fear River at Navassa	May 1984 – April 2013
B974000	Northeast Cape Fear River at NC 133 at Wilmington	January 1981 – April 2013
B980000	Cape Fear River at Channel Marker 61 at Wilmington	January 1985 – April 2013
B982000	Cape Fear River at Channel Marker 56 near Wilmington	January 1981 – April 2013



**Figure 1. Locations of Ambient Monitoring Stations Used in the DO Trend Analysis**

Only DO measurements within one foot of the water surface were evaluated, because historical depth stratified monitoring data has consistently indicated strong mixing with little vertical stratification in the estuary. As was done with the previous analysis, one outlier was removed from the dataset; 0.4 mg/l from February 1998 at the Northeast Cape Fear River station. Observations associated with major hurricane events that affected the Cape Fear Estuary were also removed. Following Hurricane Bertha on July 12, 1996 and Hurricane Fran on September 5, 1996, prolonged periods of depressed instream dissolved oxygen levels in the Cape Fear Estuary followed each storm (Mallin et al., 1997). The Mallin report indicated conditions approached anoxia at several monitoring locations after Fran, likely due to significant undocumented “point sources” including pump station and WWTP failures as well as hog lagoon breaches. After each storm, dissolved oxygen levels did not return to normal until about two months following each event. Two other hurricanes were identified that struck in the vicinity of the Cape Fear Estuary – Hurricane Bonnie on August 27, 1998 and Hurricane Floyd on September 16, 1999. Based on the recovery period reported by Mallin et al., observations were removed from each of the datasets for a period of two months following each of the four hurricanes. Figure 2 through Figure 6 show the dissolved oxygen observations for the five stations. The hurricane event observations that were omitted from the analysis are shown in red; the impact of the hurricanes on DO is visible in many cases.

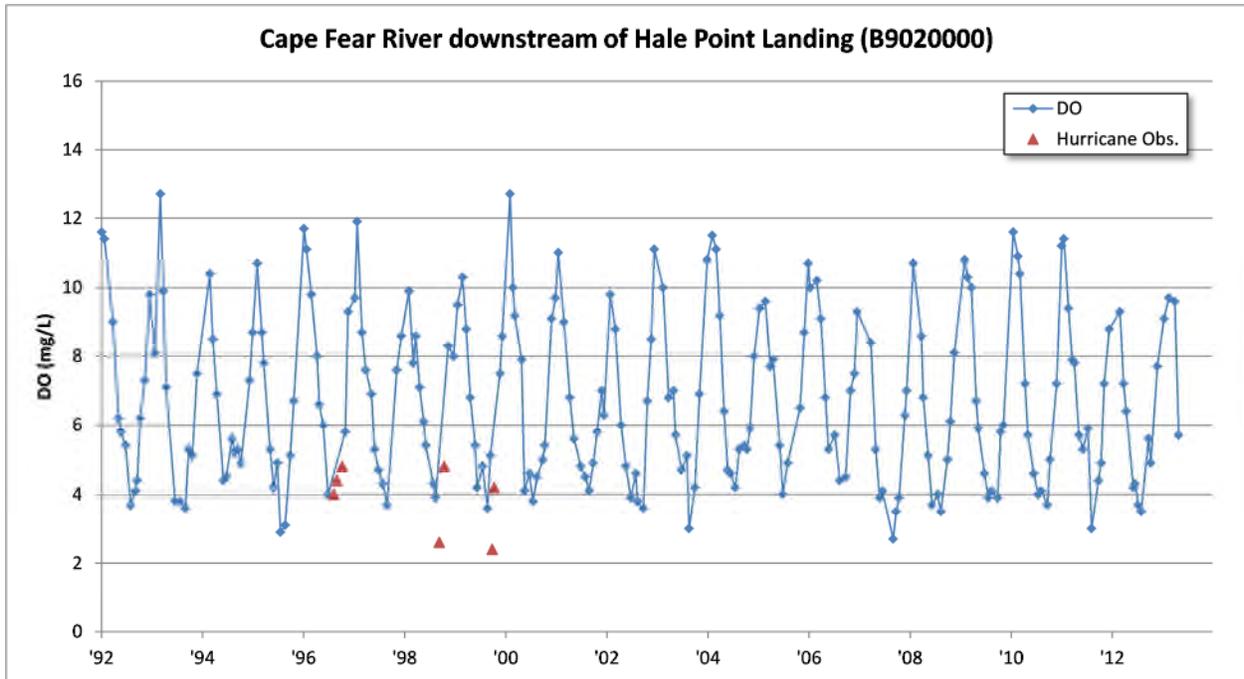


Figure 2. Dissolved Oxygen at B9020000, Cape Fear River Downstream of Hale Point Landing

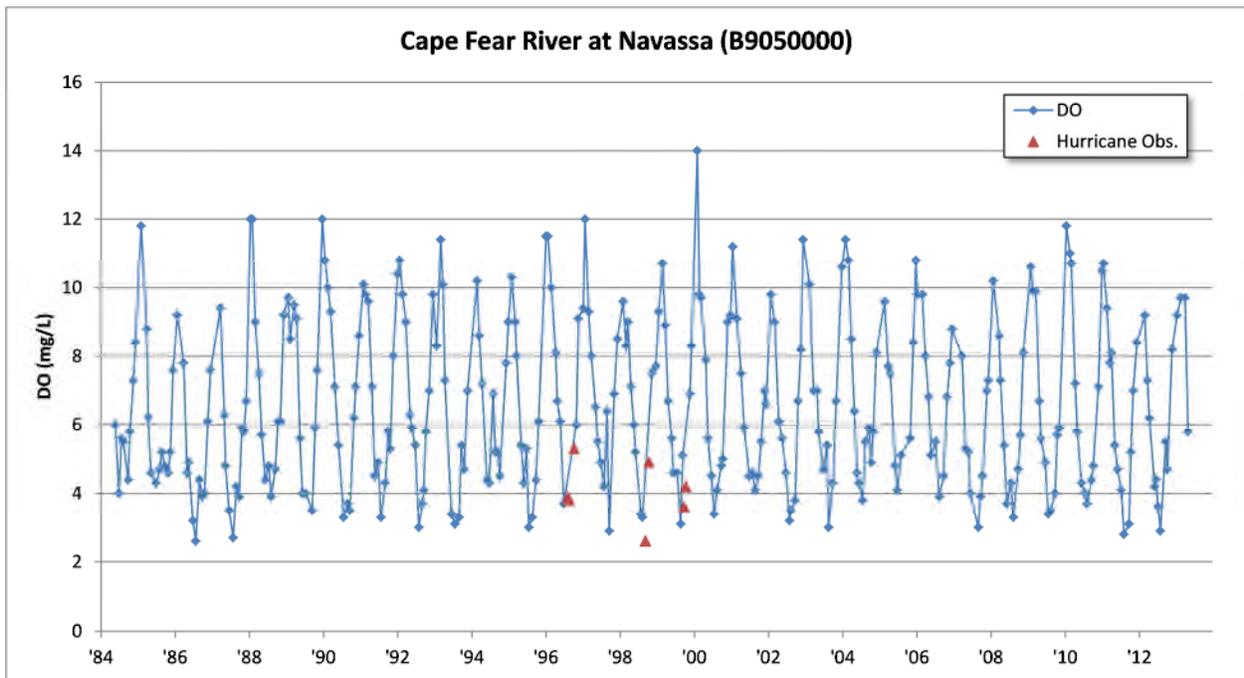


Figure 3. Dissolved Oxygen at B9050000, Cape Fear River at Navassa

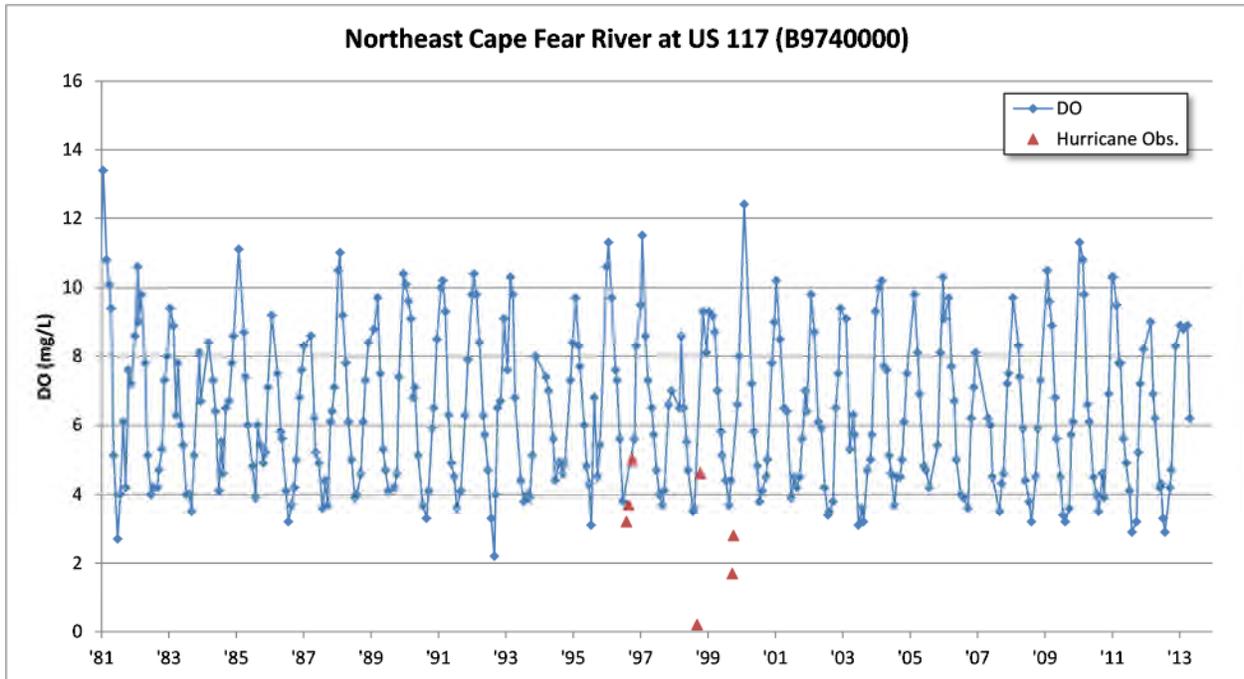


Figure 4. Dissolved Oxygen at B9740000, Northeast Cape Fear River at US 117

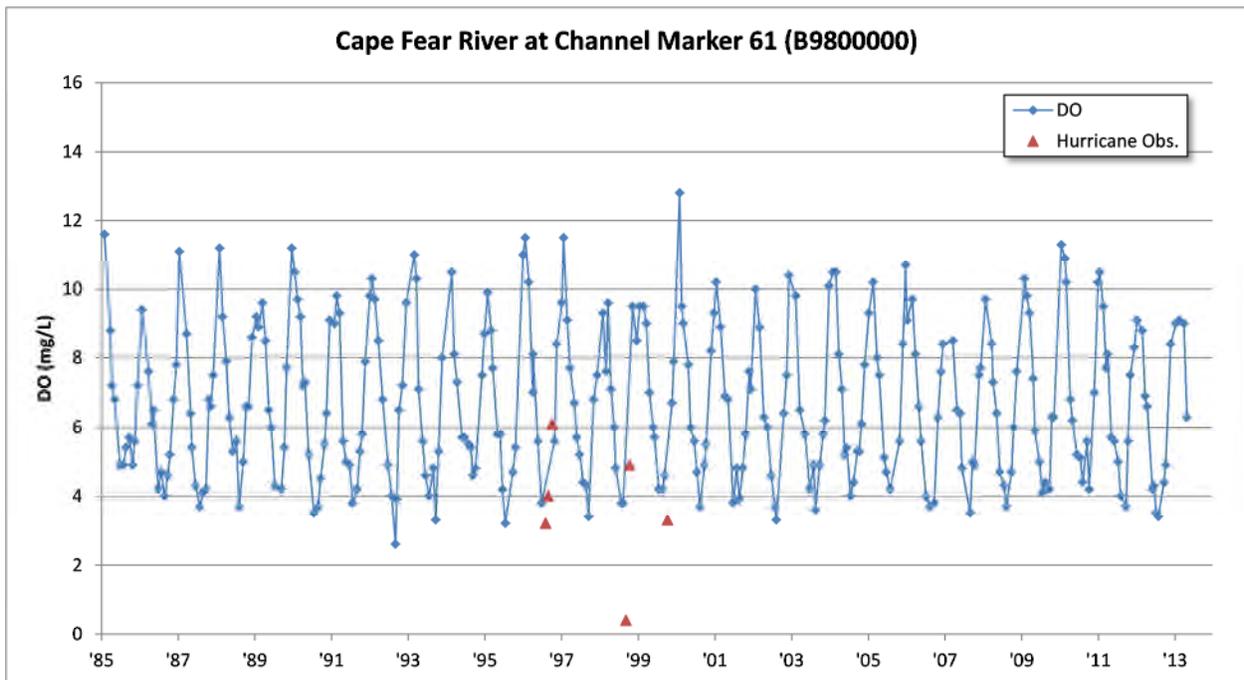


Figure 5. Dissolved Oxygen at B9800000, Cape Fear River at Channel Marker 61

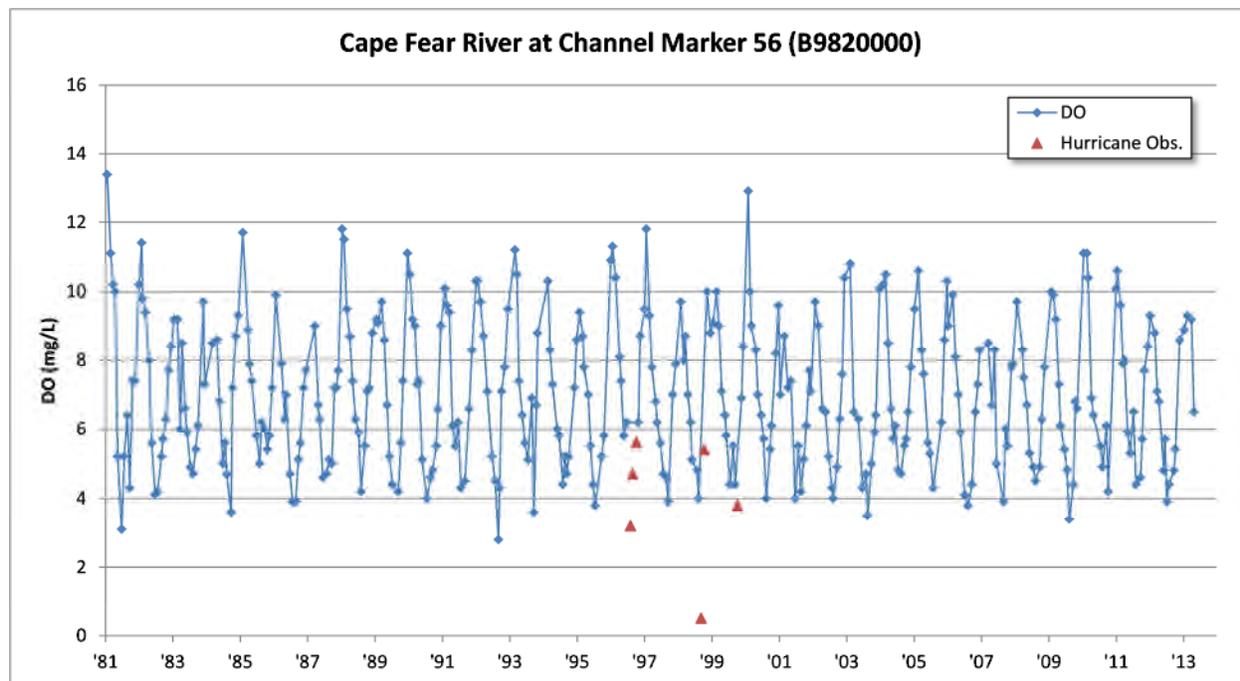


Figure 6. Dissolved Oxygen at B9820000, Cape Fear River at Channel Marker 56

## 2.2 POINT SOURCE DATA

Data were obtained from DENR for major facilities discharging oxygen demanding waste from January of 1994 through November of 2013. Previous point source pollutant loading assessments by DENR (1999) have shown that, based on actual summer effluent data from 1998 and 1999, 90% of the total point source based oxygen demanding pollutant load to the estuary comes from three facilities – International Paper (NPDES NC0003298), Wilmington Northside WWTP (NPDES NC0003298), and Wilmington Southside WWTPs (NPDES NC0003298). Brief correspondence with the DENR NPDES Permitting Unit indicated that these facilities remain the bulk of total discharge in the LCFRE. For that reason, the analysis is focused on those three point sources.

For each of the facilities, monthly loads of BOD5 and ammonia were estimated using monitoring data. In most cases, BOD5 and ammonia were reported as a daily concentration. Daily load was calculated on days where both daily concentration and daily flow data existed. The one exception was BOD5 from International Paper, which was already reported as a daily load. These daily loads were then averaged on a monthly basis, and multiplied by the number of days in the month to obtain the monthly load. There were a few cases where monthly loads had to be estimated differently:

- Daily discharge data for BOD5 and ammonia were not available from DENR for the Wilmington Southside facility during 1999. As a result, City of Wilmington monthly discharge data were used for this period. The 1999 monthly loads were estimated for the previous 2003 trend analysis memo, and were used in this analysis as well.
- Ammonia data were not reported on a routine basis between January 1994 and January 1997 at International Paper; rather, three monthly values were available during each of the three years spanning 1994 – 1996. Yearly averages were calculated from the available months, and missing values were set equal to the average from the same year; January 1997 was set equal to the average for 1996. A total of 28 values were estimated using these methods.

- Data were not available to estimate BOD5 during November 2001 at International Paper and May 2005 at Wilmington Southside. There was also an apparent reporting error for January 1997 at International Paper, with average BOD5 reported about two orders of magnitude lower than typical values. In each case, values were estimated by taking the average of the value for the previous month and the subsequent month.

Monthly BOD5 loads were converted to CBODu using multipliers inferred from graphs provided in Bowen et al. (2009). A multiplier of 5.65 was used for International Paper based on the combined average from two long term BOD studies. The multiplier for the Wilmington Southside facility long term BOD measurement was estimated as 3.0. The near detection low level of long term BOD measurement for the Wilmington Northside facility prevented estimating a multiplier from the graph with sufficient confidence, so 3.0 was used to be consistent with the Southside value. Monthly ammonia loads were converted to NBODu using a multiplier of 4.5 (the stoichiometric ratio for the amount of DO required for the oxidation of ammonia). The estimated monthly CBODu loads for each of the three facilities are shown in Figure 7 through Figure 9, and monthly NBODu loads are shown in Figure 10 through Figure 12.

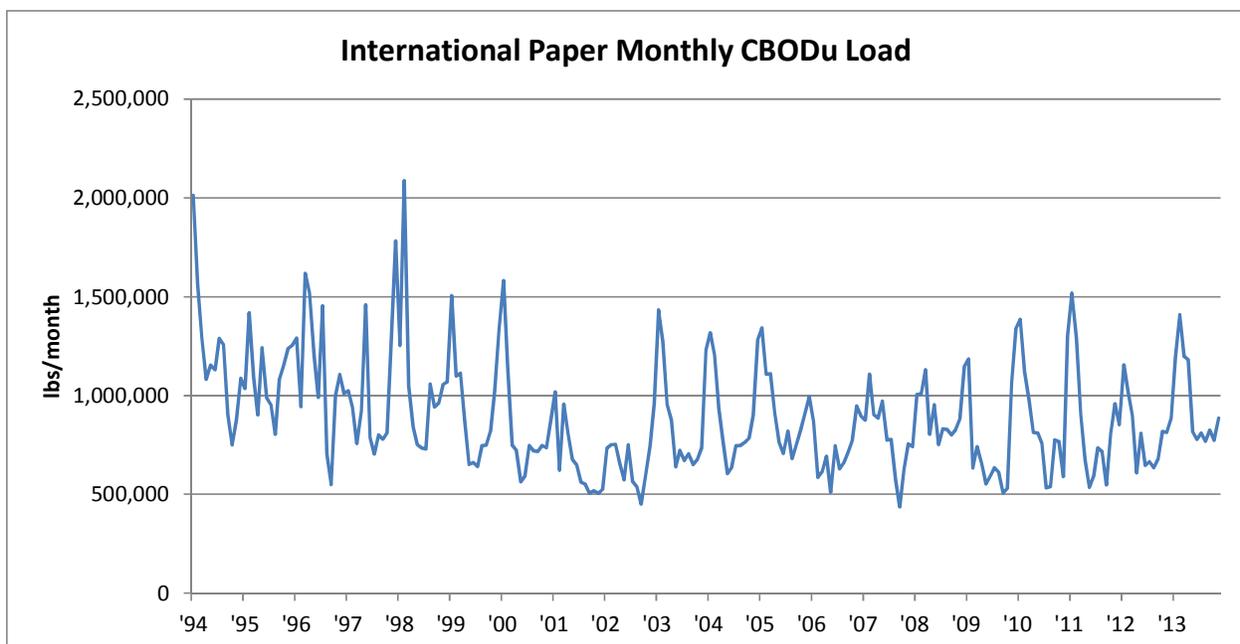


Figure 7. Estimated Monthly CBODu for International Paper

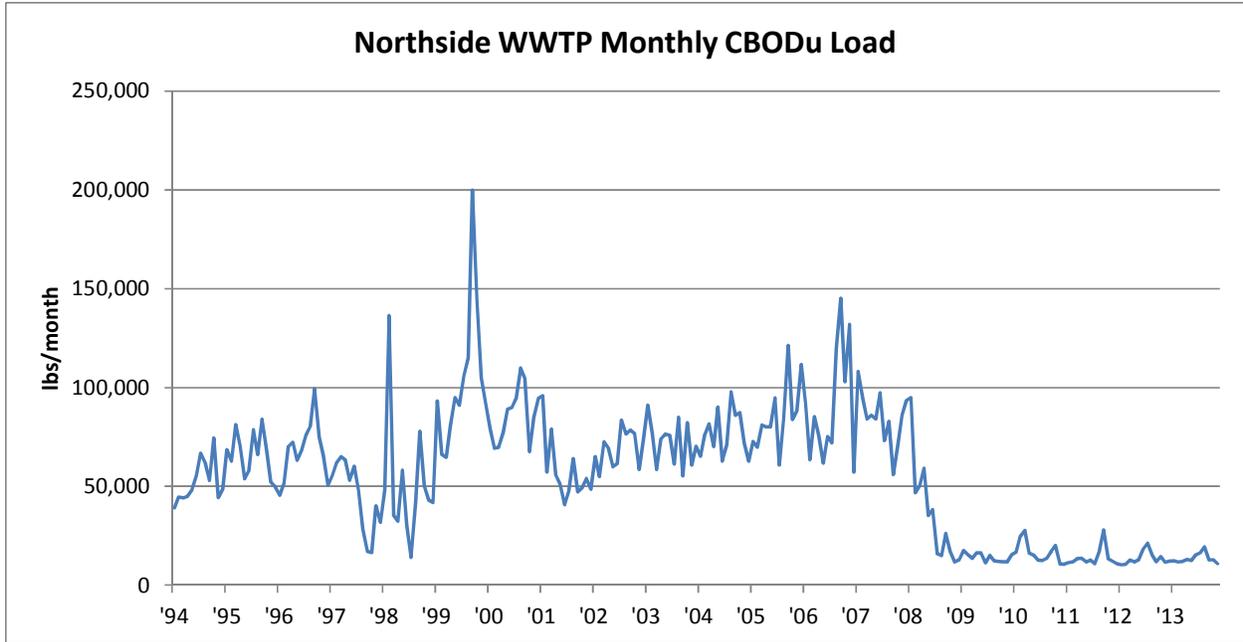


Figure 8. Estimated Monthly CBODu for Northside WWTP

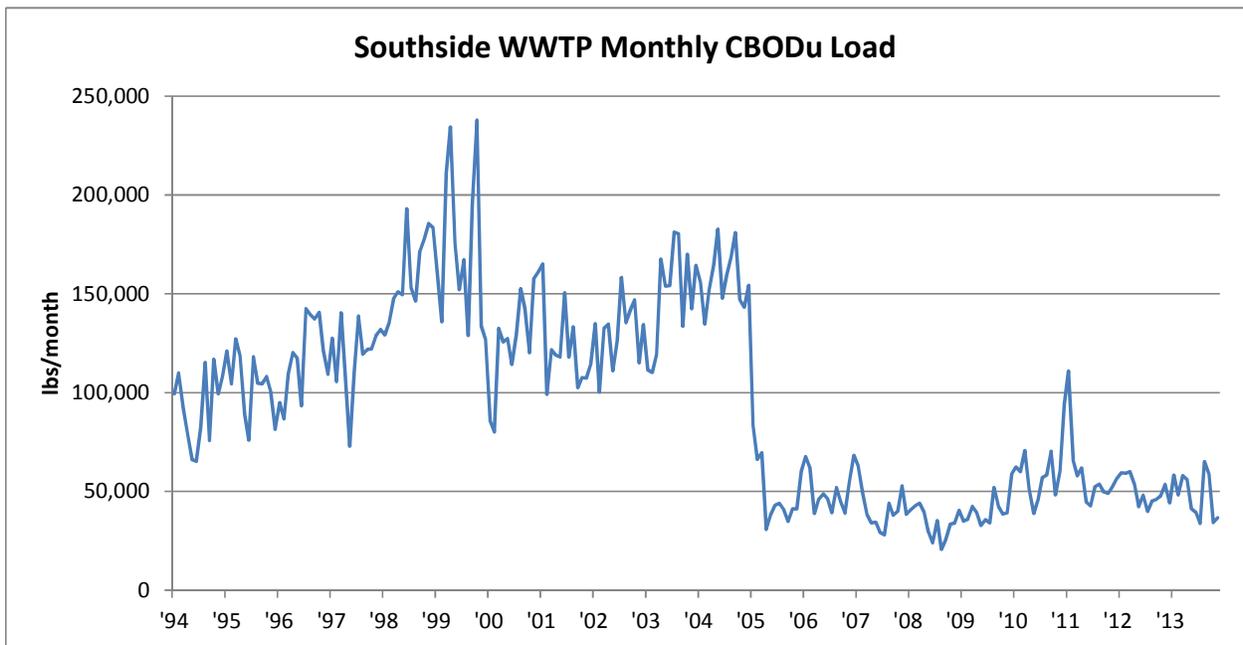


Figure 9. Estimated Monthly CBODu for Southside WWTP

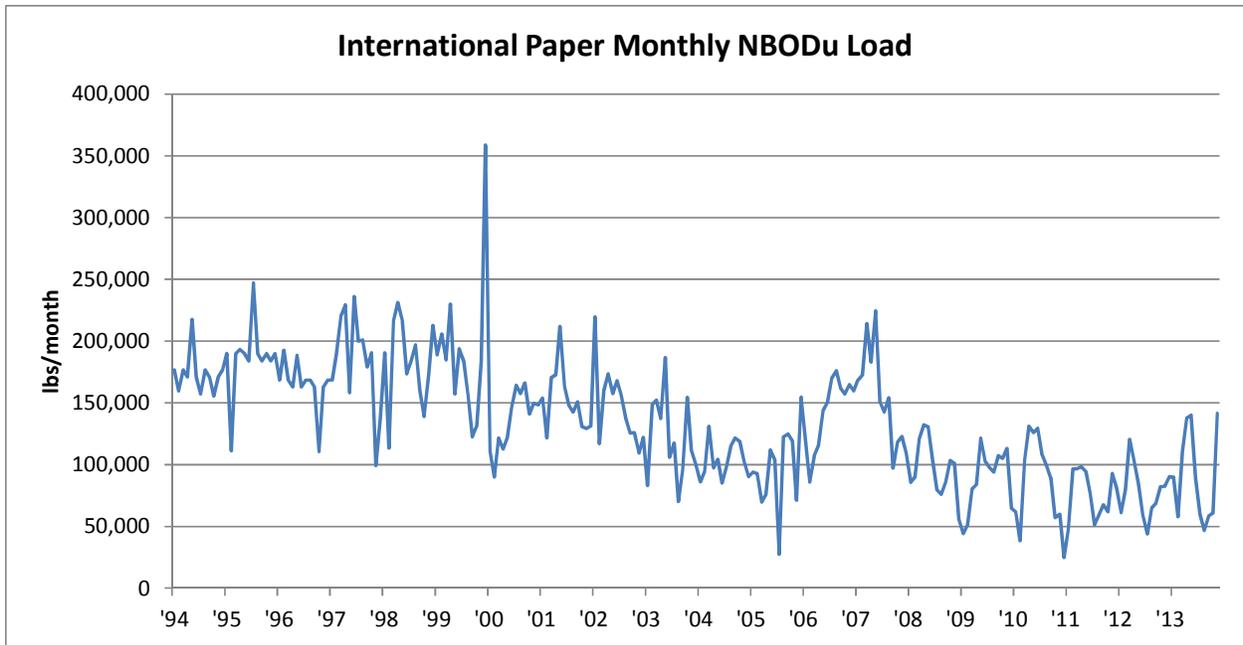


Figure 10. Estimated Monthly NBODu for International Paper

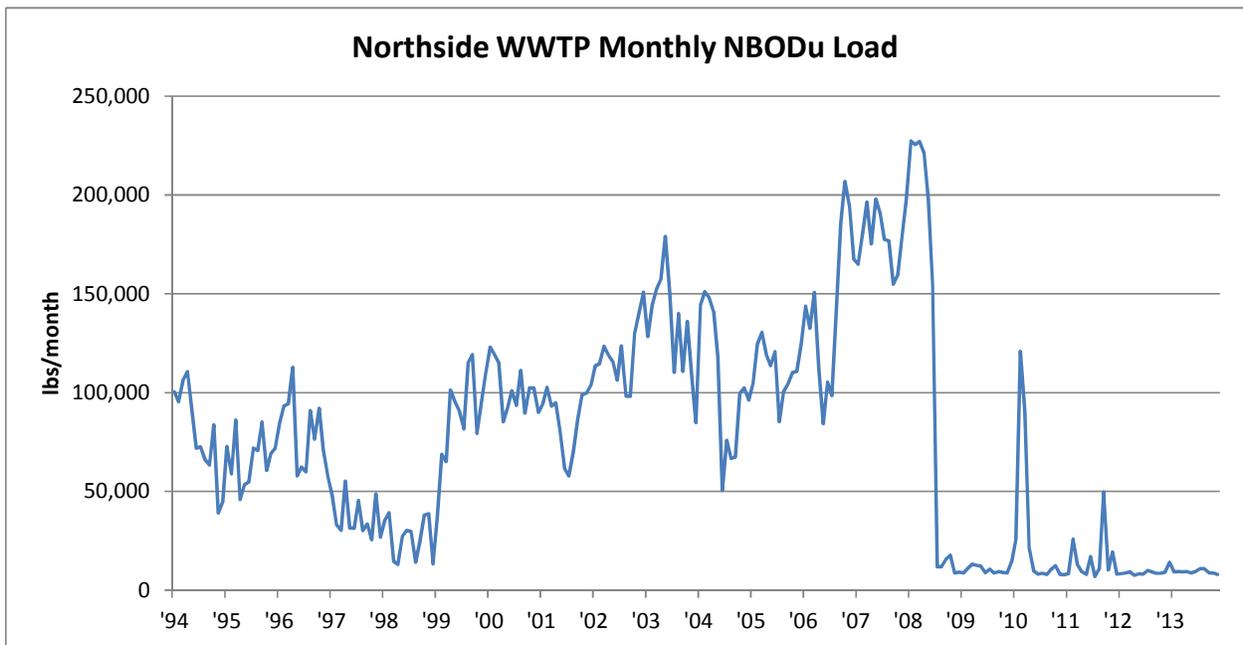


Figure 11. Estimated Monthly NBODu for Northside WWTP

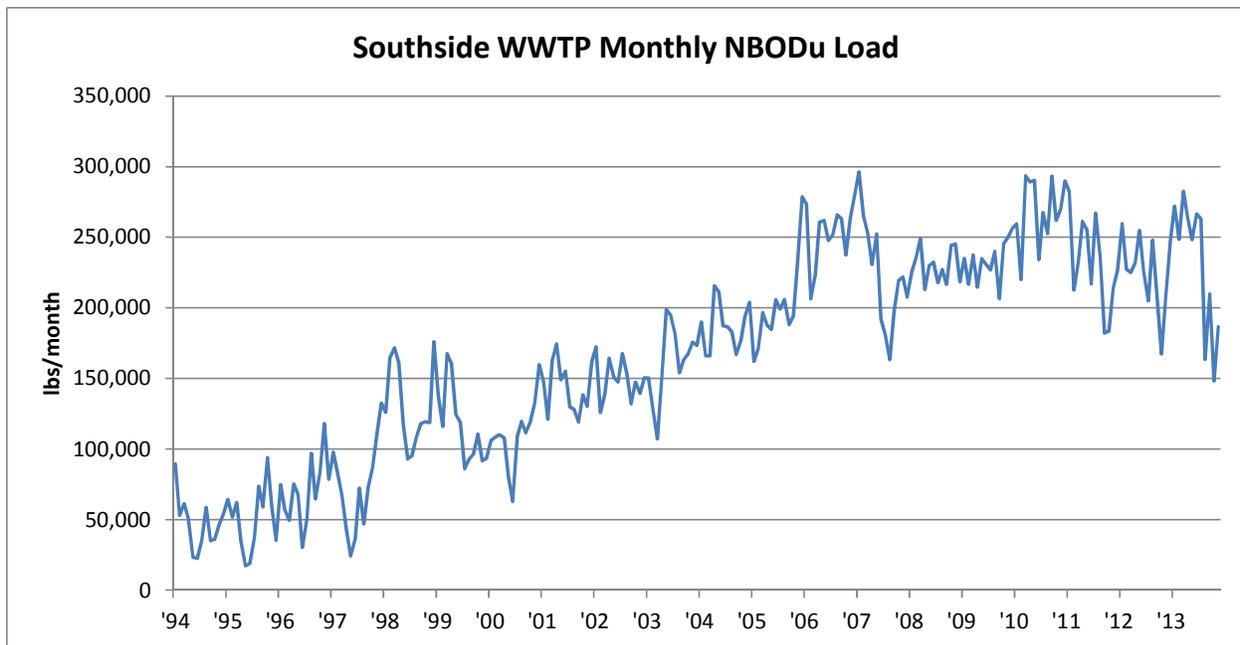
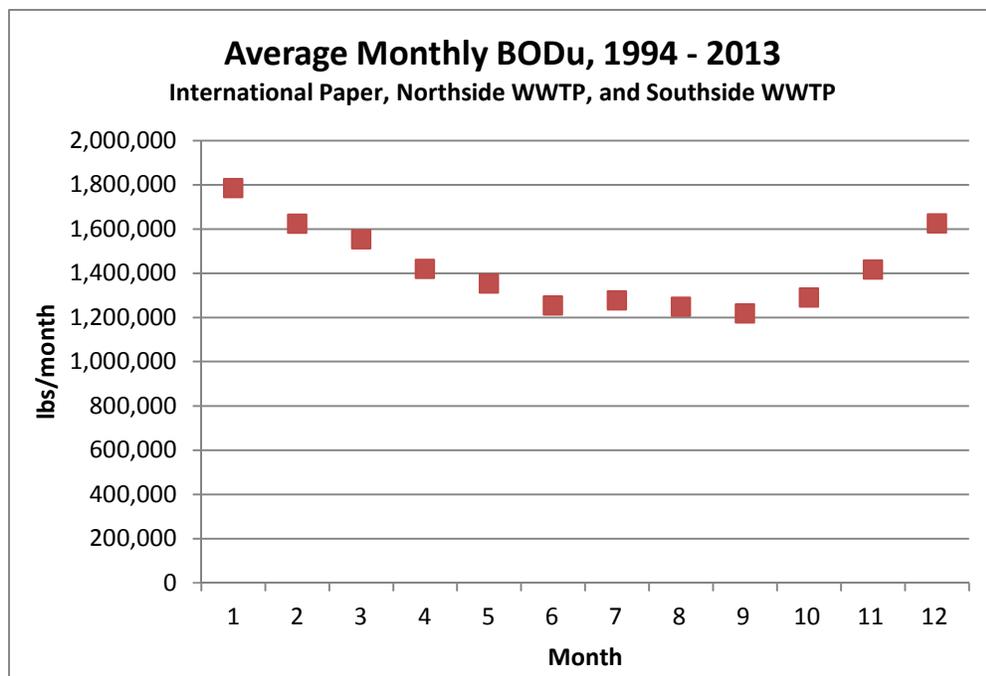


Figure 12. Estimated Monthly NBODu for Southside WWTP

## 3 Trend Analysis

### 3.1 STATISTICAL TESTS

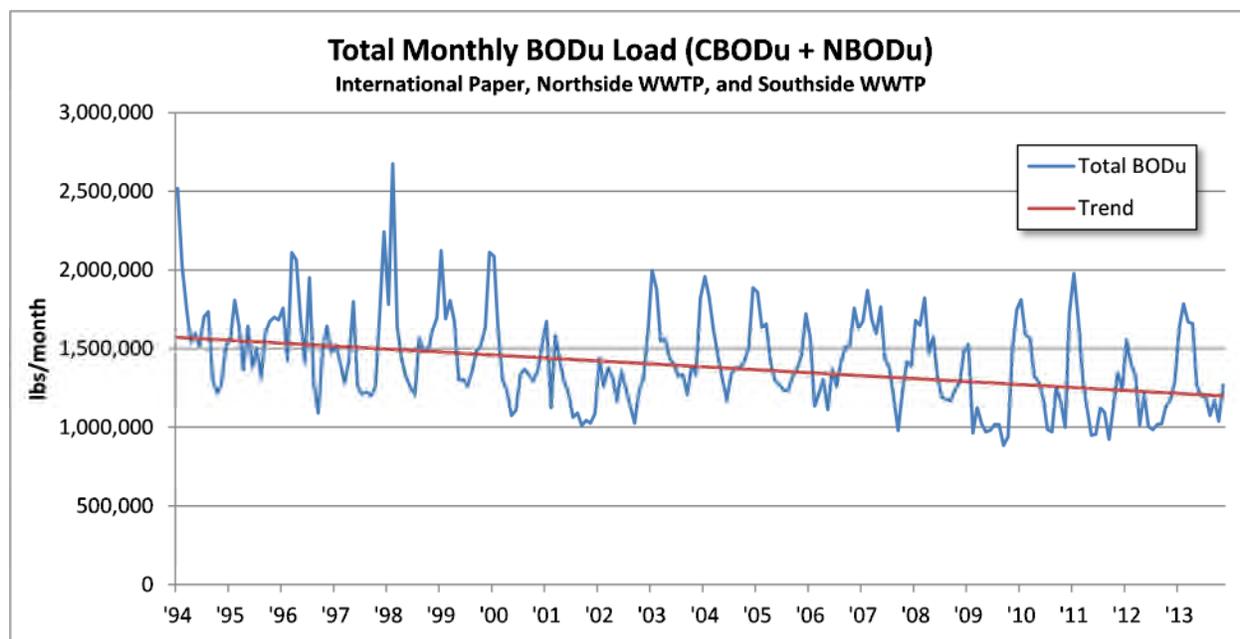
The USGS Kendall Program (Helsel et al., 2006) was used to perform the statistical trend analysis on the DO and BODu monitoring data. Specifically, the Seasonal Kendall test was selected within the USGS Kendall Program for the trend analysis because seasonality is present in the both the ambient DO and BODu data, and the Seasonal Kendall test accounts for autocorrelation across seasons. Also, the Seasonal Kendall test allows for missing values and does not require complete years of data (i.e., bias is not introduced). Additional background on the statistical methods applied is provided in Attachment A. DO is known to show a seasonal pattern, but seasonality in BOD should be confirmed prior to conducting the test. CBODu and NBODu were summed across the three point sources to develop an overall point source estimated BODu time series. Average monthly BODu was then calculated across the monitoring period of 1994 – 2013. As seen in Figure 13, there is clearly a seasonal pattern in BODu loads to the Cape Fear Estuary.



**Figure 13. Estimated Average Total Monthly BODu to Cape Fear Estuary, 1999 - 2013**

The Seasonal Kendall test was performed on the total BODu time series, using “seasons” defined by months. Monthly seasons are typically used for the Seasonal Kendall test; while seasons of a different duration can be used (e.g., bi-weekly, quarterly), the Seasonal Kendall test was developed using monthly data, and much of the guidance on minimum period of record and adjusting for autocorrelation is focused on using monthly data (Hirsch et al., 1981). In the previous trend analysis, quarterly data were used to reduce seasonal autocorrelation associated with monthly data. However, the USGS Kendall program calculates a modified version of the test statistic that accounts for the autocorrelation, so the data did not require any adjustment for the analyses conducted for this memorandum.

For total BODu, the Seasonal Kendall test indicated a trend of strong statistical significance, with a *p*-value adjusted for autocorrelation of 0.0034; any *p*-value less than 0.05 is considered significant with 95 percent confidence. The trend calculated using Sen’s slope estimator (Sen, 1968) was -18,340 lbs/month; in other words an overall annual reduction of 220,080 lbs/yr. A plot of estimated total BODu with the trend superimposed is shown in Figure 14. An additional test was conducted using BODu for a reduced time period (2003 – 2013) to check whether the trend has continued since publication of the previous trend analysis. The adjusted *p*-value was 0.0143, indicating a highly significant trend for the reduced time period, and the magnitude was actually higher at -32,730 lbs/month.



**Figure 14. Estimated Total Monthly BODu to Cape Fear Estuary, with Reported Trend**

Seasonal Kendall tests were then performed for DO at each of the five stations for the periods of record shown in Table 1. In all cases, the null hypothesis of no trend could not be rejected – in other words, a finding of no trend. The *p*-values adjusted for autocorrelation did not indicate anything close to statistical significance (Table 2). The tests were repeated for reduced time periods of 2003 – 2013 to test for any trend following publication of the previous trend analysis. Again, no trends were found and all the adjusted *p*-values did not show any statistical significance.

**Table 2. Results of DO Trend Analysis Showing No Trend of Significance**

Station ID	<i>p</i> -value, full period of record	<i>p</i> -value, 2003 – 2013
B9020000	0.5026	0.9238
B9050000	0.6853	0.4310
B9740000	0.1532	0.9334
B9800000	0.4823	0.9159
B9820000	0.1342	0.8636

### 3.2 CONCLUSIONS

This memorandum supports the same finding as the previous analysis conducted in 2003. A significant downward trend was detected in the total oxygen demanding pollutant loads from the three facilities that comprise roughly 90 percent of all point source loads to the LCFRE, while no corresponding trend was found in DO monitoring data at five separate LCFRE stations. During the 20 years of point source load monitoring included in this analysis, the total estimated BODu load from the three facilities has declined about 23 percent as indicated by the trend estimate.

## References

- Bowen, J.D., S. Negusse, J.M. Goodman, B. Duclaud, M. Robin, and J. Williams. 2009. *Development and Use of a Three-Dimensional Water Quality Model to Predict Dissolved Oxygen Concentrations in the Lower Cape Fear River Estuary, North Carolina*. Department of Civil and Environmental Engineering, University of North Carolina at Charlotte.
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# Attachment A – Background on Statistical Methods

The Seasonal Kendall test (Hirsch et al., 1982) and Sen's nonparametric slope estimator (Sen, 1968) were used to test for the presence of a statistically significant trend. Background information outlining the technical basis for the selection of these methods is provided below.

The nonparametric Mann-Kendall test for trend (Mann, 1945; Kendall, 1975) forms the basis of a method that is frequently used for trend analyses performed on water quality monitoring data – the Seasonal Kendall Test. The method was developed and popularized by USGS researchers throughout the 1980s (Hirsch et al., 1991), and USGS published computer code supporting its use.

Mann-Kendall is especially useful for detecting trends in environmental variables for several reasons:

- The test is nonparametric, and the data do not need to be normally distributed.
- Missing values are allowed; gaps are simply ignored.
- Data reported at the detection limit can be used without censoring, so long as the values are set lower than the smallest observation.

This is all possible because Mann-Kendall looks only at the relative magnitudes of sequential data, so the type of distribution, gaps, and the assumptions used for non-detects become irrelevant. The test does, however, assume that the data are not serially correlated, an assumption frequently violated by environmental monitoring data. Serial correlation (also called autocorrelation) occurs when data points are not independent from each other. Monitoring data tend to show positive serial correlation, meaning that positive errors (about the mean) in one time period are associated with positive errors in adjacent time periods (and negative errors are associated with adjacent negative errors).

The Seasonal Kendall test is a generalization of the Mann-Kendall test, developed by Hirsch et al. (1982). In its original application, data were divided into 12 “seasons”, with each month representing a season. Missing values are allowed (as is the case with the Mann-Kendall test), and complete years of all 12 seasons are not required. The Mann-Kendall test statistic and its variance are calculated separately on each season. The statistics are summed and a Z statistic computed, which is compared to the standard normal tables. The null hypothesis  $H_0$  is there is no trend, while the alternative hypothesis  $H_A$  is either an upland or downward trend (a two-tailed test). Serial correlation among values within a season can be addressed by a modification of the test statistic (Hirsch and Slack, 1984). The modification is recommended in cases where there are 10 or more observations per season (i.e., 10 years of data if seasons are defined monthly) due to difficulties accurately determining covariance for fewer data.

A slope can be calculated as well for the Seasonal Kendall test. The slope is based on Sen's nonparametric slope estimator (Sen, 1968). The method estimates a series of slopes between values from the same season. The Seasonal Kendall slope is the median of this series of slopes.

The USGS Kendall Program (Helsel et al., 2006) was developed to address a gap in publically available software for estimating trends using the Seasonal Kendall test and other Kendall tests. In the 1980s USGS popularized Kendall methods, and USGS published computer code supporting its use in popular statistical packages. However, in later years as statistical analysis moved to desktop computing, the code became difficult to execute without purchase of commercial statistical software. As a result, USGS repackaged the code into an executable program which can be used on computers supporting DOS or DOS emulation. The USGS Kendall program is freely available from a USGS website.

Helsel, D.R., D.K. Mueller, and J.R. Slack. 2006. *Computer Program for the Kendall Family of Trend Tests*. Scientific Investigations Report 2005-5275. U.S. Geological Survey. Reston, VA.

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# **Technical Memo: Task 3 - Analysis of Water Quality Data at Cape River Estuary Model Boundaries**

Prepared for

## **Lower Cape Fear River Program**

Prepared by

**CH2MHILL®**

**February 25, 2014**



# 1 Introduction

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Since 1998, the section of the Lower Cape Fear River Estuary (LCFRE) from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been listed on the State of North Carolina's 303d List as impaired for dissolved oxygen (DO). Since the original listing for DO, many technical studies of the LCFRE have been conducted by the North Carolina Department of Environment and Natural Resources (DENR), the Lower Cape Fear River Program (LCFRP), other agencies and academic researchers, and consultants. As a result, an extensive technical foundation of knowledge on the LCFRE has been created, including information on physical, chemical, and biological features and processes. Monitoring programs have provided insight regarding ambient conditions over many years on water quality, benthos, and fish. Additionally, sophisticated three-dimensional (3D), hydrodynamic modeling tools have been developed for the entire estuary and the portion of the river beginning at Lock and Dam #1 (L&D1) (Tetra Tech, 2001; Bowen et al., 2009).

The modeling results indicate that point-source discharges have little impact on DO levels, and that even significant reductions in background (both natural and nonpoint source) loads would not result in attainment of the current standard at all times. DENR has also agreed with representatives of the LCFRP that a more thorough understanding of natural and anthropogenic sources of oxygen deficit is needed.

This technical memorandum (TM) presents an analysis of water quality parameters at the points representative of inflows to the system, with the purpose of examining issues related to a supplemental DENR "Swamp" classification for the estuary. This TM examines data related to key parameters, including nutrients, pH, and DO, that are related to the occurrence of low DO in the Cape Fear River.

## 1.1 DATA SOURCES AND PROCESSING

The LCFRP has conducted monitoring in coordination with DENR since 1995, and a considerable amount of data is available prior to that. There has also been extensive data collected by the Middle Cape Fear Basin Association (MCFBA) upstream of L&D1 since mid-1998 and the Upper Cape Fear Basin Association (UCFBA) since about 2000. Data for this evaluation were downloaded from the Cape Fear River Basin Monitoring Coalitions Water Quality Data website (accessible at [http://www.comrp.org/CFP/CFP\\_map.php](http://www.comrp.org/CFP/CFP_map.php)) and the U.S. Environmental Protection Agency's (USEPA's) STOrage and RETrieval (STORET) Data Warehouse (2012 accessible at <http://www.epa.gov/storet/>). The primary stations of interest for this evaluation were:

- B8360000 Cape Fear River at NC 11 near East Arcadia (downstream of L&D1)
- B9670000 Northeast (NE) Cape Fear River near Wrightsboro
- B9000000 Black River at NC 210 at Still Bluff
- B9050000 Cape Fear River at Navassa

These stations (shown in Figure 1) represent the water quality conditions at the main inflows to the system: the Middle Cape Fear River, the Black River, and the NE Cape Fear River, and coincide with the boundary conditions of the 3D hydrodynamic model developed for the system. The station at L&D1 represents water quality in the Cape Fear River as water leaves the Sandhills and enters the coastal area. The NE Cape Fear and Black River stations measure water quality as water leaves areas currently classified as swamps. The Cape Fear monitoring station at Navassa is included in the analysis, as it reflects the changes in water quality as a result of the confluence of the middle Cape Fear River and Black River. While data is available at a number of other stations, such as B980000 (Cape Fear River at Channel Marker 61), they were not used for this analysis. The data would also capture the changes as a result of the inflow of the NE Cape Fear River, but would also more directly reflect the influence of tidal flows.

**Figure 1. Location of Stations used for Evaluation of Boundary Conditions**

The data were downloaded from the Cape Fear River Basin Monitoring Coalition's Water Quality Data and USEPA's STORET websites in February 2014. Data downloaded included all data available for these sites at that time. Parameters evaluated for this analysis include DO, nitrate-nitrite (NO<sub>2</sub>-NO<sub>3</sub>), total Kjeldahl nitrogen (TKN), pH, total phosphorus (TP), and ammonia (NH<sub>3</sub>). Data were processed to identify measurements collected during the summer period (April through October) to focus on critical DO periods. The dataset was also processed to only evaluate surface grab samples. Depth-stratified monitoring showed little vertical stratification, and inclusion of all data would have skewed results toward deeper locations with more samples per event. Finally, data were averaged on a monthly basis to simplify the comparison and reduce the effects of any outliers.

## 1.2 RESULTS

The water quality monitoring data was evaluated using basic statistics, as well as time series plots. The statistics provide a long-term evaluation of water quality; whereas, the time series plots allow for identification of key periods and the relative difference in water quality between stations in more detail. Table 1 provides a summary of the basic monthly summer (April through October) statistics for the stations of interest.

Review of the data shows distinct differences in water quality between the Cape Fear River at L&D1 and the major tributaries, the Black River, and NE Cape Fear River. The average summer (April through October) monthly DO level at L&D1 is greater than 7 mg/L; whereas, as the DO levels in the Black River are nearly 2 mg/L lower at 5.19 mg/L and more than 2 mg/L less in the NE Cape Fear River at 4.96 mg/L. This primarily reflects the low DO found in these swamp areas but it is important to note that the DO below L&D 1 maybe somewhat influenced by reaeration from the dam.

The influence of the Black River and the NE Cape Fear River on the Cape Fear River mainstem can also be seen in the summer (April through October) monthly average NO<sub>2</sub>-NO<sub>3</sub> and TP values. Concentrations of both of these constituents are higher at L&D1 when compared to the other stations. The addition of the flows from the tributaries significantly reduces the concentrations, as is seen at Navassa.

A number of time series plots were generated to assess changes in these constituents over time and to also provide a method to compare stations in a more detailed fashion. The plots for each constituent and a brief discussion is provided in Figures 2 through 7.

The DO time series (Figure 2) shows that summer (April through October) DO levels at L&D1 are greater than 5 mg/L the majority of the time. Only one event fell below 4 mg/L, which corresponded to Hurricane Fran. Summer (April through October) DO levels in the NE Cape Fear River are significantly lower at all times. The lowest observed DO in the NE Cape Fear River coincides with Hurricane Fran in 1996, Hurricane Bonnie in 1998, and Hurricane Floyd in 1999. While DO levels at L&D1 show some decrease during these events, a more significant effect is seen at the tributary stations and at Navassa. In general, the NE Cape Fear River shows the lowest DO levels, with levels at Navassa being second lowest. This suggests that inflow from the NE Cape Fear River and the swamps it drains has a significant impact on DO levels in the Cape Fear River mainstem. DO in the Black River tends to be more moderate, typically being less than concentrations at L&D1 but not as low as in the NE Cape Fear River. Inflow from the Black River is likely to have an impact but of a lesser magnitude. DO does not appear to show a negative or positive trend if the excursions related to hurricanes in the late 1990s are excluded.

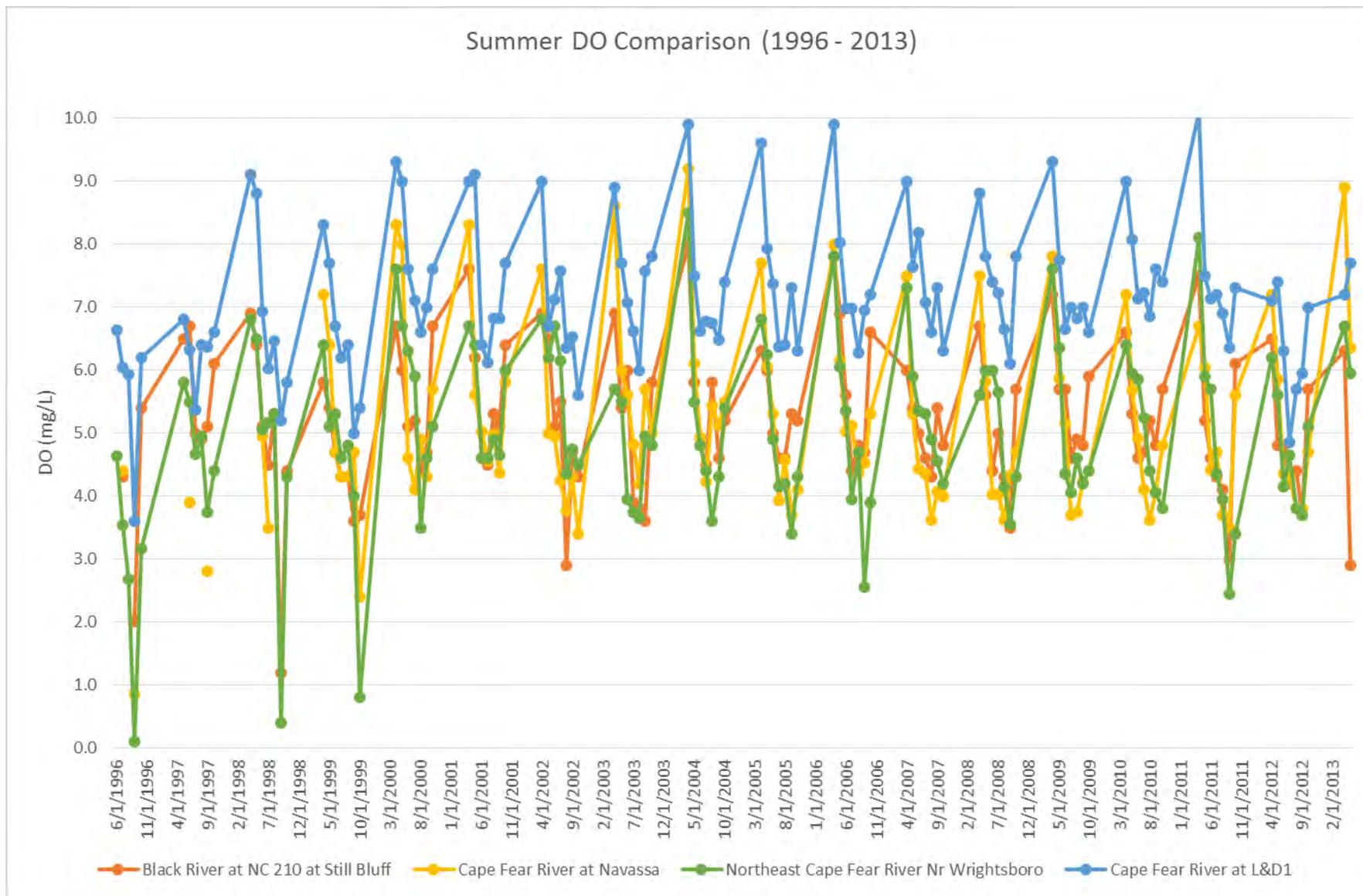
Summer (April through October) nitrate-nitrite levels (Figure 3) are the highest at L&D1, receiving nitrate loading from upstream sources and atmospheric deposition. Nitrate is readily utilized in anoxic systems, such as swamps, as an oxygen source and can often fall below 0.1 mg/L. This is reflected in the low values seen in the Black River and the NE Cape Fear River. The levels at Navassa reflect the inflow from these low nitrate areas, with levels in the Cape Fear River dropping from those seen at L&D1. Nitrate-nitrite concentrations appear to show a slight positive trend in recent years at L&D1 and Navassa.

**Table 1. Summary of Monthly Water Quality Statistics for Summer Periods (April through October)**

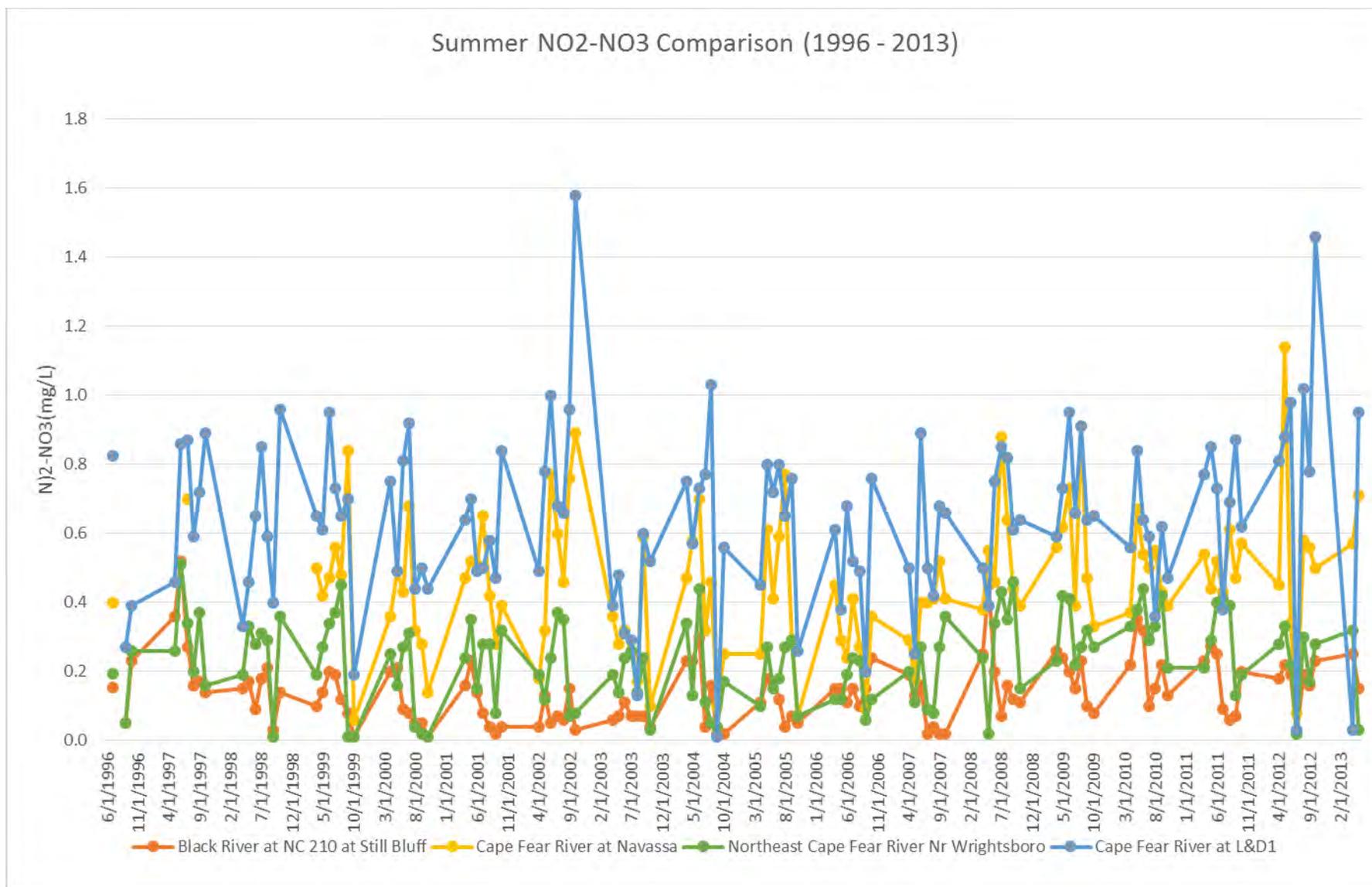
	Cape Fear River at L&D1	Black River at NC 210 at Still Bluff	Cape Fear River at Navassa	NE Cape Fear River near Wrightsboro
<b>DO</b>				
Minimum (mg/L)	3.60	1.20	0.85	0.10
Maximum (mg/L)	10.10	8.00	9.20	8.50
Average (mg/L)	7.14	5.19	5.10	4.96
<b>NO<sub>2</sub>+NO<sub>3</sub>-N</b>				
Minimum (mg/L)	0.01	0.01	0.00	0.01
Maximum (mg/L)	1.58	0.52	1.14	0.51
Average (mg/L)	0.64	0.14	0.42	0.23
<b>TKN-N</b>				
Minimum (mg/L)	0.10	0.20	0.10	0.10
Maximum (mg/L)	2.00	2.00	1.50	2.10
Average (mg/L)	0.69	0.81	0.72	0.78
<b>pH</b>				
Minimum (mg/L)	5.30	4.80	5.60	5.00
Maximum (mg/L)	7.35	7.80	7.90	7.30
Average (mg/L)	6.61	6.13	6.87	6.63
<b>TP</b>				
Minimum (mg/L)	0.08	0.04	0.04	0.05
Maximum (mg/L)	0.61	0.36	0.31	0.36
Average (mg/L)	0.18	0.10	0.14	0.12
<b>NH<sub>3</sub>-N</b>				
Minimum (mg/L)	0.01	0.01	0.01	0.01
Maximum (mg/L)	0.22	0.20	0.20	0.30
Average (mg/L)	0.07	0.05	0.07	0.05

Note:

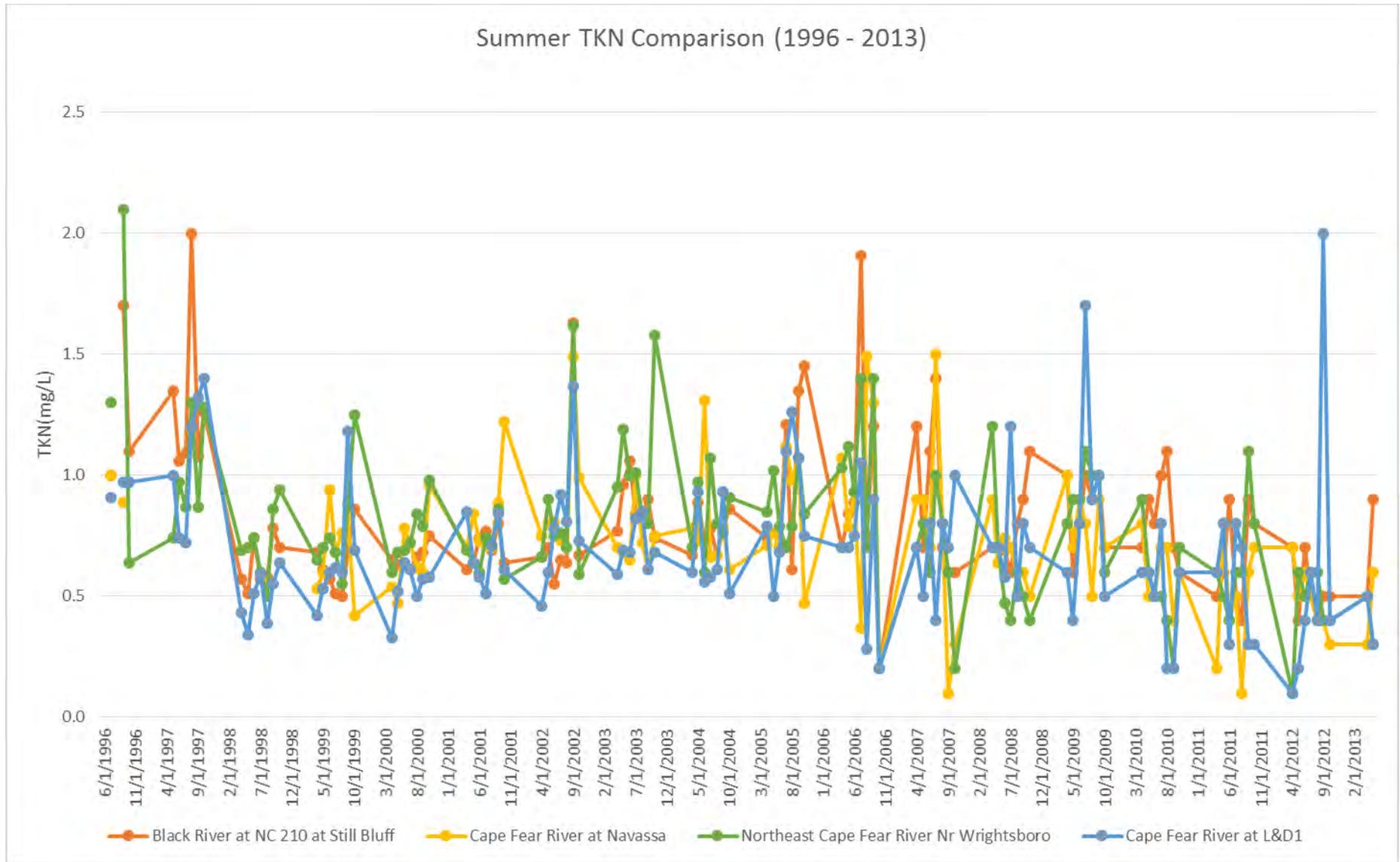
mg/L - milligram per liter



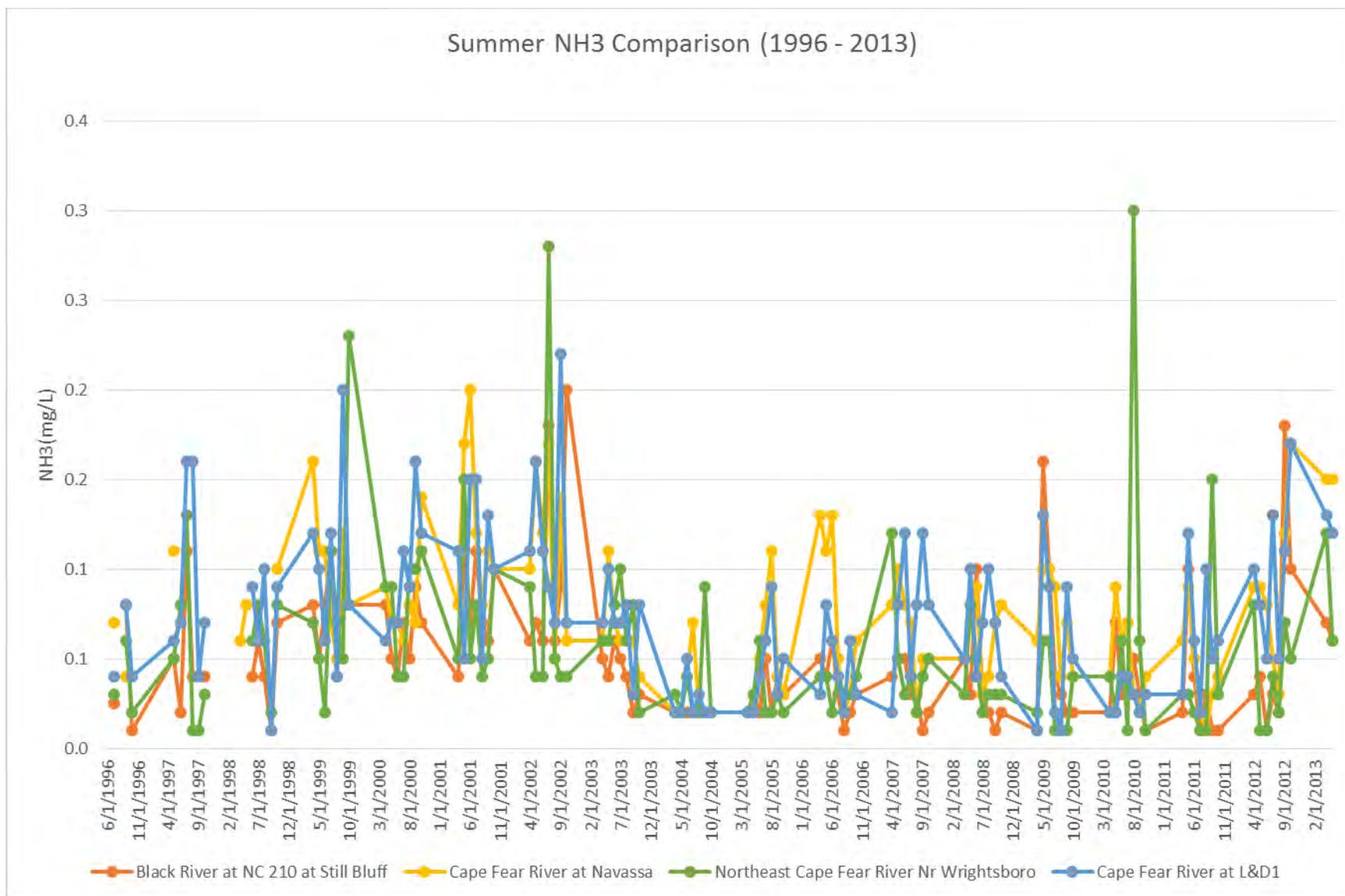
**Figure 2. Dissolved Oxygen in the LCFRE (April through October Data Only)**



**Figure 3. Nitrate-Nitrite in the LCFRE (April through October Data Only)**



**Figure 4. Total Kjeldahl Nitrogen in the LCFRE (April through October Data Only)**



**Figure 5. Ammonia in the LCFRE (April through October Data Only)**

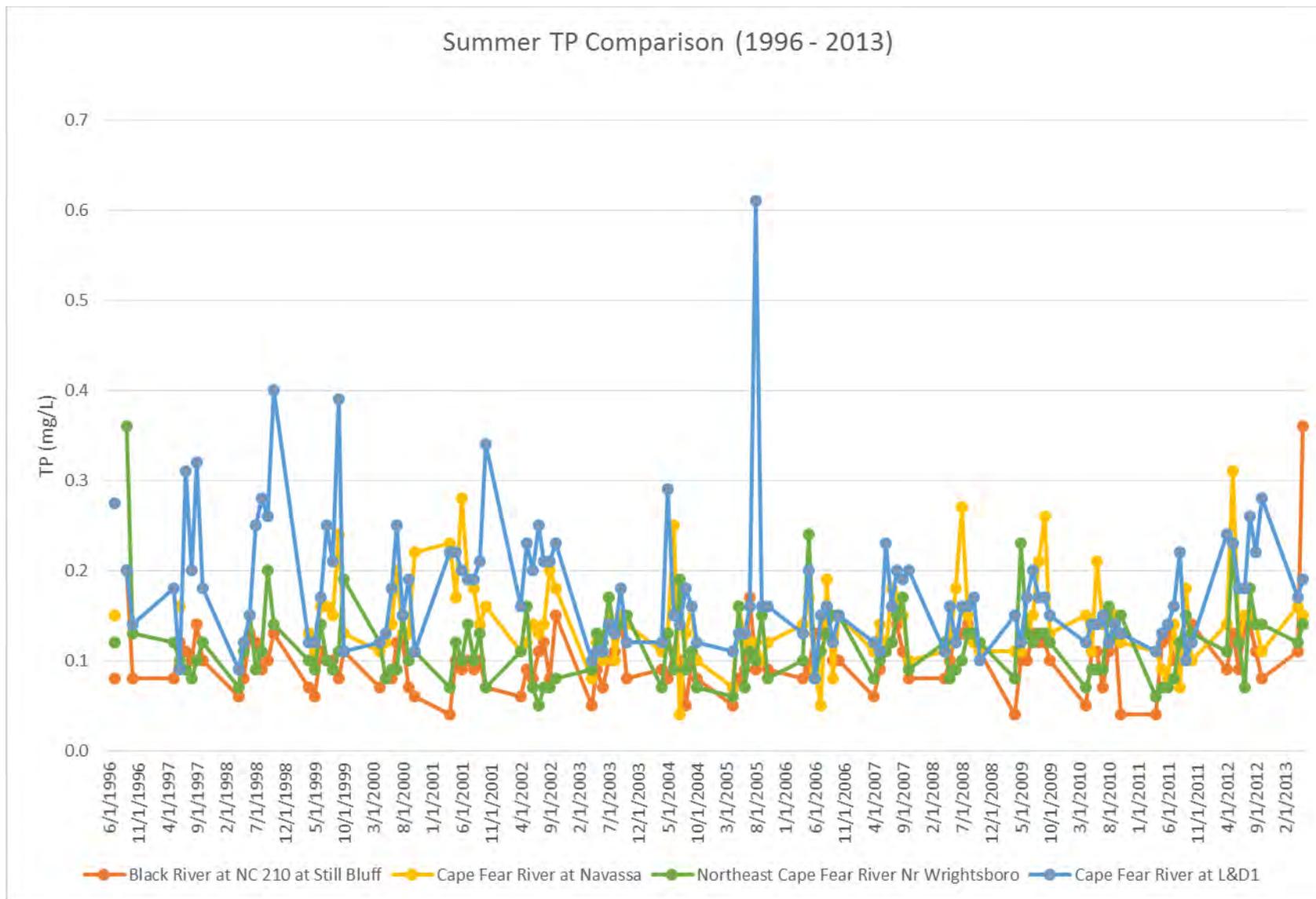
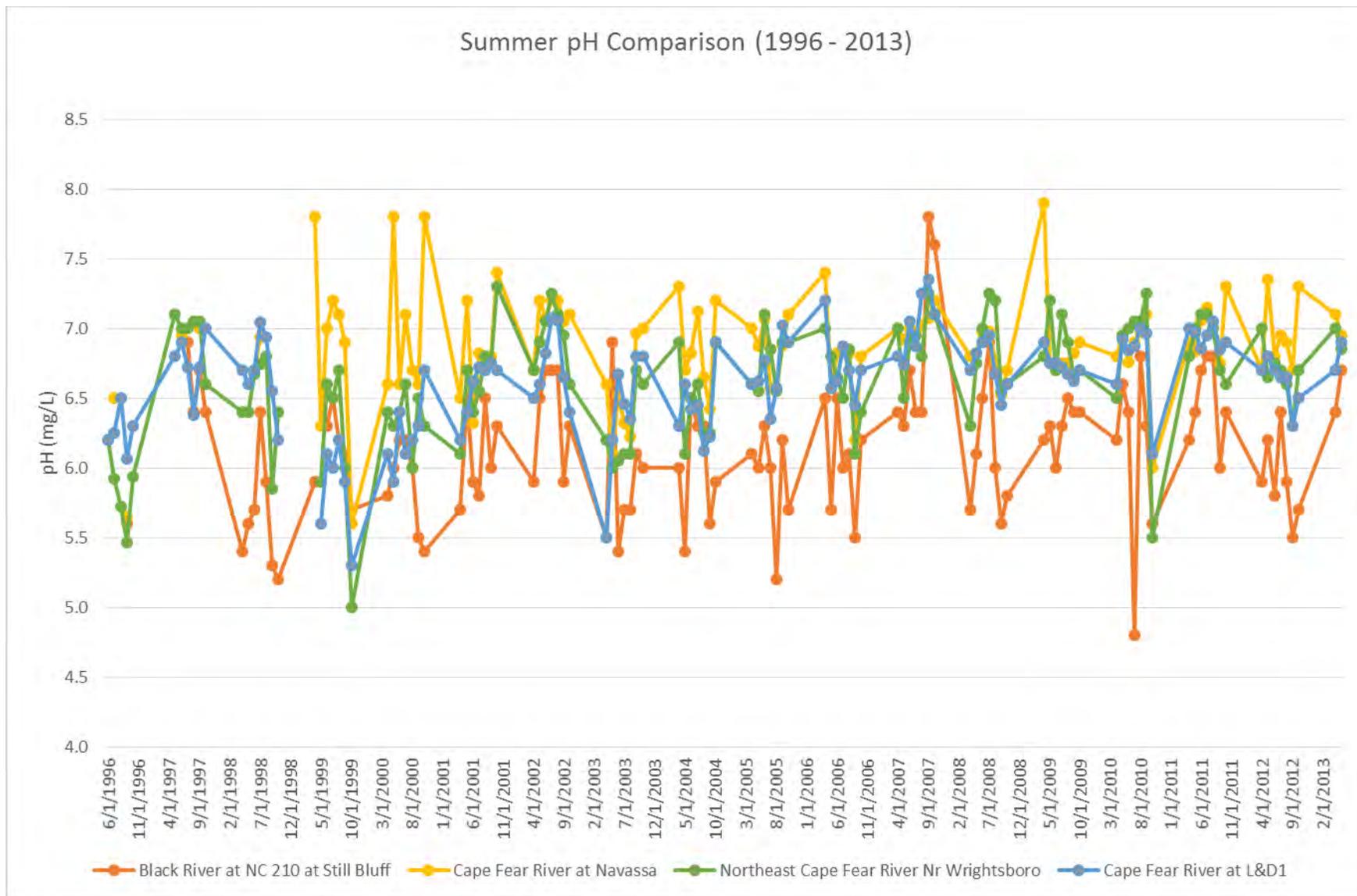


Figure 6. Total Phosphorus in the LCFRE (April through October Data Only)



**Figure 7. pH in the LCFRE (April through October Data Only)**

The highest levels of summer (April through October) TKN (Figure 4) are typically seen in the Black River and reflect the organic load generated by the high biological productivity of the adjacent marsh areas. Levels at L&D1 are consistently the lowest, although a few high values do occur at this station. TKN levels appear to be trending lower in recent years.

Summer (April through October) ammonia levels (Figure 5) at all stations were relatively similar and typically less than 0.1 mg/L. Ammonia is readily utilized for primary production, so ammonia loads are quickly transformed into organic matter. Ammonia levels appear to have dropped since 2002, with a slight increase in 2012.

Summer (April through October) phosphorus levels (Figure 6) at all stations were relatively similar and typically less than 0.2 mg/L. Phosphorus is utilized for primary production but is not the limiting nutrient in estuarine systems. Phosphorus levels in the Cape Fear River appear to have dropped since 2002, with a slight increase in 2012.

The summer (April through October) pH levels (Figure 7) at the boundary stations show an interesting pattern. The lowest levels are consistently seen in the Black River with levels often less than 6 standard units. This is typical for swamp areas where decomposition of organic matter results in the occurrence of high levels of humic acids. Levels in the NE Cape Fear River are higher than in the Black River, suggesting that the vegetation and substrate is different between the two drainages. The highest levels are at Navassa. The pH at L&D1 and NE Cape Fear are fairly similar, with the L&D1 values being approximately 0.5 standard units higher. The Cape Fear River is listed for pH impairment. A review of Figure 7 shows that the low pH excursions may be naturally occurring. Levels in the Black River are typically less than 6.5 standard pH units, and frequently fall below 6.0 standard units. A coinciding drop of pH at Navassa is seen during these periods, supporting the conclusion that low pH in the Cape Fear is driven by an influx of low pH waters from adjacent swamp areas.

## 2 Conclusions

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The evaluation of water quality data at the boundary conditions supports the concept that inflows from the swamp areas have a significant impact on water quality in the Cape Fear River. The levels of nutrients, DO, and pH are consistently different between the station at L&D1, and in the Black River and the NE Cape Fear River. A distinct response from these inflows can be seen in the levels at Navassa for these parameters, supporting the idea that water quality in the Cape Fear River is dominated by the conditions found in the swamp areas below L&D1.

## 3 Works Cited

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# **Technical Memo: The Relationship of Adjacent Wetlands and Salt Marsh to Dissolved Oxygen in the Lower Cape Fear River Estuary**

Prepared for

## **The Lower Cape Fear River Program**

Prepared by



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# 1 Introduction

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The Lower Cape Fear River Program (LCFRP) is a large-scale water quality and environmental assessment program covering the Cape Fear River Estuary and a large portion of the lower Cape Fear River watershed. The LCFRP represents a collaboration of academia, government, industry, and the public, which has been coordinating with the North Carolina Department of Environment and Natural Resources (DENR) since 1995. The purpose of this memo is to summarize previous water quality modeling performed to analyze the impact that adjacent wetlands and salt marsh areas in the Lower Cape Fear River Estuary (LCFRE) portion of the basin have on dissolved oxygen (DO) concentrations in that region. The memo was prepared as part of a joint LCFRP-DENR effort to summarize the existing body of technical evidence for submission to the North Carolina Environmental Management Commission (EMC) requesting reclassification of portions of the LCFRE into a supplemental “Swamp” designation—a designation which had been applied to the LCFRE from the late 1950’s until the early 1980’s.

Contents of the memo focus on two relatively extensive modeling studies. The first was completed in 2001 by Tetra Tech on behalf of the City of Wilmington and New Hanover County, prior to the formation of the Cape Fear Public Utility Authority (CFPUA). In that study, the physical link between wetlands, salt marshes, the main channel, water movement, and contributions to dissolved oxygen (DO) deficit was established (Tetra Tech, 2001). Follow up work by the University of North Carolina – Charlotte on behalf of NC DENR both confirmed and expanded on the link (Bowen, et. Al., 2009). The results of these modeling studies are summarized here to provide a significant part of the technical basis for reclassifying the portions of the LCFR with the supplemental “Swamp” designation.

## 2 Preliminary Modeling Effort (2001)

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In the period between 2000 and 2001, efforts were made on behalf of the City of Wilmington and New Hanover County to develop an initial application of a three-dimensional hydrodynamic model (the Environmental Fluid Dynamics Code, or EFDC, model) with the intention of meeting several objectives deemed important at the time (Tetra Tech, 2001):

- Simulation of the mixing and transport of the existing and proposed future Wilmington Northside and Wilmington Southside wastewater treatment plant effluents.
- Simulation of the impact of existing and proposed future Northside and Southside facility pollutant loads for oxygen-demanding substances.
- Evaluation of multiple sources and cumulative loads of oxygen-demanding substances to the lower Cape Fear River estuary.
- Analysis of the various processes affecting dissolved oxygen and their relative contribution to ambient dissolved oxygen deficit levels.

EFDC was selected because it is versatile, peer reviewed, accepted and endorsed by the USEPA, available in the public domain, and could be used for 1, 2, or 3-dimensional (3-D) simulation of rivers, lakes, estuaries, coastal regions and wetlands. The 2001 model development was considered a scoping level effort with an end goal of providing model results to guide further, more expansive model development supporting long term water quality management of the LCFRE. Specifically, an important question at the time was whether a 3-D model or 2-D model would be needed for the anticipated Total Maximum Daily Load (TMDL) development planned for the estuary because of its inclusion on the State’s 303(d) list of impaired waters for low dissolved oxygen in 1998 with low pH added in 2006.

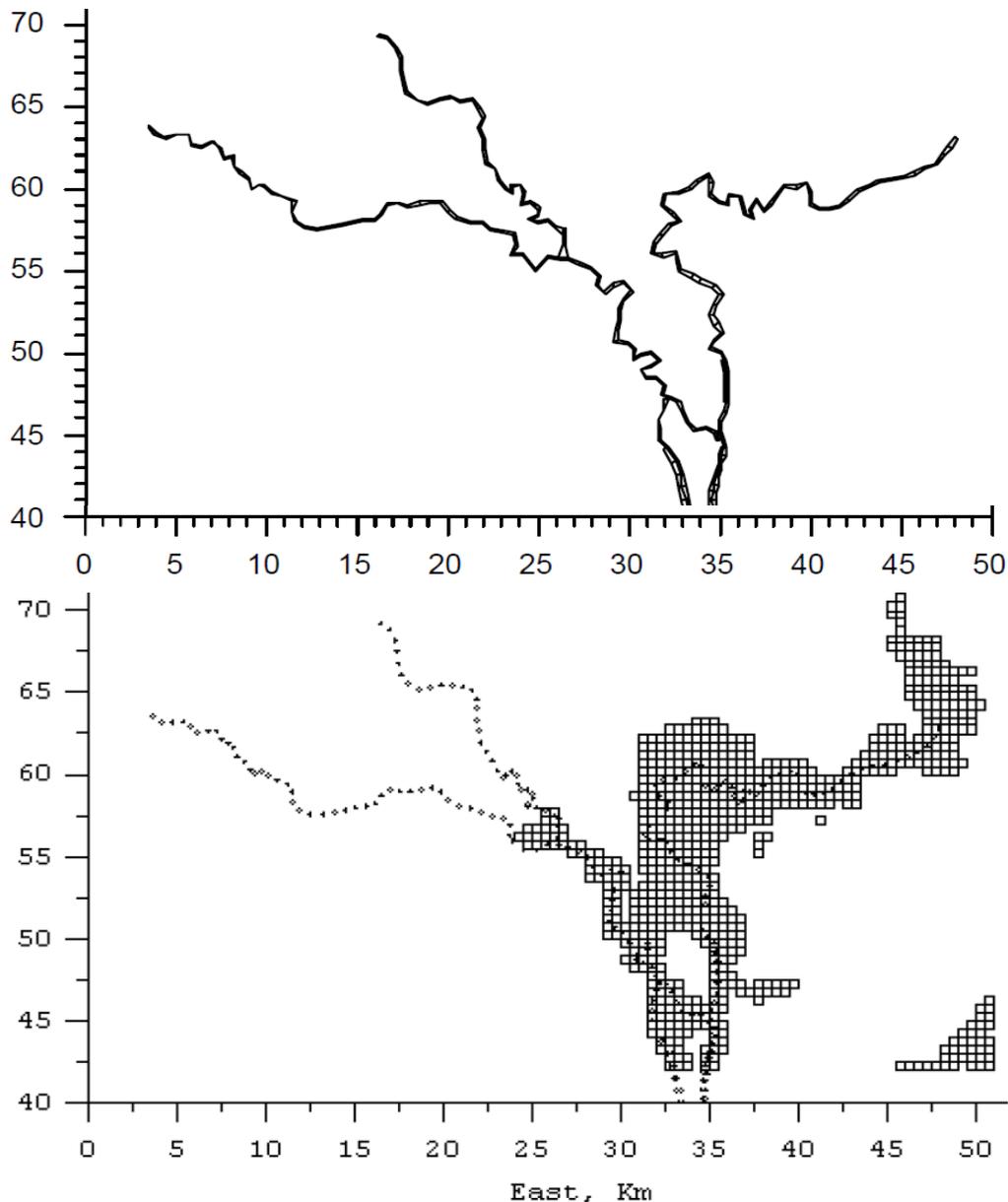
## 2.1.1 Preliminary Model Approach

A vast amount of data characterizing the LCFRE system available from numerous agencies and organizations was drawn upon to set up, calibrate, and validate the initial 3-D EFDC model. An overview of the data used in the preliminary model setup and calibration listed by sources and associated types is provided below:

- National Oceanic and Atmospheric Administration – digital bathymetry, land surface elevations, and tide data.
- US EPA– Reach File 1.0 cross-sectional data; Reach File 3.0 river shoreline data.
- National Weather Service – atmospheric data including observations of wind speed, wind direction, barometric pressure, air temperature, rainfall and cloud cover.
- US Army Corps of Engineers – electronic navigational survey data; water level, current, temperature, and salinity data collected during extensive 3 month intensive survey in 1993.
- US Geological Survey – daily river flow data; dye dispersion study.
- LCFRP – ambient water quality data.
- NC DENR – ambient water quality data; NPDES discharge data; Long-term BOD analyses; Sediment Oxygen Demand (SOD) in-situ measurements.

Additionally, two extensive dye studies were conducted in December 1999 (Tetra Tech, 2001). Approximately 1,300 samples were collected for dye, salinity, and temperature throughout the estuary during the two studies. A fixed station was also monitored for water level, salinity, and temperature at 15-minute intervals for 10 days. In addition to providing data to support calibration of the hydrodynamic portion of the model, the dye studies provided a basis for examining near field mixing and far field transport of the existing effluents. During these initial field studies, movement of water into adjacent wetlands and salt marshes during flood portions of the tide, and drainage of these areas during the ebb portion of tides, was observed.

In the course of the subsequent EFDC model calibration, the previously set up model grid was enhanced through the addition of several areas of swamp grid cells to better represent the wetting and drying of floodplain wetlands and their effect on in-stream dissolved oxygen levels (Figure 1). Out of the revised total of 950 cells, 146 (~15%) were “marsh” cells with the remaining 804 modeled as “channel” cells. To evaluate the sensitivity of the model to the presence of the swamp areas, the model was run without the additional grid cells. Although there were not specific model calibration points in swamp only areas, the main model calibration points showed substantial improvement of model performance with the added representation of the marsh cells.

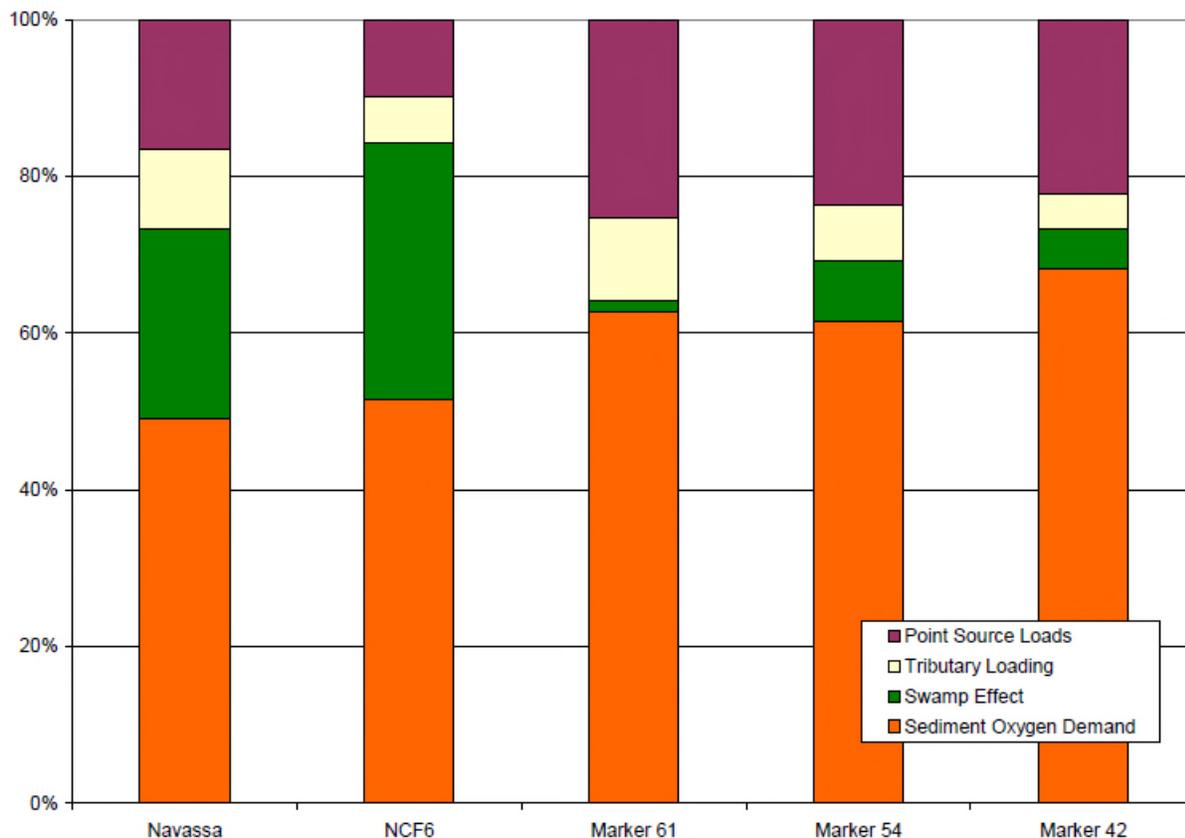


**Figure 1. Upper Section of 2001 EFDC Model Grid Without, and With, Swamp Areas Delineated on the Basis of Elevation from the NOAA Coastal Relief Database**

### 2.1.2 Preliminary Model Results

Results of multiple sensitivity analyses performed with the 2001 EFDC model for the LCFRE provided for a type of DO deficit component analysis. Results for July 19, 1998 were graphed in the study, and are shown below in Figure 2. July 19, 1998 was selected because it represented the day of lowest predicted DO for the baseline analysis prior to the effect of Hurricane Bonnie (i.e., a summer critical condition day). Each bar graph displays the model-predicted relative effect of each source of oxygen demand at five separate stations in the LCFRE for the simulated day of July 19. The bar graphs for the Navassa and Northeast Cape Fear River mouth stations (where observed DO concentrations are often the lowest during summer critical periods) show that SOD and swamp oxygen demand are predicted to account for between 73 and 84 percent of the total oxygen demand at those stations. SOD and swamp oxygen demand also comprised the majority of the total oxygen demands at other stations showing the importance of these

sources. Overall, the combined effect of SOD and swamp oxygen demand was predicted to be between 3 and 4 times greater than the combined impact of loading from point source and tributary BOD loads during a summer critical condition day. This was one of the first demonstrations that the low DO occurring in the LCFRE was driven by exchange with the bottom sediment and naturally occurring low DO from adjacent marsh/swamp lands and not from loads from point source discharges and major tributaries including the mainstem above Lock and Dam No. 1.



**Figure 2. Predicted Relative Impact of Sources of Oxygen Demand in the Estuary (July 19, 1998)**

Although the 2001 EFDC modeling demonstrated that a significant portion of the DO deficit near Navassa and down through Channel Marker 61 could be attributed to the combined effects of instream SOD and the oxygen demand from adjacent decaying marsh and swamp vegetation, it was acknowledged that uncertainty remained regarding the precise allocation to the two different oxygen demanding sources because of limited field data on each. The 2001 study recommended that additional study be performed on the LCFRE system to help delineate marsh impacts from instream SOD, which could help further refine the modeling assumptions for these parameters.

### 3 Subsequent Modeling Effort (2009)

To support the State’s regulatory program for dissolved oxygen management in the LCFRE, a detailed monitoring and modeling program was conducted in the mid-2000s culminating with an updated EFDC modeling study (Bowen, et. al., 2009). As with the 2001 modeling effort, existing pertinent data were gathered to support model development, calibration, and validation. Two recommendations from the

earlier 2001 modeling effort—that additional information be gathered on the bathymetry within the estuary, and that additional work be done to quantify the effect of the riparian wetlands within the estuary—were undertaken during the updated hydrodynamic model calibration.

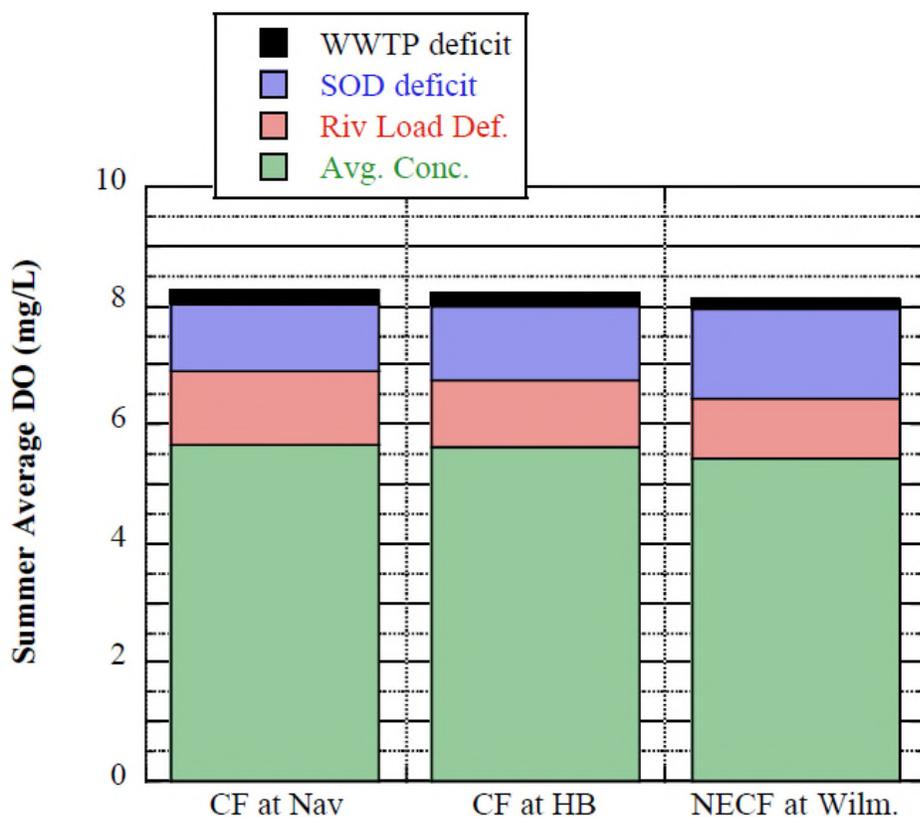
Twenty-one river cross-sections were surveyed by NC DENR and the additional bathymetric information was incorporated into the updated specification of the model grid. Additional grid work was also performed to specify the location and size of “wetland” cells that adjoin the main river channel. The overall strategy in determining wetland surface area was to use the information on the attenuation of the tidal amplitude to determine the distribution and overall area of the fringing marshes while considering the wetland delineations performed by the NC Division of Coastal Management in 1999. As a result, the 2009 EFDC model included 100 additional model grid cells, of which 95 were “marsh” cells (Figure 3). This modification brought the number of marsh cells up to 241, approximately 23 percent of the model’s total cell count of 1050 (up from 15 percent of 2001 model’s total cell count).



Figure 3. 2009 EFDC Model Grid Showing Location and Size of Marsh Cells; (map image extracted from Bowen, et al., 2009)

Results from the 2009 modeling effort showing average DO concentrations and deficit sources predicted for the model summer period (April through October) are displayed in Figure 4. Unlike the 2001 effort, the swamp and tributary loading predictions were lumped into one category, “Riv Load Def.” as labeled in Figure 4. The 2009 modeling results, similar to the 2001 results, show that the portion of the DO deficit attributed to SOD and river loadings of organic matter is significantly greater than that attributed to point source loads (i.e., Waste Water Treatment Plant, or WWTP, effluent). Additionally, while the 2001 model considered wetlands to be a sink of DO but did not model these areas as sources of organic matter (OM) loadings, the 2009 model considered tidal creeks and wetlands as both sinks of DO and a source of OM and freshwater back to the channel cells. Note that since the 2009 results are for average summer conditions; we would expect the contributions at critical low flow conditions within the summer to show even more dominance by wetlands since the filling and draining of adjacent marshland would continue due to tidal cycle while the amount of tributary loading would decrease with freshwater flow decreases during the critical period.

Although the 2009 model results combine riverine and wetland loads, the updated model configuration physically links even more area to wetland and salt marsh sources than the 2001 model (23 percent as opposed to 15 percent previously). Since the 2001 model results already showed greater impact on DO deficit from wetlands than riverine loadings at key locations such as Navassa and the mouth of the Northeast Cape Fear River (refer back to Figure 2), one might reasonably infer that with even greater physical attribution to wetlands and salt marsh in the 2009 model that the swamp impact is greater than the river load regarding deficit in the LCFRE hot spots. Additionally, the 2009 modeling confirmed that DO deficit associated with the total point source load in the LCFRE (noted by “WWTP deficit” in Figure 4) is less than 10 percent of the total DO deficit.



**Figure 4. Summer Season (Apr-Oct) Time-Averaged Model Predicted DO Concentrations (image from Bowen, et al., 2009)**

Additional scenario testing performed by Bowen et. al. (2009) simulated conditions in the LCFRE with up to 70 percent of the riverine (nonpoint source) oxygen demanding load being removed. The results indicated that even with such a large nonpoint source load reduction, DO concentrations are predicted to be less than the current water quality standard of 5 mg/L roughly 20 percent of the time during summer conditions. The 2009 modeling study therefore added further weight of evidence that other local, naturally occurring sources of oxygen demand (i.e., marshland and SOD) are driving low DO during the summer period.

## 4 Summary

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At the time of the initial 1998 303(d) listing of the LCFRE as impaired due to low dissolved oxygen, NC DENR used a DO standard of 5 mg/L to make its assessment and the reason for impairment was thought to be a combination of point source discharge and nonpoint source pollutant loadings. The setup, calibration, validation, and independent application of two EFDC hydrodynamic water quality models for the LCFRE (Tetra Tech, 2001, and Bowen et.al., 2009) provide a strong scientific basis for isolating primary influences on DO concentrations in the LCFRE. Both modeling efforts demonstrated that the impact from point source loads in the LCFRE contributes to less than 10 percent of the DO deficit in the LCFRE. The 2001 modeling effort demonstrated that an accurate calibration could not be achieved without representing the wetting and drying of adjacent low elevation wetland and salt marsh areas. That modeling estimated that wetland/marsh and SOD sources accounted for between three quarters and four fifths of all oxygen demand in the LCFRE. The 2009 modeling effort validated and expanded the influence of adjacent marshland based on more detailed analysis. Further, application of the 2009 model that simulated up to 70 percent of nonpoint source load reduction demonstrated that even with such large pollutant loading reductions, DO concentrations would be expected to be below 5 mg/L 20 percent of the time in the LCFRE during the summer. Therefore, the 2001 and 2009 modeling analyses provide further weight of evidence collectively that other local, naturally occurring sources of oxygen demand (i.e., marshland and SOD) are driving low DO during the summer period and suggest that reinstatement of the supplemental “Swamp” designation for the LCFRE should be considered by NC DENR and the Environmental Management Commission.

## References

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- Bowen, J.D., S. Negusse, J.M. Goodman, B. Duclaud, M. Robin, and J. Williams. 2009. Development And Use Of A Three-Dimensional Water Quality Model To Predict Dissolved Oxygen Concentrations In The Lower Cape Fear River Estuary, North Carolina. Department of Civil and Environmental Engineering, University of North Carolina at Charlotte. Prepared for NCDENR.
- Tetra Tech. 2001. 3-Dimensional EFDC Water Quality Model of the Lower Cape Fear River and its Estuary. Prepared for the City of Wilmington and New Hanover County, North Carolina. May, 2001.

**15A NCAC 02B .0220 TIDAL SALT WATER QUALITY STANDARDS FOR CLASS SC WATERS**

General. The water quality standards for all tidal salt waters shall be the basic standards applicable to Class SC waters. Additional and more stringent standards applicable to other specific tidal salt water classifications are specified in Rules .0221 and .0222 of this Section. Action Levels, for purposes of National Pollutant Discharge Elimination System (NPDES) permitting, are specified in Item (20) of this Rule.

- (1) Best Usage of Waters: any usage except primary recreation or shellfishing for market purposes; usages include aquatic life propagation and maintenance of biological integrity (including fishing, fish and functioning Primary Nursery Areas (PNAs)), wildlife, and secondary recreation;
- (2) Conditions Related to Best Usage: the waters shall be suitable for aquatic life propagation and maintenance of biological integrity, wildlife, and secondary recreation. Any source of water pollution that precludes any of these uses, including their functioning as PNAs, on either a short-term or a long-term basis shall be considered to be violating a water quality standard;
- (3) Chlorophyll a (corrected): not greater than 40 ug/l in sounds, estuaries, and other waters subject to growths of macroscopic or microscopic vegetation. The Commission or its designee may prohibit or limit any discharge of waste into surface waters if, in the opinion of the Director, the surface waters experience or the discharge would result in growths of microscopic or macroscopic vegetation such that the standards established pursuant to this Rule would be violated or the intended best usage of the waters would be impaired;
- (4) Cyanide: 1 ug/l;
- (5) Dissolved oxygen: not less than 5.0 mg/l, except that swamp waters, poorly flushed tidally influenced streams or embayments, or estuarine bottom waters may have lower values if caused by natural conditions;
- (6) Enterococcus, including *Enterococcus faecalis*, *Enterococcus faecium*, *Enterococcus avium* and *Enterococcus gallinarum*: not to exceed a geometric mean of 35 enterococci per 100 ml based upon a minimum of five samples within any consecutive 30 days. For purposes of beach monitoring and notification, "Coastal Recreational Waters Monitoring, Evaluation and Notification" regulations (15A NCAC 18A .3400), available free of charge at: <http://www.ncoah.com/>, are hereby incorporated by reference including any subsequent amendments;
- (7) Floating solids, settleable solids, or sludge deposits: only such amounts attributable to sewage, industrial wastes, or other wastes, as shall not make the waters unsafe or unsuitable for aquatic life and wildlife, or impair the waters for any designated uses;
- (8) Gases, total dissolved: not greater than 110 percent of saturation;
- (9) Metals:
  - (a) With the exception of mercury and selenium, tidal salt water quality standards for metals shall be based upon measurement of the dissolved fraction of the metals. Mercury and selenium shall be based upon measurement of the total recoverable metal;
  - (b) Compliance with acute instream metals standards shall only be evaluated using an average of two or more samples collected within one hour. Compliance with chronic instream metals standards shall only be evaluated using averages of a minimum of four samples taken on consecutive days, or as a 96-hour average;
  - (c) Metals criteria shall be used for proactive environmental management. An instream exceedence of the numeric criterion for metals shall not be considered to have caused an adverse impact to the aquatic community without biological confirmation and a comparison of all available monitoring data and applicable water quality standards. This weight of evidence evaluation shall take into account data quality and the overall confidence in how representative the sampling is of conditions in the waterbody segment before an assessment of aquatic life use attainment, or non-attainment, is made by the Division. Recognizing the synergistic and antagonistic complexities of other water quality variables on the actual toxicity of metals, with the exception of mercury and selenium, biological monitoring shall be used to validate, by direct measurement, whether or not the aquatic life use is supported.
  - (d) Acute and chronic tidal salt water quality metals standards are as follows:
    - (i) Arsenic, acute: WER· 69 ug/l;
    - (ii) Arsenic, chronic: WER· 36 ug/l;
    - (iii) Cadmium, acute: WER· 40 ug/l;

- (iv) Cadmium, chronic: WER· 8.8 ug/l;
- (v) Chromium VI, acute: WER· 1100 ug/l;
- (vi) Chromium VI, chronic: WER· 50 ug/l;
- (vii) Copper, acute: WER· 4.8 ug/l;
- (viii) Copper, chronic: WER· 3.1 ug/l;
- (ix) Lead, acute: WER· 210 ug/l;
- (x) Lead, chronic: WER· 8.1 ug/l;
- (xi) Mercury, total recoverable, chronic: 0.025 ug/l;
- (xii) Nickel, acute: WER· 74 ug/l;
- (xiii) Nickel, chronic: WER· 8.2 ug/l;
- (xiv) Selenium, total recoverable, chronic: 71 ug/l;
- (xv) Silver, acute: WER· 1.9 ug/l;
- (xvi) Silver, chronic: WER· 0.1 ug/l;
- (xvii) Zinc, acute: WER· 90 ug/l; and
- (xviii) Zinc, chronic: WER· 81 ug/l;

With the exception of mercury and selenium, acute and chronic tidal saltwater quality aquatic life standards for metals listed above apply to the dissolved form of the metal and apply as a function of the pollutant's water effect ratio (WER). A WER expresses the difference between the measures of the toxicity of a substance in laboratory waters and the toxicity in site water. The WER shall be assigned a value equal to one unless any person demonstrates to the Division's satisfaction in a permit proceeding that another value is developed in accordance with the "Water Quality Standards Handbook: Second Edition" published by the US Environmental Protection Agency (EPA-823-B-12-002), free of charge, at <http://water.epa.gov/scitech/swguidance/standards/handbook/>, hereby incorporated by reference including any subsequent amendments. Alternative site-specific standards may also be developed when any person submits values that demonstrate to the Commissions' satisfaction that they were derived in accordance with the "Water Quality Standards Handbook: Second Edition, Recalculation Procedure or the Resident Species Procedure", hereby incorporated by reference including subsequent amendments at <http://water.epa.gov/scitech/swguidance/standards/handbook/>.

This material is available free of charge;

- (10) Oils, deleterious substances, colored, or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, aquatic life, and wildlife or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses. For the purpose of implementing this Rule, oils, deleterious substances, colored, or other wastes shall include substances that cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines pursuant to 40 CFR 110.3;
- (11) Pesticides:
  - (a) Aldrin: 0.003 ug/l;
  - (b) Chlordane: 0.004 ug/l;
  - (c) DDT: 0.001 ug/l;
  - (d) Demeton: 0.1 ug/l;
  - (e) Dieldrin: 0.002 ug/l;
  - (f) Endosulfan: 0.009 ug/l;
  - (g) Endrin: 0.002 ug/l;
  - (h) Guthion: 0.01 ug/l;
  - (i) Heptachlor: 0.004 ug/l;
  - (j) Lindane: 0.004 ug/l;
  - (k) Methoxychlor: 0.03 ug/l;
  - (l) Mirex: 0.001 ug/l;
  - (m) Parathion: 0.178 ug/l; and
  - (n) Toxaphene: 0.0002 ug/l;
- (12) pH: shall be normal for the waters in the area, which range between 6.8 and 8.5, except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions;
- (13) Phenolic compounds: only such levels as shall not result in fish-flesh tainting or impairment of other best usage;

- (14) Polychlorinated biphenyls: (total of all PCBs and congeners identified) 0.001 ug/l;
- (15) Radioactive substances:
- (a) Combined radium-226 and radium-228: The average annual activity level (based on at least one sample collected per quarter) for combined radium-226, and radium-228 shall not exceed five picoCuries per liter;
  - (b) Alpha Emitters. The average annual gross alpha particle activity (including radium-226, but excluding radon and uranium) shall not exceed 15 picoCuries per liter;
  - (c) Beta Emitters. The average annual activity level (based on at least one sample collected per quarter) for strontium-90 shall not exceed eight picoCuries per liter; nor shall the average annual gross beta particle activity (excluding potassium-40 and other naturally occurring radionuclides exceed 50 picoCuries per liter; nor shall the average annual activity level for tritium exceed 20,000 picoCuries per liter;
- (16) Salinity: changes in salinity due to hydrological modifications shall not result in removal of the functions of a PNA. Projects that are determined by the Director to result in modifications of salinity such that functions of a PNA are impaired shall be required to employ water management practices to mitigate salinity impacts;
- (17) Temperature: shall not be increased above the natural water temperature by more than 0.8 degrees C (1.44 degrees F) during the months of June, July, and August nor more than 2.2 degrees C (3.96 degrees F) during other months and in no cases to exceed 32 degrees C (89.6 degrees F) due to the discharge of heated liquids;
- (18) Trialkyltin compounds: 0.007 ug/l expressed as tributyltin;
- (19) Turbidity: the turbidity in the receiving water shall not exceed 25 Nephelometric Turbidity Units (NTU); if turbidity exceeds this level due to natural background conditions, the existing turbidity level shall not be increased. Compliance with this turbidity standard can be met when land management activities employ Best Management Practices (BMPs) [as defined by Rule .0202 of this Section] recommended by the Designated Nonpoint Source Agency (as defined by Rule .0202 of this Section). BMPs shall be in full compliance with all specifications governing the proper design, installation, operation, and maintenance of such BMPs;
- (20) Action Levels for Toxic Substances Applicable to NPDES Permits:
- (a) Copper, dissolved, chronic: 3.1 ug/l;
  - (b) Silver, dissolved, chronic: 0.1 ug/l;
  - (c) Zinc, dissolved, chronic: 81 ug/l
- If the action levels for any of the substances listed in this Item (which are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility, stream characteristics, or associated waste characteristics) shall be determined by the waste load allocation to be exceeded in a receiving water by a discharge under the 7Q10 flow criterion for toxic substances, the discharger shall monitor the chemical or biological effects of the discharge; efforts shall be made by all dischargers to reduce or eliminate these substances from their effluents. Those substances for which action levels are listed in this Item shall be limited as appropriate in the NPDES permit if sufficient information (to be determined for metals by measurements of that portion of the dissolved instream concentration of the action level parameter attributable to a specific NPDES permitted discharge) exists to indicate that any of those substances may be a causative factor resulting in toxicity of the effluent.

*History Note: Authority G.S. 143-214.1; 143-215.3(a)(1);  
Eff. October 1, 1995;  
Amended Eff. January 1, 2015; May 1, 2007; August 1, 2000.*

**15A NCAC 02B .0227 WATER QUALITY MANAGEMENT PLANS**

(a) In implementing the water quality standards to protect the existing uses [as defined by Rule .0202 of this Section] of the waters of the state or the water quality which supports those uses, the Commission shall develop water quality management plans on a priority basis to attain, maintain or enhance water quality throughout the state. Additional specific actions deemed necessary by the Commission to protect the water quality or the existing uses of the waters of the state shall be specified in Paragraph (b) of this Rule. These actions may include anything within the powers of the Commission. The Commission may also consider local actions which have been taken to protect a waterbody in determining the appropriate protection options to be incorporated into the water quality management plan.

(b) All waters determined by the Commission to be protected by a water quality management plan are listed with specific actions as follows:

The Lockwoods Folly River Area (Lumber River Basin), which includes all waters of the lower Lockwoods Folly River in an area extending north from the Intracoastal Waterway to a line extending from Genoes Point to Mullet Creek, shall be protected by the specific actions described in Subparagraphs (1) through (5) of this Paragraph.

- (1) New development activities within 575' of the mean high water line which require a Sedimentation Erosion Control Plan or a CAMA major development permit must comply with the low density option of the coastal Stormwater Runoff Disposal Rules [as specified in 15A NCAC 2H .1005(2)(a)].
- (2) New or expanded NPDES permits shall be issued only for non-domestic, non-industrial process type discharges (such as non-industrial process cooling or seafood processing discharges). A public hearing is mandatory for any proposed (new or expanded) NPDES permit to this protected area.
- (3) New non-discharge permits shall be required to meet reduced loading rates and increased buffer zones, to be determined on a case-by-case basis.
- (4) New or expanded marinas must be located in upland basin areas.
- (5) No dredge or fill activities shall be allowed where significant shellfish or submerged aquatic vegetation bed resources occur, except for maintenance dredging, such as that required to maintain access to existing channels and facilities located within the protected area or maintenance dredging for activities such as agriculture.

*History Note:* Authority G.S. 143-214.1; 143-215.8A;  
Eff. October 1, 1995;  
Amended Eff. January 1, 1996.

## Fiscal Analysis

**Rule Citation Numbers:** 15A NCAC 2B .0227 Water Quality Management Plans and 15A NCAC 2B .0311 Cape Fear River Basin

**Rule Topic:** Proposed Reclassification of a Segment of the Cape Fear River in New Hanover and Brunswick Counties (Cape Fear River Basin) from Class SC to Class SC Sw with a Water Quality Management Plan

**DENR Division:** Division of Water Resources

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**Impact Summary:**

State government:	No
Local government:	No
Private entities:	No
Substantial Impact:	No
Federal government:	No

**Necessity:** The proposed water quality management plan associated with the proposed reclassification codifies the current permitting policy already in existence for new individual NPDES wastewater discharges and expansions of existing individual National Pollutant Discharge Elimination System (NPDES) wastewater discharges to the subject waters. In addition, the proposed reclassification in partnership with the proposed management plan provides a path forward for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges, thus enabling the local community to plan accordingly.

### 1. Summary

The Lower Cape Fear River Program has submitted a surface water reclassification request for a portion of the Cape Fear River. This portion of the Cape Fear River of interest is proposed to be reclassified from Class SC to Class SC Swamp with a water quality management plan.

The proposal codifies the current permitting policy already in place for new wastewater discharges and expansions of existing wastewater discharges to the subject waters. In addition, the proposal provides a path for the subject water's discharges, and thus for local communities, for future planning purposes. Finally, the proposal may positively impact the subject water's current water quality impairments.

There are no quantifiable impacts of the proposed rulemaking according to this fiscal analysis. The expected reclassification effective date is November 1, 2015.

## 2. Background

The area that would be impacted by this proposal is the portion of the Cape Fear River from upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut. This river segment flows along the border of Brunswick and New Hanover counties. In these waters as well as adjacent waters, there are several tidal saltwater species, including the federally endangered Shortnose Sturgeon and Atlantic Sturgeon, and the associated Marine Fisheries Commission designations of Primary Nursery Area, or PNA; PNA waters are by definition High Quality Waters, or HQW, per 15A NCAC 2B .0101. In addition, the types of land cover occurring adjacent to the proposed river segment are comprised of wetlands, some developed lands, other open waters, forest lands, and shrub/scrub lands. Furthermore, the segment of the Cape Fear River directly above and below the river segment to be reclassified is classified C Swamp and SC, respectively, and the named tributaries flowing to this river segment are currently classified either SC Swamp, WS-IV, SC, or C Swamp.

Several tidal saltwater species, including the federally endangered Shortnose Sturgeon and federally endangered Atlantic Sturgeon, and the striped bass live in the subject waters. The NC Division of Marine Fisheries (DMF) has a tagging program for striped bass and sturgeon in this vicinity. This is an area of diverse and abundant fish use, partially since salinity fluctuates widely. When salinity is lower, fresh-brackish water species such as catfish and gar can be found, while during high salinity times, spotted red drum and spadefish have been documented.

There are currently eight NPDES individual permitted wastewater discharges within this segment. According to the 2012 North Carolina 303(d) list, the river segment is impaired for water quality parameters including dissolved oxygen (DO) and pH.

According to the reclassification request, "...the DO standard of 5 mg/l for the Lower Cape Fear River Estuary is not appropriate since it is not achieved a significant portion of the time as a result of natural drainage from riverine wetlands and salt marshes. Modeling results indicate that the current DO standard of 5 mg/L is not attained about 30 percent of the time during the summer months and that point sources in this segment are a minor contributor to overall dissolved oxygen depletion. Subsequent modeling and data analyses have indicated that drainage and the wetting and drying of floodplain wetlands and salt marshes are the most significant contributor to the waterbody's not meeting the DO standard for non-swamp classified waters. From a regulatory standpoint, a straightforward way to recognize the natural influence on standards is to reclassify the area with the supplemental Sw classification. "

The regulations applicable to Class SC waters, which include the subject waters, provide a base of protection to all of the state's tidal saltwaters and allow for lower dissolved oxygen and pH values under natural conditions for SC waters that carry the supplemental Swamp designation. For Class SC waters, currently the dissolved oxygen standard is 5 mg/l, and the pH standard is a range between 6.8-8.5; if this segment is reclassified to include the Swamp designation, then the pH can be as low as 4.3 if caused by natural conditions, and the dissolved oxygen can be lower than 5.0 mg/l if caused by natural conditions. These regulations are located in rule, 15A NCAC 02B .0220.

The proposed management plan to accompany the proposed Swamp designation contains effluent limits that new individual NPDES wastewater discharges and expansions of existing individual NPDES

wastewater discharges within the river segment would have to meet regarding oxygen consuming wastes. These limits are similar to the limits for High Quality Waters (HQW), and the subject waters are HQW by virtue of being designated as Primary Nursery Areas. Effluent limits of 5 mg/l for biochemical oxygen demand (BOD), 1 mg/l for Ammonia, and 6 mg/l for dissolved oxygen would apply. For industrial discharges, site specific best available technology on a case by case basis would be utilized to determine the limits for BOD, Ammonia and DO.

For new individual NPDES facilities and expansions of existing individual NPDES facilities, the management plan includes consideration of seasonal effluent limits on a case by case basis in accordance with 15A NCAC 2B .0404. The plan also includes the following stipulation: Any new or expanded individual NPDES pollutant discharge of oxygen-consuming waste shall not cause the dissolved oxygen of the receiving water to drop more than 0.1 mg/l below the modeled in-stream dissolved oxygen at total permitted capacity.

The proposed management plan is consistent with the current permitting policy already in place for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters. Furthermore, there is no known plans for new NPDES wastewater discharges and there is one planned expansion of an existing NPDES wastewater discharge in the reclassification area (Cape Fear Public Utility Authority Southside Wilmington, NC), which already meets the proposal's requirements. Finally, the proposed management plan in conjunction with the Swamp designation provides a path for the subject waters' dischargers, and thus for local communities, for future planning purposes, and also may, in a positive fashion, impact the subject water's current impairments. As a result, this proposal serves the environment and public interest per Executive Order #70 and complies with G.S. 150B-19.1.

### 3. Costs

- (i.) **New and Existing Individual NPDES Wastewater Discharges**  
There are eight existing individual NPDES wastewater discharges. For now, there are currently no known planned new individual NPDES wastewater discharges and one planned expansion of an existing individual NPDES wastewater discharge in the reclassification area, which already meets the proposal's requirements. The proposed management plan to accompany the proposed Swamp designation contains effluent limits that new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges within the river segment would have to meet regarding oxygen consuming wastes. These limits are similar to the limits for High Quality Waters, and the subject waters are HQW by virtue of being designated as Primary Nursery Areas. Effluent limits of 5 mg/l for BOD, 1 mg/l for Ammonia, and 6 mg/l for dissolved oxygen would apply. For industrial discharges, site specific best available technology on a case by case basis would be utilized to determine the limits for BOD, Ammonia and DO. In sum, the proposed regulations would not have any impact on current or future wastewater discharges.
- (ii.) **Implementing Agencies**  
The proposed rulemaking will have no cost to the State implementing agency (DWR/DENR). These amendments will not require DWR to revise its existing procedures nor will they require DWR to procure additional staff. Therefore, this proposed rulemaking will have no economic impact to the implementing agency.

## (iii.) Environment/Ecosystem

Like it was mentioned in the summary above, according to the reclassification request, "...the DO standard of 5 mg/l for the Lower Cape Fear River Estuary is not appropriate since it is not achieved a significant portion of the time as a result of natural drainage from riverine wetlands and salt marshes. From a regulatory standpoint, a straightforward way to recognize the natural influence on standards is to reclassify the area with the supplemental Sw classification...." As a result of the Sw reclassification, ambient (in-situ) standards for DO and pH would be allowed to reflect natural conditions rather than standards reflected solely by the SC classification. Water quality monitoring may reflect DO and pH at levels below solely SC requirements. It is uncertain if and/or to what extent the DO and pH levels will change over time once the proposal becomes effective.

**4. Benefits**

## (i.) Humans

This reclassification does not provide a direct benefit to humans. No changes to local government programs are required, and there are no existing or proposed activities affected by the proposal.

## (ii.) New Individual NPDES and Existing Individual NPDES Wastewater Discharges

New individual NPDES and existing individual NPDES wastewater discharges will not incur any direct benefits from the proposal, other than more accurately describing the characteristics of the waters in this river. There are no existing or known proposed discharges affected by the proposal. However, the proposed management plan codifies the current permitting policy already in place for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters, cementing permitting expectations for those discharges. In addition, the proposed management plan in conjunction with the Swamp designation provides a path for the subject waters' discharges, and thus for local communities, for future planning purposes. Finally, as a result of the Sw reclassification, ambient (in-situ) standards for DO and pH would be allowed to reflect natural conditions rather than standards reflected solely by the SC classification. Water quality monitoring may reflect DO and pH at levels solely below SC requirements. Discharges may in the future be granted additional wasteload allocations; the amount, if any, of additional wasteload allocations can only be determined with additional water quality monitoring and analysis. This analysis would also reflect if the reclassification has any positive impact on the subject water's current impairments. It is uncertain if and/or to what extent the DO and pH levels will change over time once the proposal becomes effective.

**5. Total Economic Impact**

The economic impacts of the proposed rulemaking, both in terms of cost and benefit, are not quantifiable as measured from the baseline conditions. Consequently, there were no specific cost or benefit estimations to report in this fiscal note.

## Appendix

**DRAFT****15A NCAC 02B .0227 WATER QUALITY MANAGEMENT PLANS**

(a) In implementing the water quality standards to protect the existing uses [as defined by Rule .0202 of this Section] of the waters of the state or the water quality which supports those uses, the Commission shall develop water quality management plans on a priority basis to attain, maintain or enhance water quality throughout the state. Additional specific actions deemed necessary by the Commission to protect the water quality or the existing uses of the waters of the state shall be specified in Paragraph (b) of this Rule. These actions may include anything within the powers of the Commission. The Commission may also consider local actions which have been taken to protect a waterbody in determining the appropriate protection options to be incorporated into the water quality management plan.

(b) All waters determined by the Commission to be protected by a water quality management plan are listed with specific actions as follows:

The Lockwoods Folly River Area (Lumber River Basin), which includes all waters of the lower Lockwoods Folly River in an area extending north from the Intracoastal Waterway to a line extending from Genoes Point to Mullet Creek, shall be protected by the specific actions described in Subparagraphs (1) through (5) of this Paragraph.

- (1) New development activities within 575' of the mean high water line which require a Sedimentation Erosion Control Plan or a CAMA major development permit must comply with the low density option of the coastal Stormwater Runoff Disposal Rules [as specified in 15A NCAC 2H .1005(2)(a)].
- (2) New or expanded NPDES permits shall be issued only for non-domestic, non-industrial process type discharges (such as non-industrial process cooling or seafood processing discharges). A public hearing is mandatory for any proposed (new or expanded) NPDES permit to this protected area.
- (3) New non-discharge permits shall be required to meet reduced loading rates and increased buffer zones, to be determined on a case-by-case basis.
- (4) New or expanded marinas must be located in upland basin areas.
- (5) No dredge or fill activities shall be allowed where significant shellfish or submerged aquatic vegetation bed resources occur, except for maintenance dredging, such as that required to maintain access to existing channels and facilities located within the protected area or maintenance dredging for activities such as agriculture.

A part of the Cape Fear River (Cape Fear River Basin) comprised of a section of 18-(71) from upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut shall be protected by the Class SC Sw standards as well as the site-specific action described in Subparagraph (1) of this Paragraph:

(1) All new **individual** NPDES wastewater discharges and expansions of existing NPDES wastewater discharges shall be required to provide the treatment described below:

(A) Oxygen consuming wastes: Effluent limitations shall be as follows: BOD<sub>5</sub> = 5 mg/l, NH<sub>3</sub>-N = 1 mg/l and DO = 6 mg/l, or site-specific best available technology on a case-by-case basis for industrial discharges. Seasonal effluent limits for oxygen-consuming wastes will be considered on a case-by-case basis in accordance with 15A NCAC 2B.0404. Any new or expanded permitted pollutant discharge of oxygen-consuming waste shall not cause the dissolved oxygen of the receiving water to drop more than 0.1 mg/l below the modeled in-stream dissolved oxygen at total permitted capacity.

*History Note: Authority G.S. 143-214.1; 143-215.8A;  
Eff. October 1, 1995;  
Amended Eff. November 1, 2015; January 1, 1996.*

## DRAFT

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### 15A NCAC 02B .0311 CAPE FEAR RIVER BASIN

(a) Effective February 1, 1976, the adopted classifications assigned to the waters within the Cape Fear River Basin are set forth in the Cape Fear River Basin Schedule of Classifications and Water Quality Standards, which may be inspected at the following places:

- (1) the Internet at <http://portal.ncdenr.org/web/wq/ps/csu/rules>; and
- (2) the North Carolina Department of Environment and Natural Resources:
  - (A) Winston-Salem Regional Office  
585 Waughtown Street  
Winston-Salem, North Carolina
  - (B) Fayetteville Regional Office  
225 Green Street  
Systel Building Suite 714  
Fayetteville, North Carolina
  - (C) Raleigh Regional Office  
3800 Barrett Drive  
Raleigh, North Carolina
  - (D) Washington Regional Office  
943 Washington Square Mall  
Washington, North Carolina
  - (E) Wilmington Regional Office  
127 Cardinal Drive Extension  
Wilmington, North Carolina
  - (F) Division of Water Quality  
Central Office  
512 North Salisbury Street  
Raleigh, North Carolina.

(b) The Cape Fear River Basin Schedule of Classification and Water Quality Standards was amended effective:

- (1) March 1, 1977;
- (2) December 13, 1979;
- (3) December 14, 1980;
- (4) August 9, 1981;
- (5) April 1, 1982;
- (6) December 1, 1983;
- (7) January 1, 1985;
- (8) August 1, 1985;
- (9) December 1, 1985;
- (10) February 1, 1986;
- (11) July 1, 1987;
- (12) October 1, 1987;
- (13) March 1, 1988;
- (14) August 1, 1990.

(c) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective June 1, 1988 as follows:

- (1) Cane Creek [Index No. 16-21-(1)] from source to a point 0.5 mile north of N.C. Hwy. 54 (Cane Reservoir Dam) including the Cane Creek Reservoir and all tributaries has been reclassified from Class WS-III to WS-I.
- (2) Morgan Creek [Index No. 16-41-1-(1)] to the University Lake dam including University Lake and all tributaries has been reclassified from Class WS-III to WS-I.

(d) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective July 1, 1988 by the reclassification of Crane Creek (Crains Creek) [Index No. 18-23-16-(1)] from source to mouth of Beaver Creek including all tributaries from C to WS-III.

(e) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective January 1, 1990 as follows:

- (1) Intracoastal Waterway (Index No. 18-87) from southern edge of White Oak River Basin to western end of Permuda Island (a line from Morris Landing to Atlantic Ocean), from the eastern mouth of Old Topsail Creek to the southwestern shore of Howe Creek and from the southwest mouth of Shinn Creek to channel marker No. 153 including all tributaries except the King Creek Restricted Area, Hardison Creek, Old Topsail Creek, Mill Creek, Futch Creek and Pages Creek were reclassified from Class SA to Class SA ORW.
- (2) Topsail Sound and Middle Sound ORW Area which includes all waters between the Barrier Islands and the Intracoastal Waterway located between a line running from the western most shore of Mason Inlet to the southwestern shore of Howe Creek and a line running from the western shore of New Topsail Inlet to the eastern mouth of Old Topsail Creek was reclassified from Class SA to Class SA ORW.
- (3) Masonboro Sound ORW Area which includes all waters between the Barrier Islands and the mainland from a line running from the southwest mouth of Shinn Creek at the Intracoastal Waterway to the southern shore of Masonboro Inlet and a line running from the Intracoastal Waterway Channel marker No. 153 to the southside of the Carolina Beach Inlet was reclassified from Class SA to Class SA ORW.

(f) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective January 1, 1990 as follows: Big Alamance Creek [Index No. 16-19-(1)] from source to Lake Mackintosh Dam including all tributaries has been reclassified from Class WS-III NSW to Class WS-II NSW.

(g) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective August 3, 1992 with the reclassification of all water supply waters (waters with a primary classification of WS-I, WS-II or WS-III). These waters were reclassified to WS-I, WS-II, WS-III, WS-IV or WS-V as defined in the revised water supply protection rules, (15A NCAC 02B .0100, .0200 and .0300) which became effective on August 3, 1992. In some cases, streams with primary classifications other than WS were reclassified to a WS classification due to their proximity and linkage to water supply waters. In other cases, waters were reclassified from a WS classification to an alternate appropriate primary classification after being identified as downstream of a water supply intake or identified as not being used for water supply purposes.

(h) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective June 1, 1994 as follows:

- (1) The Black River from its source to the Cape Fear River [Index Nos. 18-68-(0.5), 18-68-(3.5) and 18-65-(11.5)] was reclassified from Classes C Sw and C Sw HQW to Class C Sw ORW.
- (2) The South River from Big Swamp to the Black River [Index Nos. 18-68-12-(0.5) and 18-68-12(11.5)] was reclassified from Classes C Sw and C Sw HQW to Class C Sw ORW.
- (3) Six Runs Creek from Quewhiffle Swamp to the Black River [Index No. 18-68-2] was reclassified from Class C Sw to Class C Sw ORW.

(i) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective September 1, 1994 with the reclassification of the Deep River [Index No. 17-(36.5)] from the Town of Gulf-Goldston water supply intake to US highway 421 including associated tributaries from Class C to Classes C, WS-IV and WS-IV CA.

(j) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective August 1, 1998 with the revision to the primary classification for portions of the Deep River [Index No. 17-(28.5)] from Class WS-IV to Class WS-V, Deep River [Index No. 17-(41.5)] from Class WS-IV to Class C, and the Cape Fear River [Index 18-(10.5)] from Class WS-IV to Class WS-V.

(k) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective April 1, 1999 with the reclassification of Buckhorn Creek (Harris Lake)[Index No. 18-7-(3)] from the backwaters of Harris Lake to the Dam at Harris Lake from Class C to Class WS-V.

(l) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective April 1, 1999 with the reclassification of the Deep River [Index No. 17-(4)] from the dam at Oakdale-Cotton Mills, Inc. to the dam at Randleman Reservoir (located 1.6 mile upstream of U.S. Hwy 220 Business), and including tributaries from Class C and Class B to Class WS-IV and Class WS-IV & B. Streams within the Randleman Reservoir Critical Area have been reclassified to WS-IV CA. The Critical Area for a WS-IV reservoir is defined as 0.5 mile and draining to the normal pool elevation of the reservoir. All waters within the Randleman Reservoir Water Supply Watershed are within a designated Critical Water Supply Watershed and are subject to a special management strategy specified in 15A NCAC 02B .0248.

(m) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective August 1, 2002 as follows:

- (1) Mill Creek [Index Nos. 18-23-11-(1), 18-23-11-(2), 18-23-11-3, 18-23-11-(5)] from its source to the Little River, including all tributaries was reclassified from Class WS-III NSW and Class WS-III B NSW to Class WS-III NSW HQW@ and Class WS-III B NSW HQW@.
- (2) McDeed's Creek [Index Nos. 18-23-11-4, 18-23-11-4-1] from its source to Mill Creek, including all tributaries was reclassified from Class WS III NSW and Class WS-III B NSW to Class WS-III NSW HQW@ and Class WS-III B NSW HQW@.

The "@" symbol as used in this Paragraph means that if the governing municipality has deemed that a development is covered under a "5/70 provision" as described in Rule 15A NCAC 02B .0215(3)(b)(i)(E) (Fresh Surface Water Quality Standards for Class WS-III Waters), then that development is not subject to the stormwater requirements as described in rule 15A NCAC 02H .1006 (Stormwater Requirements: High Quality Waters).

(n) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective November 1, 2004 as follows:

- (1) the portion of Rocky River [Index Number 17-43-(1)] from a point 0.3 mile upstream of Town of Siler City upper reservoir dam to a point 0.3 mile downstream of Lacy Creek from WS-III to WS-III CA.
- (2) the portion of Rocky River [Index Number 17-43-(8)] from dam at lower water supply reservoir for Town of Siler City to a point 65 feet below dam (site of proposed dam) from C to WS-III CA.
- (3) the portion of Mud Lick Creek (Index No. 17-43-6) from a point 0.4 mile upstream of Chatham County SR 1355 to Town of Siler City lower water supply reservoir from WS-III to WS-III CA.
- (4) the portion of Lacy Creek (17-43-7) from a point 0.6 mile downstream of Chatham County SR 1362 to Town of Siler City lower water supply reservoir from WS-III to WS-III CA.

(o) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective November 1, 2007 with the reclassifications listed below, and the North Carolina Division of Water Quality maintains a Geographic Information Systems data layer of these UWLs.

- (1) Military Ocean Terminal Sunny Point Pools, all on the eastern shore of the Cape Fear River [Index No. 18-(71)] were reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (2) Salters Lake Bay near Salters Lake [Index No. 18-44-4] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (3) Jones Lake Bay near Jones Lake [Index No. 18-46-7-1] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (4) Weymouth Woods Sandhill Seep near Mill Creek [18-23-11-(1)] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (5) Fly Trap Savanna near Cape Fear River [Index No. 18-(71)] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (6) Lily Pond near Cape Fear River [Index No. 18-(71)] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (7) Grassy Pond near Cape Fear River [Index No. 18-(71)] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (8) The Neck Savanna near Sandy Run Swamp [Index No. 18-74-33-2] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (9) Bower's Bog near Mill Creek [Index No. 18-23-11-(1)] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.
- (10) Bushy Lake near Turnbull Creek [Index No. 18-46] was reclassified to Class WL UWL as defined in 15A NCAC 02B .0101.

(p) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective January 1, 2009 as follows:

- (1) the portion of Cape Fear River [Index No. 18-(26)] (including tributaries) from Smithfield Packing Company's intake, located approximately 2 miles upstream of County Road 1316, to a point 0.5 miles upstream of Smithfield Packing Company's intake from Class C to Class WS-IV CA.
- (2) the portion of Cape Fear River [Index No.18-(26)] (including tributaries) from a point 0.5 miles upstream of Smithfield Packing Company's intake to a point 1 mile upstream of Grays Creek from Class C to Class WS-IV.

(q) The schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective August 11, 2009 with the reclassification of all Class C NSW waters and all Class B NSW waters upstream

of the dam at B. Everett Jordan Reservoir from Class C NSW and Class B NSW to Class WS-V NSW and Class WS-V & B NSW, respectively. All waters within the B. Everett Jordan Reservoir Watershed are within a designated Critical Water Supply Watershed and are subject to a special management strategy specified in 15A NCAC 02B .0262 through .0273.

(r) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective September 1, 2009 with the reclassification of a portion of the Haw River [Index No. 16-(28.5)] from the Town of Pittsboro water supply intake, which is located approximately 0.15 mile west of U.S. 15/501, to a point 0.5 mile upstream of the Town of Pittsboro water supply intake from Class WS-IV to Class WS-IV CA.

(s) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective March 1, 2012 with the reclassification of the portion of the Haw River [Index No. 16-(1)] from the City of Greensboro's intake, located approximately 650 feet upstream of Guilford County 2712, to a point 0.5 miles upstream of the intake from Class WS-V NSW to Class WS-IV CA NSW, and the portion of the Haw River [Index No. 16-(1)] from a point 0.5 miles upstream of the intake to a point 0.6 miles downstream of U.S. Route 29 from Class WS-V NSW to Class WS-IV NSW.

(t) The Schedule of Classifications and Water Quality Standards for the Cape Fear River Basin was amended effective November 1, 2015 with the reclassification of a section of 18-(71) from upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut from Class SC to Class SC Sw. A site-specific management strategy is outlined in 15A NCAC 02B .0227.

*History Note: Authority G.S. 143-214.1; 143-215.1; 143-215.3(a)(1);  
Eff. February 1, 1976;  
Amended Eff. November 1, 2015; March 1, 2012; September 1, 2009; August 11, 2009; January 1, 2009; November 1, 2007; November 1, 2004; August 1, 2002; April 1, 1999; August 1, 1998; September 1, 1994; June 1, 1994; August 3, 1992; August 1, 1990.*

**PROPOSED SWAMP RECLASSIFICATION WITH WATER QUALITY MANAGEMENT PLAN  
FOR PART OF CAPE FEAR RIVER:  
PUBLIC HEARING SET FOR FEBRUARY 2015**

[PUBLIC HEARING](#)

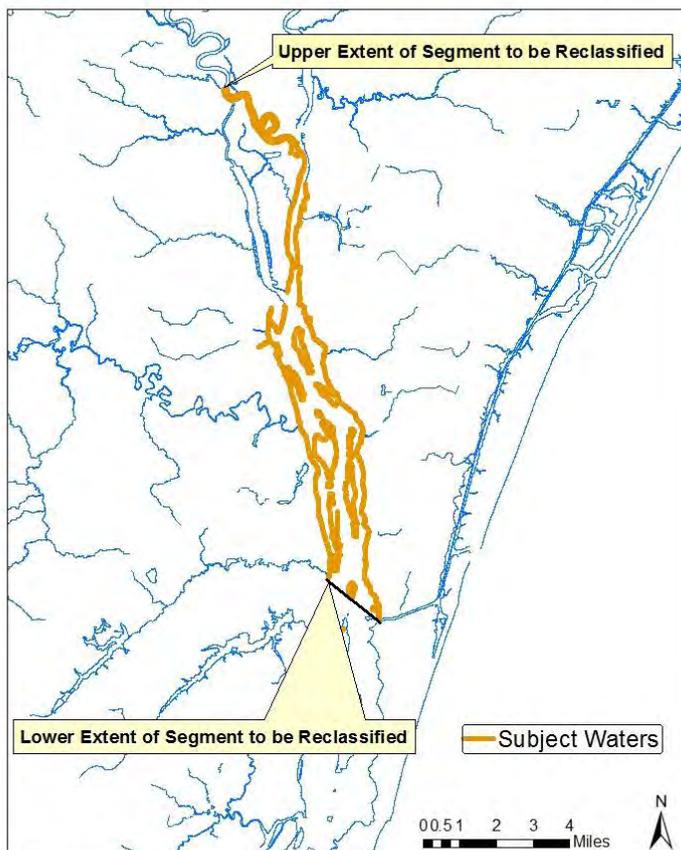
The Cape Fear River Class SC waters shown on the map below are proposed to be assigned the supplemental Swamp (Sw) classification, and would be subject to the provisions of the Sw designation as well as the provisions of a water quality management plan that is also proposed to be assigned to these waters.

Location: USS North Carolina Battleship  
1 Battleship Road Northeast  
Wilmington, NC 28401

Time & Date: 6:30 p.m., Thursday, February 5, 2015

Purpose: to receive public comments on a proposed reclassification and water quality management plan for a section of the Cape Fear River in Brunswick and New Hanover Counties (Cape Fear River Basin)

**Proposed Swamp Reclassification and Water Quality Management Plan  
Cape Fear River, Brunswick and New Hanover Counties, NC**



NCDENR-Division of Water Resources  
Water Planning Section  
November 24, 2014

**WATERS AFFECTED BY PROPOSED RECLASSIFICATION & WATER QUALITY MANAGEMENT PLAN**

The proposed reclassification and water quality management plan concern the portion of the Cape Fear River from the upstream mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut, where the Intracoastal Waterway (ICW) meets the river. No tributaries to this section of the Cape Fear River are to be affected by the proposed actions. Wetlands, developed lands, other open waters, forest lands, shrub/scrub lands, and primarily Class Sw tributaries exist directly adjacent to the subject waters. Several tidal saltwater species, including the federally endangered shortnose sturgeon and federally endangered Atlantic sturgeon, live in these waters. Within the subject waters, there are eight (8) existing NPDES wastewater discharges.

### **REGULATIONS INVOKED BY PROPOSED RECLASSIFICATION & WATER QUALITY MANAGEMENT PLAN**

If the proposed reclassification and management plan become effective, then the pH standard applicable to these waters can be as low as 4.3 if caused by natural conditions, and the dissolved oxygen (DO) standard applicable to these waters can be lower than 5.0 mg/l if caused by natural conditions; currently the DO standard is 5 mg/l, and the pH standard is a range between 6.8-8.5, for the subject waters. In addition, new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges in the subject waters would have to meet specific effluent limits for oxygen consuming wastes. For such domestic facilities, effluent limits of 5 mg/l for BOD<sub>5</sub>, 1 mg/l for ammonia, and 6 mg/l for DO would apply. For industrial discharges, site specific best available technology on a case by case basis would be utilized to determine the limits for BOD<sub>5</sub>, ammonia and DO. For new individual NPDES wastewater facilities and expansions of existing individual NPDES wastewater discharges, the management plan would include consideration of seasonal effluent limits on a case by case basis, and the following stipulation: Any new or expanded permitted pollutant discharge of oxygen-consuming waste shall not cause the DO of the receiving water to drop more than 0.1 mg/l below the modeled in-stream DO at total permitted capacity.

The proposed management plan is consistent with the current permitting policy for new individual NPDES wastewater discharges and expansions of existing individual NPDES wastewater discharges to the subject waters. There are currently no known planned new individual NPDES wastewater discharges and one (1) planned expansion of an existing individual NPDES wastewater discharge in the subject waters, which already meets the proposal's requirements. The proposed water quality management plan in conjunction with the Sw designation provides a path forward for the subject waters' dischargers, and thus for local communities, for future planning purposes. Finally, it is unknown how the Sw standards will affect the current DO and pH impairment status of these waters.

A fiscal analysis for this proposal has been completed, and revealed no quantifiable cost or benefit to the ecosystem, humans, implementing agencies, new individual NPDES wastewater discharges, and expansions of existing individual NPDES wastewater discharges.

### **MEETING FEDERAL TRIENNIAL REVIEW REQUIREMENTS**

The public hearing and comment period are to be held in accordance with the federal Clean Water Act that requires States, at least every three years, to review and revise water quality standards. These standards are provided in existing rules NCAC 15A 02B .0100 and .0201 through .0228. The process is in accordance with the Triennial Review and includes an assessment and revision of the designated uses of waters (classifications) and the water quality criteria (standards), which are based on the designated uses. More specifically, this public hearing and comment period are to address the potential assignment of a Sw classification and water quality management plan to a portion of the Cape Fear River. This proposal will result in additional water quality standards applicable to the subject waters.

### **HOW TO SUBMIT COMMENTS**

You may attend the public hearing and provide verbal comments that specifically address the proposed reclassification and water quality management plan for the subject portion of the Cape Fear River. The Hearing Officer may limit the length of time that you may speak at the public hearing, if necessary, so that all those who wish to speak may have an opportunity to do so. In addition, written comments addressing the proposed reclassification and water quality management plan for the Cape Fear River segment will be accepted until March 3, 2015.

All persons interested and potentially affected by the proposal are encouraged to read this announcement and make comments on the proposal. The EMC may not adopt a rule that differs substantially from the text of the proposed rule published in the North Carolina Register unless the EMC publishes the text of the proposed different rule and accepts comments on the new text. The proposed effective date for this proposed reclassification is November 1, 2015. Written comments on the proposed reclassification and water quality management plan for the Cape Fear River segment may be submitted to Elizabeth Kountis of the Division of Water Resources Planning Section at the postal address, e-mail address, or fax number listed below.

### **FOR ADDITIONAL INFORMATION**

This announcement and a map of the subject waters are located on the internet via <http://portal.ncdenr.org/web/wq/event-calendar> (look under "2015-02-5"). In the case of inclement weather on the day of the scheduled public hearing, please contact the telephone number below for a recorded message regarding any changes to the location, date, or time of the hearing. Further explanations and details on reclassifications may be obtained by writing or calling:

Elizabeth Kountis, DENR-Division of Water Resources, Planning Section  
1611 Mail Service Center, Raleigh, NC 27699-1611  
phone (919) 807-6418, fax (919) 807-6497, e-mail [elizabeth.kountis@ncdenr.gov](mailto:elizabeth.kountis@ncdenr.gov)

To learn more about how the Division of Water Resources protects water quality in North Carolina, go to <http://portal.ncdenr.org/web/wq/home/wyk>.



North Carolina Department of Environment and Natural Resources

Pat McCrory  
Governor

Donald R. van der Vaart  
Secretary

**January 9, 2015**

TO: Major Newspapers of NC

FROM: Ms. Elizabeth Kountis  
Environmental Senior Specialist  
N.C. Department of Environment and Natural Resources  
Division of Water Resources

SUBJECT: Publication of Announcement for Proposed Swamp Reclassification and Water Quality Management Plan for Cape Fear River

Attached is an announcement for the Proposed Swamp Reclassification and Water Quality Management Plan for the Cape Fear River. The legal requirements for notice as required by G.S. 150B-21.2 have been met by publishing this notice in the *NC Register*. Publishing this notice in newspapers is not a statutory requirement and has therefore been recently cut from the Department's budget as non-essential spending. However, we do recognize that newspapers are one of the most effective methods to convey information to the public, and many newspapers contain a public announcement (or similar) section that does not charge a fee to service its readers with public announcements. Therefore, we are presenting the attached announcement to you for your information to publish at your discretion.

Should you decide to publish this information, it would be greatly appreciated if you would notify us. I can be contacted at any of the following:

By Email: [Elizabeth.Kountis@ncdenr.gov](mailto:Elizabeth.Kountis@ncdenr.gov)  
By Fax #: (919) 807-6497  
By postal mail:  
Ms. Elizabeth Kountis  
NCDENR-DWR-Planning Section  
1611 Mail Service Center, Raleigh, NC 27699-1611  
By phone: (919) 807-6418

If you should have any questions, please do not hesitate to contact me. Thank you sincerely for your consideration.

Enclosure



# ENVIRONMENTAL MANAGEMENT COMMISSION

NORTH CAROLINA  
DEPARTMENT OF ENVIRONMENT AND NATURAL  
RESOURCES

Benne C. Hutson  
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Kevin Martin  
Vice Chairman

Pat McCrory, Governor  
John Skvarla, Secretary

David W. Anderson  
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Manning Puette  
Dr. Lawrence W. Raymond  
Dr. Albert R. Rubin  
Clyde E. Smith, Jr.  
Steve W. Tedder  
Julie A. Wilsey

November 13, 2014

## MEMORANDUM

TO: Julie A. Wilsey

FROM: Benne C. Hutson

SUBJECT: Hearing Officer Appointment, Lower Cape Fear River Reclassification

I hereby designate you to serve as hearing officer for the public hearing to be held on the proposed reclassification of the Lower Cape Fear River in New Hanover and Brunswick Counties (Cape Fear River Basin) from Class SC to Class SC Sw with a water quality management plan. Staff will be contacting you to discuss the process and establish the date, time, and location of the public hearing. Please present your findings and recommendations to the Environmental Management Commission.

Thank you for your assistance and service.

cc: Tom Reeder  
Tom Fransen  
Jeff Manning  
Elizabeth Kountis  
Lois Thomas

**LIST OF ATTENDEES**  
**PROPOSED RECLASSIFICATION AND WATER QUALITY MANAGEMENT PLAN**  
**FOR CAPE FEAR RIVER SEGMENT**

**PUBLIC HEARING: FEBRUARY 5, 2015, WILMINGTON, NC**

**Hearing Officer**

Wilsey Julie Environmental Management Commissioner

**Div. of Water Resources (CSRRB = Classifications & Standards Rules Review Branch)**

Kountis Elizabeth Senior Environmental Specialist, CSRRB, Water Planning Section  
 Kreiser Gary Groundwater Vairance and Rulemaking, CSRRB, Water Planning Section  
 Manning Jeff Chief, CSRRB, Water Planning Section  
 Weaver Adriene Senior Environmental Specialist, CSRRB, Water Planning Section  
 Deamer Nora Cape Fear River Basin Planner, Basin Planning Branch, Water Planning Section  
 Rajbhandari Narayan Modeler, Modelling and Assessment Branch, Water Planning Section  
 Kroeger Steve Supervisor, Ecosystems Branch, Water Sciences Section  
 Ruhlman Carrie Monitoring Coalition Coordinator, Ecosystems Branch, Water Sciences Section  
 Tracy Bryn Fish Community Assessments and Environmental Fish Reviews, Biological Assessment Branch, Water Sciences Section  
 Gregson Jim Regional Supervisor, Wilmington Regional Office, Water Qual. Regional Operations Section  
 Garrett Stephanie Water Quality Monitoring, Wilmington Regional Office, Water Qual. Regional Operatons Section  
 Massengale Susan Public Information Officer

**Department of Environment and Natural Resources**

Bromby Craig Assistant General Counsel

**Citizens in Attendance (\*=made verbal comments)**

<u>Last Name</u>	<u>First Name</u>	<u>Entity Representing</u>	<u>City</u>	<u>County</u>	<u>State</u>
Feller	Donald	Aqua NC	Wilmington	New Hanover	NC
Williams	Donald	Aqua NC	Hampstead	Pender	NC
York	Dawn	Cape Fear River Partnership	Wilmington	New Hanover	NC
Sargent	Dana	Cape Fear River Watch	NA	NA	NA
Yelverton	Frank	Cape Fear River Watch	Wilmington	New Hanover	NC*
Vogt	Ken	CFPUA	Wilmington	New Hanover	NC*
Kreutzberger	Bill	CH2M Hill	Charlotte	Mecklenberg	NC*
McEwen	Tony	City of Wilmington	NA	NA	NA
Thompson	Dacia	Duke Environmental Policy Clinic	Durham	Durham	NC*
Sebastian	Abiles	Duke Environmental Policy Clinic	Durham	Durham	NC*
Longest	Ryke	Duke Environmental Policy Clinic	Durham	Durham	NC*
O'Connor	Shawn	General Electric Company	Wilmington	New Hanover	NC
Kreul	Edward	International Paper	Riegelwood	Columbus	NC*
Henderson	Emily	International Paper	Riegelwood	Columbus	NC
Merritt	James	LCFRP - UNCW	Wilmington	New Hanover	NC*
Tomlin	Andrew	NA	Wilmington	New Hanover	NC
Becker	May	NA	Chapel Hill	Orange	NC
Hasvell	Dianne	New Hanover County	NA	NA	NC
O'Connor	Jennifer	self	Leland	Brunswick	NC
Gattett	Rick	self	Burgaw	Pender	NC
Mallin	Michael	UNCW	Wilmington	New Hanover	NC*
McIver	Matthew	UNCW	Wilmington	New Hanover	NC*
Shew	Roger	UNCW	Wilmington	New Hanover	NC
Alexander	Mike	Vopak Terminals	Wilmington	New Hanover	NC

**Kountis, Elizabeth**

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**From:** Glenn Harbeck  
**Sent:** Wednesday, January 07, 2015 12:03 PM  
**To:** Sterling Cheatham; Richard King  
**Cc:** Tony Caudle; Margaret Haynes; [elizabeth.kountis@ncdenr.gov](mailto:elizabeth.kountis@ncdenr.gov)  
**Subject:** RE: Comment Period and Hearing for Lower Cape Fear River Proposed Sw Reclassification and Water Quality Management Plan

Just a clarification. Phil is not the voting member serving on the Cape Fear River Program. At the time the vote was cast, it was either Council Member Laura Padgett or Council Member Margaret Haynes, if Ms. Haynes was the City's rep at the time of the most recent vote. Sorry for the clumsy wording!

Glenn

Glenn Harbeck, AICP  
 Director of Planning, Development & Transportation  
 City of Wilmington  
 305 Chestnut Street  
 P.O. Box 1810  
 Wilmington, NC 28402-1810  
 910-341-5808      [glenn.harbeck@wilmingtonnc.gov](mailto:glenn.harbeck@wilmingtonnc.gov)

**CITY-BUILDING:**

*The most constructive way to view the relationship between the planning agency and the development community is as PARTNERS in the business of city-building. The planning agency helps its citizens and leaders create a clear vision of the future city. The developer helps implement the city's vision.*



**From:** Glenn Harbeck  
**Sent:** Wednesday, January 07, 2015 11:48 AM  
**To:** Sterling Cheatham; Richard King  
**Cc:** Tony Caudle; Margaret Haynes; 'elizabeth.kountis@ncdenr.gov'  
**Subject:** RE: Comment Period and Hearing for Lower Cape Fear River Proposed Sw Reclassification and Water Quality Management Plan

Wilmington Senior Planner Phil Prete advises that, as a voting member of the Lower Cape Fear River Program, we as the City of Wilmington, have expressed our support for the reclassification by our vote for the measure. However, if we need to reiterate our support on the City's letterhead, signed by the Mayor or Council's rep to the LCFRP, we can certainly do so. As the City's technical rep, Phil plans to attend the hearing on February 5<sup>th</sup> at the Battleship.

Glenn

Glenn Harbeck, AICP  
 Director of Planning, Development & Transportation  
 City of Wilmington  
 305 Chestnut Street

P.O. Box 1810  
Wilmington, NC 28402-1810  
910-341-5808      [glenn.harbeck@wilmingtonnc.gov](mailto:glenn.harbeck@wilmingtonnc.gov)

*CITY-BUILDING:*

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**PROPOSED SWAMP RECLASSIFICATION WITH WATER QUALITY MANAGEMENT PLAN  
FOR PART OF CAPE FEAR RIVER:  
PUBLIC HEARING - FEBRUARY 2015**

Good evening. My name is Ed Kreul. I work for International Paper and have been involved with the Lower Cape Fear River Program since 1997.

The potential water quality impairment of the Lower Cape Fear River has been a topic of discussion my entire time with the program. I am here to speak in support of this proposed reclassification as it is strongly indicated by the technical information and resolves a long standing regulatory issue affecting municipal and industrial wastewater dischargers.

First I would like to provide a little more background on the Lower Cape Fear River Program

- The Program was formed in May 1994 as one of the first water quality monitoring coalitions established through a memorandum of agreement (MOA) with the North Carolina Department of Environment and Natural Resources (DENR). These coalitions use comprehensive and coordinated monitoring programs rather than individual NPDES permit requirements to perform in-stream monitoring.
- This collective approach provides substantially more data than individual permittees would, facilitates developing a better understanding of the Lower Cape Fear River and provides a mechanism for information exchange and public education.
- In cooperation with the University of North Carolina Wilmington's Center for Marine Science, the program has collected data to assess chemical and ecological conditions in the river since 1995.
- Currently, there are 17 National Pollutant Discharge Elimination System (NPDES) permit holders that are party to the MOA and many other members of the Lower Cape Fear River Program representing a range of governmental and non-governmental organizations from the Cape Fear area.

Now I would like to give a little history of the work on dissolved oxygen in the estuary and what I see will be the results of the proposed changes.

- Since 1998, the section of the Lower Cape Fear River estuary from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been listed on the State of North Carolina's impaired waters list for dissolved oxygen (DO). In 2006, DENR added pH as impaired for this segment.
- DENR had been pursuing development of a total maximum daily load (TMDL) to address low DO by further limiting oxygen demanding pollutants from point source discharges.
- Toward that end, the agency undertook an extensive effort to develop a three-dimensional hydrodynamic and water quality response model for this section of the River. That modeling work showed that even under natural conditions, the 5 milligrams per liter (mg/L) standard for dissolved oxygen would not be met during considerable periods of time in the summer. The modeling also showed that point-source discharges have a relatively minor impact on dissolved oxygen.
- Supplementing the current "SC" classification of the river with a swamp designation, just as upstream fresh waters are classified, will recognize the influence of natural drainage from riverine and saltwater marsh systems. The agency can then take these natural conditions into account in permitting decisions.
- Meanwhile, Lower Cape Fear River Program members and all new and expanding NPDES dischargers will continue to meet highly protective discharge limits for oxygen consuming wastes.
- This proposal will clarify discharge permit administration and further codify the high treatment standards for point source wastewater discharges. I support this classification and the Division of Water Resources taking actions to protect the high quality waters of the Lower Cape Fear River estuary.

.....

Statement by Bill Kreutzberger

CH2M HILL

Consultant to Lower Cape Fear River Program

Feb. 5, 2015

I am Bill Kreutzberger, Fellow Technologist with CH2M HILL and a consultant to the Lower Cape Fear River Program. I am here to speak in favor of the proposed reclassification to add the supplemental Swamp designation to a portion of the estuary and the proposed management strategy for point sources.

I have been involved with water quality issues in the Lower Cape Fear River for nearly the past 30 years as a consultant and in my prior employment with the state's water quality program. There have been a number of comments made this evening in support and against the proposed reclassification. I want to emphasize a few key points:

1. The swamp designation allows the state to evaluate whether natural or man-made effects are contributing to any deviation to the assigned water quality criteria for dissolved oxygen and pH – it does not say that all deviations are natural
2. The swamp designation for the lower Cape Fear River estuary in no way limits the ability of the state to address nonpoint source contributions of nutrients and other pollutants
3. The coastal wetlands drainage contributions to low DO and pH conditions in the estuary have been recognized for a long time and the supplemental swamp designation was originally included when the classification and water quality standards for the Cape Fear River Basin were first adopted in the early 1960s. The swamp designation was removed in 1982 without any supporting technical analysis.
4. While we certainly acknowledge and strongly support the work done by researchers within the Lower Cape Fear River Program focusing on impacts of agricultural activities and animal operations, the DO

conditions in the area being affected by the reclassification have not appreciatively changed in the last 20 years – a period in which the agricultural animal populations increased dramatically.

5. In regard to the specific role of sediment oxygen demand and conclusions of the modeling report, I believe earlier statements inappropriately interpreted the report. The sediment oxygen demand rates in the model are based on measured values – and are actually quite low and typical of many river and estuarine systems in North Carolina. So the statement that these rates can be appreciably reduced is not consistent with the measurements done to support the model development. We will provide additional technical comment on this issue.

6. The low DO conditions of the lower Cape Fear River estuary is not unique – and there is considerable effort to evaluate appropriate DO conditions for coastal rivers and estuaries from Florida to New England – with strong recognition that natural conditions contribute to the low DO.

In conclusion, the proposed reclassification and the management strategy aimed at point sources dischargers assists in resolving a regulatory issue that some members of the Lower Cape Fear River Program and the State have been dealing with for more than 15 years. This reclassification and strategy recognizes the minimal effect point sources have on DO in the river and provides certainty as facilities move forward in planning for the future.

→ Use attainability analysis

## **Cape Fear River SC to SC Swamp Reclassification**

### **02.05.2015 NCDENR Public Hearing**

#### **CFPUA Position Statement**

Good evening. My name is Kenneth L. Vogt Jr., PE, BCEE, and I serve as Wastewater Treatment Superintendent for the Cape Fear Public Utility Authority (CFPUA). I have been authorized by CFPUA to present this position on their behalf.

The CFPUA was formed in 2008 to manage the water treatment, water distribution, wastewater collection, and wastewater treatment functions previously performed by the City of Wilmington and New Hanover County. Since about 1998, while serving in the referenced capacity, I also had the opportunity to become involved with the Lower Cape Fear River Program (LCFRP) and its TMDL-related sub-committees. I'm here this evening to represent the Authority's position in support of the reclassification of selected sections of the Cape Fear River from Class SC to SC - Swamp and to provide justification for adopting this position.

Initially, the City of Wilmington (COW) and New Hanover County (NHC) and, subsequently, the CFPUA, have been interested in dissolved oxygen (DO) depletion within the Cape Fear River since 1998 when a significant portion of the Lower Cape Fear River estuary was declared impaired and placed upon the 303d list. These determinations cast doubt not only upon the river's assimilative capacity to receive wastewater treatment plant (WWTP) effluent but also the overall ability of the area to meet designated uses and to sustain a favorable quality of life due to deteriorating water quality.

Any TMDL for low DO instituted within the estuary is believed to exert far-reaching influences over many watershed activities. DO depletion can be attributed to numerous influences including virtually all forms of anthropogenic (man-made) activities such as agricultural and urban land development as well as certain natural conditions. Furthermore, causes for low DO within the estuary are not limited to being physically located within the estuary. Therefore, not only sources within the impaired reaches but sources of DO depletion throughout the entire Cape Fear River watershed would likely be subject to a low DO TMDL's restrictions.

In conjunction with COW NPDES permitting, in 2000/2001 COW undertook extensive modeling which revealed that point sources (such as WWTP discharges) within the estuary comprised a relatively minor/insignificant basis for DO depletion. Subsequent follow-up efforts conducted by NCDENR culminated in 2009 with similar findings. Collectively, these studies suggest that anthropogenic sources were not the most significant cause for DO depletion and perhaps non-anthropogenic (natural) sources predominated and exerted a more pronounced effect upon DO depletion within the estuary. It is now apparent to both the regulators and the regulated community that imposition and enforcement of additional controls were unlikely to yield a corresponding improvement in DO sufficient to achieve the mandated 5.0 mg/l DO standard.

Of several options considered, the one selected as being most feasible was reclassification of a section of the Cape Fear River estuary from Class SC to SW - Swamp together with implementation of a water quality management plan. While recognizing the DO-depleting tendencies of natural conditions, it imposes stringent levels of treatment upon new and expanding NPDES discharges in addition to prescribing that these discharges will not cause the receiving water DO to drop more than 0.1 mg/l below modeled in-stream DO levels at permitted capacities. This measure clarifies, stabilizes, and resolves much of the uncertainty which existed concerning management of current and future NPDES permitting. While this proposal may seem to be a partial solution inasmuch as it addresses primarily point sources, NCDENR has indicated it will continue to assess and address non-point sources potentially contributing to oxygen depletion or other sources of pollution through ongoing water quality programs.

CFPUA supports the proposed action consisting of reclassification of a section of the Cape Fear River estuary with the addition of the supplemental SW - Swamp classification together with implementation of a water quality management plan as a reasonable solution to the long standing and pending Cape

Fear River low DO TMDL. It accepts its responsibility for its NPDES point sources to conform to the high level of treatment stipulated within the proposed action. The proposal codifies point source discharge requirements to a high level of treatment and does not limit further efforts toward addressing other sources of oxygen depleting materials. In so doing, we believe the aggregated effect of the proposed action will enhance the long term health of the estuary and improve the quality of life enjoyed by its inhabitants.

My name is James Merritt and I am here speaking on behalf of the Lower Cape Fear River Program. I have served as coordinator for the program since its inception in 1994. The LCFRP is an ongoing research and monitoring program that is supported by the Center for Marine Science at UNCW, citizens groups, industry, business, and local, regional and state government.

I would especially like to thank NCDENR and the Division of Water Resources for encouraging the establishment of this program and the other similar ones working on other sections of the Cape Fear River and other river water sheds in North Carolina.

The Lower Cape Fear River Program represents a positive collaboration between academia, industry, NCDENR and the public.

The objectives are to develop an understanding of the fundamental scientific processes shaping and controlling the Cape Fear River Estuary and provide a mechanism for information exchange and public education.

The foundation of the Program is a large-scale water quality and biota assessment program developed in collaboration with DENR and covering the estuary and a large portion of the lower watershed.

Numerous physical, chemical, and biological measurements are being collected on a regular basis at many key locations to supplement data collected by DENR.

The availability of regular, replicated, long-term data covering a wide area of this large system is extremely valuable to biologists, chemists, physicists, and geologists working in near shore marine environments, estuarine waters and freshwater.

This basic information and understanding is available to public officials and environmental managers to help increase the effectiveness of management practices designed to improve the river water quality, maintain sustainable economic development and protect the overall ecosystem of the Cape Fear River by stimulating ecologically friendly practices by all people living in the watershed.

The Program has an Advisory Board, (Chairman Chris May) and a Technical committee (Chairman Ed. Kreul) which consists of representatives from environmental groups, regulatory agencies, local government, industries, agriculture, the business community, and academia. Meetings are held bimonthly to discuss data and other issues regarding the program.

The Lower Cape Fear River Program has been working the NCDENR Division of Water Resources since 1998 on the EPA mandated TMDL for the Dissolved oxygen violation in the Lower Cape Fear River. The subcommittee working with the DWR and using all data available proposed a plan of action to help determine a solution and resolve this issue. The Lower Cape Fear River Program submitted a recommendation for this reclassification March 5, 2014 including a packet of data supporting the recommendation. I therefore I support the current recommendation under consideration

*James F Merritt, Ph.D*



**NORTH CAROLINA  
FARM BUREAU FEDERATION, INC.**

PO Box 27766, Raleigh, NC 27611 Phone: 919-782-1705 Fax: 919-783-3593 www.ncfb.org

March 3, 2015

Ms. Elizabeth Kountis  
NC Division of Water Resources  
Water Planning Section  
1611 Mail Service Center  
Raleigh, NC 27699-1611

Delivered via email: elizabeth.kountis@ncdenr.gov

Dear Ms. Kountis,

The North Carolina Farm Bureau (NCFB) is North Carolina's largest general farm organization, representing the interests of farm and rural people in our State. This letter is to comment on the proposed reclassification of a portion of the Lower Cape Fear River from Class SC to Class SC Sw waters by the Environmental Management Commission (EMC). This reclassification request was submitted by the Lower Cape Fear River Program, of which NCFB is an Advisory Board member. NCFB supports the reclassification request as proposed by the EMC.

The Lower Cape Fear River is currently on the 303(d) list as an impaired waterbody due to low dissolved oxygen. However, studies and modeling performed on behalf of the Lower Cape Fear River Program have established that the low dissolved oxygen is due to natural conditions. Specifically, natural drainage from riverine wetlands and marshes of the Black and Northeast Cape Fear Rivers results in dissolved oxygen levels less than 5 mg/l in the Lower Cape Fear River. Both the Black and Northeast Cape Fear Rivers currently have the supplemental Sw designations, and contribute significant flow to the Cape Fear River.

The supplemental Sw designation would allow dissolved oxygen to be less than 5 mg/l and the pH to be as low as 4.3, if caused by natural conditions. As demonstrated by the Lower Cape Fear River Program and discussed below, even significant reductions in both point and nonpoint source loadings would not result in attainment of the dissolved oxygen standard of 5 mg/l during summer months.

The Lower Cape Fear River Program developed a series of technical memos to support the reclassification request. Memo number two analyzes dissolved oxygen trends in the river since 1984. The analysis shows that dissolved oxygen levels have remained constant even with a 25 percent reduction in BOD loading from point sources over the same period. This analysis supports the conclusion that the dissolved oxygen impairment is a result of natural conditions. Memo number three analyzes water quality monitoring data at various locations in the watershed. The analysis shows that dissolved oxygen levels are consistently lower in the Black and Northeast Cape Fear Rivers (which currently carry the Sw designation) than at Lock and Dam 1 on the main stem of the Cape Fear. This analysis shows that dissolved oxygen levels in

the Lower Cape Fear River are negatively influenced by the natural swamp conditions of the Black and Northeast Cape Fear Rivers.

Memo number four summarizes two modeling efforts by Tetra Tech. The first model indicates that wetland/marsh and sediment oxygen demand accounts for 75 percent of oxygen demand in the Lower Cape Fear River. The second model shows that even with a 70 percent reduction in nonpoint source loading, the Lower Cape Fear River would still have dissolved oxygen levels below 5 mg/l 20 percent of the time in summer months. This memo demonstrates that natural conditions are the main contributor to the low dissolved oxygen levels of the lower Cape Fear River, and supports the Sw classification.

The proposed rule includes a point source management strategy. Due to existing requirements of the Primary Nursery Area designation and the accompanying HQW limits, DWR determined that there would be no additional cost to implement the point source strategy.

We recommend that no nonpoint source strategy be included in the final rule. Based on recent nutrient strategies (Jordan and Falls Lakes), any nonpoint source strategy will include all nonpoint source categories (agriculture, development, stormwater, etc.). Based on Tetra Tech models, even a 70% reduction in oxygen demanding load from nonpoint sources would not change the impaired status. However, adding a nonpoint source strategy would impose significant costs to the state for implementation, as well as to landowners, local governments, and farmers, without significant benefit.

NCFB supports this reclassification request as proposed, and encourages approval by the EMC without changes. As summarized above, the reclassification is warranted because the natural conditions of the Lower Cape Fear River, and the influence of the swamp waters of the Black and Northeast Cape Fear Rivers, result in dissolved oxygen levels below 5 mg/l.

Thank you for the opportunity to provide comments on the proposed Lower Cape Fear River reclassification. If you have questions about any of our comments or would like more information, you can contact me by phone at (919) 987-1257 or by email at [keith.larick@ncfb.org](mailto:keith.larick@ncfb.org).

Sincerely,



Keith Larick  
Special Projects Director

March 3, 2015

Elizabeth Kountis  
 DENR-Division of Water Resources, Planning Section  
 1611 Mail Service Center  
 Raleigh, NC 27699-1611

Subject: Additional Comments Regarding the Proposed Reclassification of the Lower Cape Fear River with Supplemental "Swamp" Classification and Proposed Water Quality Management Plan

Dear Ms. Kountis:

On behalf of representatives of the Lower Cape Fear River Program (LCFRP) that testified at the public hearing, I am writing to provide some additional comments in support of the proposed subject reclassification and water quality management plan.

At the public hearing on February 5, we had four speakers speak on behalf of the program including:

- Ken Vogt – Wastewater Superintendent for Cape Fear Public Utility Authority
- Ed Kreul - Manager - Environment, Health, Safety and Sustainability for International Paper
- Bill Kreutzberger – Consultant with CH2M HILL
- Jim Merritt – Executive Director of the Lower Cape Fear River Program

The speakers discussed the coordinated efforts of the LCFRP and the Department of Environment and Natural Resources (DENR) to assess the issues in the estuary, the technical justification for the propose reclassification and water quality management plan, and the benefits of this action. Written copies of comments were submitted at the hearing.

Based on some comments made at the public hearing, we want to provide some supplemental information and to offer some clarifying language to the water quality management plan language as proposed.

## **Responses to Comments in Opposition**

### **Overview**

Several of the commenters opposed the reclassification primarily because of concern about nonpoint sources - specifically agricultural runoff related to animal operations. The concern was that the proposal did nothing to address agricultural nonpoint sources and that these were a major contributor to the low DO situation in the estuary. In making these comments, commenters were either unaware of or misinterpreted prior studies that have occurred since the Lower Cape Fear River estuary (LCFRE) was listed as impaired in 1998. The LCFRP formally made the request for reclassification in March 2014 and in support of the request included technical information that summarized and interpreted historical data as well as recent water quality modeling studies completed in 2009 by Dr. James Bowen of UNC-Charlotte under contract to DENR. This information was incorporated in four technical memoranda that were included with the reclassification request. Some of the key points from that submittal include the following:

- Swamp influences were identified even during the early studies of the river/estuary in the 1950s and the entire LCFRE and tributaries were recommended and subsequently classified with the supplemental "Swamp" classification in the early 1960s which was later removed from the estuary with no technical justification.

- The hydrodynamic and water quality model completed in 2009 demonstrated that the point sources have a minor contribution to the DO deficit and that even with 30 to 70 percent reductions in loadings of oxygen demanding materials from tributaries and wetlands/marsh systems (a combination of anthropogenic and natural sources), the DO standard of 5 mg/L could not be achieved between 20 and 30 percent of the time.
- An updated trend analysis of DO conditions in the LCFRE showed no significant trend in DO levels over the 20 year period from 1994 through 2013 while the loading of ultimate Biochemical Oxygen Demand (BODu) from major point sources declined by 23 percent over the same time period confirming model results indicating that point sources are having a minor impact on DO levels in the LCFRE.
- The evaluation of water quality data at the boundary conditions supports the conclusion that inflows from the swamp areas have a significant impact on water quality in the Cape Fear River. The levels of nutrients, DO, and pH are consistently different between the station at Lock & Dam 1 (L&D1) on the main stem of the Cape Fear River, and in the major blackwater tributaries – the Black River and the NE Cape Fear River.
- Modeling analyses conducted in 2001 and 2009 provide further weight of evidence collectively that flow and oxygen-demanding loads from wetlands/marsh systems and SOD are driving low DO during the summer period and suggest that reinstatement of the supplemental “Swamp” designation for the LCFRE should be considered by DENR and the EMC.

Attachment 1 to this letter summarizes these Technical Memoranda and the major technical points that support the reclassification.

### **Impact of Nonpoint Sources**

There were several comments that pointed out the significant animal population in coastal counties in the Cape Fear River watershed as well as highlighting that the waste exceeded the ability of soils and crops to utilize the nutrients. We believe that this information is anecdotal and indicative of potential for water quality problems to occur. The main way these nutrients could impact dissolved oxygen in the portion of the estuary modeled is through increases in algal productivity that could impact daily DO variations as well as generate organic material that can degrade and impact DO either directly or through accumulation in sediments and generating sediment oxygen demand (SOD). The water quality modeling completed by Dr. James Bowen of UNC-Charlotte (a recent appointee to the Science Advisory Committee to aid DENR’s Nutrient Criteria Development Plan) indicates in the modeling report that nutrients and associated algal productivity is currently having a minor impact on the DO regime in the Lower Cape Fear River Estuary.

### **Importance of Sediment Oxygen Demand**

There were some comments that specifically pointed out that Dr. Bowen’s modeling report indicated sensitivity of the model to SOD and that runoff from animal operations was a significant contributor to SOD through a direct contribution of long term BOD and through contribution to algal productivity. It was indicated that this sensitivity analysis specifically showed the importance of SOD and if SOD rates were reduced, presumably through more controls on agricultural runoff, DO concentration in the river would be above 5 mg/L a substantial portion of the time.

In considering this comment, it is important to review the modeling information and specifically SOD. In Technical Memorandum 4, submitted in support of the reclassification request and summarized in Attachment 1, it was concluded that “wetland/marsh and sediment oxygen demand (SOD) sources accounted for between 75 and 80 percent of all oxygen demand in the LCFRE”. However, it is also important to note that SOD rates were a calibrated value in the model which was set after reviewing measurements conducted by DENR. The applied rate in the model is 0.4 gm/m<sup>2</sup>/day which is actually quite low. The

following is a summary of measured SOD rates (using the average concentration in g/m<sup>2</sup>/day at each location normalized to 20 degrees C) for the Cape Fear River Basin as a whole and the portion of the basin downstream of Lock & Dam No. 1:

<u>All 67 locations In Cape Fear River Basin</u>	
Min	0.19
Median	1.11
Max	6.48
Std. Dev	0.95

<u>16 locations below L&amp;D 1</u>	
Min	0.19
Med	0.48
Max	6.48
Std. Dev	1.47

Dr. Bowen's applied SOD rate of 0.4 is already below the median for both the entire river basin and the area below L&D 1 datasets. We believe these low rates indicate that while the model showed sensitivity to SOD rates, the rates used in the model indicate there is little opportunity to further reduce these rates through management of nonpoint sources. A 50 percent reduction in SOD from 0.4 would place the resulting rate (0.2) as the second lowest rate measured in the entire river basin. Based on the DENR data, this is not a likely scenario.

The point of Technical Memorandum 4 is to demonstrate the relative importance of wetlands and salt marsh to accurately predicting DO in the LCFRE in the modeled areas. First hypothesized by Tetra Tech (Tt) in 2001, Dr. Bowen's work demonstrated an even greater impact from the wetlands and salt marsh using more areal coverage and reducing SOD rates (from those applied by Tt during earlier scoping level modeling) and causing the wetlands and salt marsh to have an even larger impact than originally hypothesized. This information clearly supports that view that there is a significant "natural" contribution to the observed low DO values in the river and supports the proposed action to reclassify the river as "swamp" waters.

### **A Use Attainability Analysis is Required to Reclassify the Lower Cape Fear River as "Swamp"**

One commenter indicated that a use attainability analysis was required to support the proposed action. US EPA water quality standards regulations included in 40 CFR 131.10 (j) states:

- (j) A State must conduct a use attainability analysis as described in § 131.3(g) whenever:*
- (1) The State designates or has designated uses that do not include the uses specified in section 101(a)(2) of the Act, or*
  - (2) The State wishes to remove a designated use that is specified in section 101(a)(2) of the Act or to adopt subcategories of uses specified in section 101(a)(2) of the Act which require less stringent criteria.*

The proposed action to classify a portion of the estuary as "Swamp" is not impacting the designated use of the estuary (which do meet the uses specified in the Clean Water Act) nor does it remove a use or require less stringent water quality criteria. The current DO and pH criteria remain in effect for the area designated as "Swamp". However, the narrative portion of the standard allows the State to make a determination as to whether any deviation from these criteria is due to natural causes. If this determination is made, values below the numerical criteria are not considered a deviation from the water quality standard.

## The Proposed Action is to Get Around the Development of a Total Maximum Daily Load (TMDL)

Generally, most commenters agreed that point source dischargers have little impact on DO levels in the estuary. However, one commenter specifically indicated that the proposed action was to get around the development of a TMDL. On the contrary, the LCFRP and DENR worked towards development of a TMDL from about 2000 through 2010. At that point, DENR determined that development of a TMDL was not feasible due to the apparent natural contribution to DO levels below the standard of 5 mg/L. The request for reclassification developed from this effort. DENR staff has determined that the proposed reclassification supplemented with the proposed water quality management plan is an appropriate way to address this issue.

## Clarification to the Proposed Water Quality Management Plan Language

In discussions that lead to the proposed water quality management plan requirements, it was clear that this language was to apply to sources of domestic and industrial wastewater. To completely clarify this, the following additions are suggested to the proposed language, marked in red, as follows:

(1) All new individual NPDES wastewater discharges and expansions of existing NPDES wastewater discharges permitted in accordance with 15A NCAC 02H .0102 (1), (2) and (3) shall be required to provide the treatment described below:

(A) Oxygen consuming wastes: Effluent limitations shall be as follows: BOD<sub>5</sub>= 5 mg/l, NH<sub>3</sub>-N = 1 mg/l and DO = 6 mg/l, or site-specific best available technology on a case-by-case basis for industrial discharges. Seasonal effluent limits for oxygen-consuming wastes will be considered on a case-by-case basis in accordance with 15A NCAC 2B.0404. Any new or expanded permitted pollutant discharge of oxygen-consuming waste shall not cause the dissolved oxygen of the receiving water to drop more than 0.1 mg/l below the modeled in-stream dissolved oxygen at total permitted capacity.

This completes our supplemental comments on the proposed reclassification of a portion of the Lower Cape Fear River estuary to include the supplemental "Swamp" classification and the proposed water quality management plan specified as part of 15A NCAC 2B .0227. We strongly support adoption of this classification and the management plan, with the clarifying language, by the Environmental Management Commission.

Sincerely,

CH2M HILL



William A. Kreutzberger  
Vice President

c: Jim Merritt/UNCW  
Ken Vogt/CFPUA  
Ed Kreul/International Paper

# Attachment 1

## Technical Memoranda Submitted in Support of the Reclassification Request

### Supporting Information

There is a wealth of research and technical assessment studies that have been conducted on the LCFRE since the formation of the LCFRP in 1995, as well as during the 40 years prior to that time. In discussing this reclassification request with DWR staff, it was suggested that a summary of information be prepared to support the reclassification request. Four Technical Memoranda (TM) have been prepared in support of this reclassification request and are included as Attachments to this letter. The following is a brief summary of each TM.

### **TM 1 - Summary of Background Information and Previous Studies for the Lower Cape Fear River**

This TM served to review available background information for the LCFRE dating back to original studies in the 1950s where water quality and pollutions sources were assessed and initial recommendations on stream classifications were made. Key studies and assessments up to the present time were also reviewed and a bibliography of studies and research papers was also included. A several of the key points from this TM include:

- Swamp influences were identified even during the early studies and the entire LCFRE and tributaries were recommended and subsequently classified with the supplemental Sw classification
- The supplemental Sw classification was removed from the Class SC portion of the Cape Fear River in 1981 without extensive evaluation for the basis of this change
- LCFRP monitoring in the mid to late 1990s documented the impact of swamp drainage following hurricanes, similar to what was documented during the 1990s
- The EFDC hydrodynamic and water quality model completed in 2009 demonstrated that the point sources had a minor contribution to the DO deficit and that even with 30 to 70 percent reductions in loadings of oxygen demanding materials from tributaries and wetlands/marsh systems (a combination of anthropogenic and natural sources), the DO standard of 5 mg/L could not be achieved between 20 and 30 percent of the time.

### **TM 2 - Updated Trend Analysis of DO Conditions and Pollutant Loading from Point Sources**

This TM was an update of an analysis done in 2003. The previous DO trend analysis found no statistically significant trend for DO for the period of 1984 through 2002 for DO conditions at several stations within or immediately adjacent to the 303(d) listed portion of the LCFRE. The same conclusion was drawn for the period of 1991 through 2002, despite a statistically significant reduction in major point source ultimate

biochemical oxygen demand (BODu) load of approximately 25 percent for that period. The updated analysis used monitoring data and information on point source loading from 1994 through 2013. The updated point source analysis focused on International Paper and Cape Fear Public Utilities Authority (CFPUA) Northside and Southside discharges since these facilities comprise over 90 percent of the point source loading to the local watershed. This analysis also showed no significant trend in DO levels in the LCFRE over the 20 year period while the loading of BODu from these three facilities declined by 23 percent over the same time period. This analysis confirms model results indicating that point sources are having a minor impact on DO levels in the LCFRE.

### **TM 3 - Analysis of Long-term Data near the Limits of the Tidal Influence for the Cape Fear River, Black River, and NE Cape Fear River**

This TM presents an analysis of water quality parameters at the sampling stations representative of inflows to the system, with the purpose of examining issues related to a supplemental Sw classification for the estuary. Data was examined for several key parameters, including nutrients, pH, and DO, that are related to the occurrence of low DO in the Cape Fear River. The evaluation of water quality data at the boundary conditions supports the concept that inflows from the swamp areas have a significant impact on water quality in the Cape Fear River. The levels of nutrients, DO, and pH are consistently different between the station at Lock & Dam 1 (L&D1) on the main stem of the Cape Fear River, and in the major blackwater tributaries – the Black River and the NE Cape Fear River. A distinct response from these inflows can be seen in the levels for these parameters in the portion of the Cape Fear River near Navassa, providing additional supporting evidence that water quality in the Cape Fear River is significantly influenced by the conditions found in the swamp areas tributary to the river downstream of L&D1.

### **TM 4 - An Analysis of Model Results to Assess the Relative Impact of Riparian Wetlands and Salt Marshes versus other Tributary Loadings**

This TM used the results of the two modeling efforts with the EFDC model in the 2000s to examine the technical basis for a supplemental Sw classification for the LCFRE. The two modeling studies included the initial EFDC model developments by Tetra Tech on behalf of the City of Wilmington and New Hanover County and the follow up work by the University of North Carolina – Charlotte on behalf of NC DENR. Both modeling efforts demonstrated that the impact from point source loads in the LCFRE contributes to less than 10 percent of the DO deficit in the LCFRE. The 2001 modeling effort demonstrated that an accurate calibration could not be achieved without representing the wetting and drying of adjacent low elevation wetland and salt marsh areas. That modeling estimated that wetland/marsh and sediment oxygen demand (SOD) sources accounted for between 75 and 80 percent of all oxygen demand in the LCFRE. The 2009 modeling effort validated and expanded the influence of adjacent marshland based on more detailed analysis. Further, application of the 2009 model that simulated up to 70 percent of nonpoint source load reduction demonstrated that even with such large pollutant loading reductions, DO concentrations would be expected to be below 5 mg/L approximately 20 percent of the time in the LCFRE during the summer. Therefore, the 2001 and 2009 modeling analyses provide further weight of evidence collectively that flow and oxygen-demanding loads from wetlands/marsh systems and SOD are driving low DO during the summer period and suggest that reinstatement of the supplemental Sw designation for the LCFRE should be considered by DENR and the EMC.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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MAR 02 2015

Ms. Elizabeth Kountis  
 Division of Water Resources Planning Section  
 North Carolina Department of Environment  
 and Natural Resources  
 1611 Mail Service Center  
 Raleigh, NC 27699-1611

Dear Ms. Kountis:

Following receipt of the hearing announcement for the "Proposed Swamp Reclassification with Water Quality Management Plan for Part of the Cape Fear River," the EPA reviewed several documents prepared in support of the subject reclassification. The EPA found these documents summarized well how the reclassification came to be requested, along with summaries of the existing studies that have been completed, to better understand the cause(s) behind the dissolved oxygen (DO) levels which on occasion are below the currently applicable 5 mg/L DO criterion. These documents also discuss whether there is any longer a need for the development of a Total Maximum Daily Load (TMDL). After reading these documents, we thought it would be beneficial to make specific comments to ensure that the resulting final criteria, or more specifically the possibility for lower pH and DO values, are adequately protective of the waterbody. Additionally, EPA supports the State's continued efforts to make improvements in water quality that still may be desired, such as through decreases from anthropogenic sources, following the change in reclassification.

The EPA provides the following comments to the State, grouped by topic. These comments are also being made to ensure the State provides the necessary supporting documentation at the time of submittal as well as consider possible revisions to the proposal where indicated below.

Natural versus Anthropogenic Influences and Swamp Classification

- 1) The fourth technical memorandum indicates that modeling estimates 75-80% of the oxygen demand in the Lower Cape Fear River comes from wetland/marsh and SOD sources. While the analysis of the non-anthropogenic sources is useful to supporting the proposed swamp classification, when making the argument that alternative criteria are appropriate for a given waterbody, particularly on the basis of natural background, the EPA must consider whether a condition is exacerbated by other influences which are not considered natural. As indicated in the first technical memorandum, when eliminating the wastewater point source loadings the 10<sup>th</sup> percentile DO did increase. The State could consider a revision to the DO and pH language indicating that sources which are not natural will still need to be considered and addressed during activities which consider in-stream and downstream water quality, like permitting or future criteria development efforts. Additional comments on DO and pH are discussed later.

- 2) Within the materials, it was noted that swamp classification was removed from this segment in 1981. In the October 6, 1981 report of proceedings, a staff representative indicated the streams “had improved enough so that [the streams can] meet the C standard without being allowed the designated exception.” EPA recommends the state further address this previous change which removed the swamp classification as it relates to the proposed change, reverting it back to a swamp classification.
- 3) As described in the definition for swamp waters, such waters “have very low velocities and other characteristics which are different from adjacent streams draining steeper topography.” Since this relates to the proposed classification, the State should provide additional documentation indicating the velocities and other characteristics that make the swamp classification appropriate for the Lower Cape Fear River.

#### Allowance for DO less than 5 mg/L

- 1) As an alternative to including the type of language suggested in item one above, the State could consider some specific lower bound be selected for DO, as is the case with pH. Future assessments of the waterbody will be much more streamlined and reproducible if a specific DO criterion minimum is in place. Also, for dischargers that are not new or expanding, and therefore not covered by the management plan, it will be simpler to determine reasonable potential if a specific criterion for the waterbody is in place. As another alternative the State could consider a seasonally, or specific month(s), based lower bound for DO to more accurately represent known data from the period of record and modeling efforts.
- 2) Without a lower bound for DO, is there any limitation on the duration or frequency by which a measured DO level can be below the 5mg/L criterion? How will the assessment of the exceedances below 5 mg/L be determined to be based on natural conditions? EPA encourages the State to consider providing additional clarity through the adopted revisions to ensure proper implementation of the classification if adopted.

#### pH of 4.3

- 1) In general the support for the change to pH appears to have less supporting documentation than DO. The EPA recommends the State provide data documentation from the historical monitoring efforts for this segment to justify the conclusion that values as low as 4.3 are appropriate, as well as protective. Although describing upstream data, the information shown for pH provides monthly averages on page D-45. Unless monthly average was intended, it may be more useful to present data in a different way, to match the intended duration for the 4.3 value.
- 2) The EPA suggests that the State clarify whether the 4.3 represents an instantaneous measurement, typically referred to as a “shall not exceed” value. If something different is intended, that should also be documented and supported.

#### Threatened and Endangered Species

- 1) The EPA is aware that Ms. Kountis worked with the Services in advance of this proposal. This upfront coordination and consideration of the Service’s comments is important and EPA greatly appreciates the State’s effort to do this. As part of the State’s final documentation, the EPA recommends the materials include a discussion on how the water quality requirements (such as DO levels) were considered and will result in a designated use, with its corresponding water quality criteria, that will be protective of the two sturgeon species that could be present in the segment.

TMDL and/or Restoration Efforts

- 1) Although information has been provided to describe natural sources of lower DO and pH values, it will be important to ensure that the influence from anthropogenic sources is still addressed and continues to be monitored to ensure anthropogenic sources are not contributing to lower DO or pH levels.
- 2) As noted on page D-3 of the materials, the petition seems to indicate that point sources will have waste load allocations developed for them. The EPA supports this conclusion.
- 3) The first technical memorandum mentions that further channel dredging “also showed a significant impact [on DO conditions].” Can the State provide the EPA with additional information on this analysis and how it was considered?

General Documentation

- 1) We encourage the State to provide specific documentation to EPA no later than the time of the State’s submittal to EPA for 303(c) review to ensure a timely final review. EPA staff are also available to review any supplemental information in advance if that is the State’s preference.

If you have any questions, please contact me at (404) 562-9967 or have a member of your staff contact Ms. Lauren Petter at (404) 562-9272.

Sincerely,



Annie Godfrey, Chief  
Water Quality Standards Section



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
 Raleigh Field Office  
 Post Office Box 33726  
 Raleigh, North Carolina 27636-3726

March 3, 2015

Ms. Elizabeth Kountis  
 DENR/ Division of Water Resources, Planning Section  
 1611 Mail Service Center  
 Raleigh, NC 27699-1611

Dear Ms. Kountis:

This letter conveys the U.S. Fish and Wildlife Service's (Service) comments on proposed reclassification of a section of the Cape Fear River (Brunswick and New Hanover Counties) from Class SC to Class SC Swamp (Sw) with a water quality management plan. The Division of Water Resources (DWR), on behalf of the Environmental Management Commission, seeks comments on the proposed changes which were detailed in a January 12, 2015 public hearing notice.

The Service is the principal Federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. Among our priorities is the health and restoration of diadromous fish stocks in the area, including striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and American eel (*Anguilla rostrata*). All diadromous species have complex life cycles entailing use of freshwater and marine habitats, so the proposed reclassification of the lower Cape Fear River is of interest to us and partners working on fish restoration.

We appreciate DWR's early coordination with us on the proposal. At your request, on April 23, 2014 we emailed references documenting 1) protected aquatic species and species of special management importance in the lower Cape Fear River, with emphasis on the lifestages present in late spring, summer and early fall when dissolved oxygen (DO) would be lowest (and therefore potentially most affected by a Sw reclassification); 2) DO tolerances of fish species of management concern, including references demonstrating adverse effects to fish early lifestages at DO concentrations less than the standard of 5 mg/L; and 3) concern that a Sw classification, allowing lower DO if caused by natural conditions, might make it more difficult to determine use support related to DO in the future without some mechanism to define a new lower bound on DO indicative of background conditions. The three April 23, 2014 emails are incorporated here by reference.

Last summer, a biologist with our Coastal Program (which is integrally involved in Cape Fear River fisheries and habitat restoration) met with reclassification proponents and consultants. From those meetings, supporting technical memoranda, and water quality modeling reports, we better understand the intention of the reclassification -- to document the large influence of

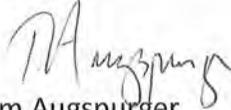
wetlands and sediment and lesser influence of local point sources on local DO conditions. That should allow stakeholders to refocus restoration efforts on those factors which have the greatest impact, including anthropogenic sources of oxygen consuming waste upstream of the reclassified reach. We offer four technical suggestions for DWR's consideration:

- 1) The proposed management plan concludes with "Any new or expanded permitted pollutant discharge of oxygen-consuming waste shall not cause the DO of the receiving water to drop more than 0.1 mg/l below the modeled in-stream DO at total permitted capacity." We suggest replacing "Any" with "All" so that the cumulative impact of all additional permitted oxygen consuming waste is a diminishment of less than 0.1 mg/L. This is important because the monitoring and modeling confirm the reach has essentially no assimilative capacity given DO already low due to natural conditions.
- 2) The management plan should include the means by which the 0.1 mg/L cap on lowered DO will be determined. Important details to establish and get reviewed by stakeholders include the model to be used, input parameters, season to be modeled, location for compliance, and whether compliance is to be based on instantaneous versus average conditions.
- 3) Modeling reports note that reductions of oxygen consuming waste upstream of the modeled reach could appreciably improve DO in the modeled reach -- reducing excursions below the 5 mg/L standard. In other words, upstream water quality improvements could positively influence DO in the lower Cape Fear River. The reclassification may help in addressing important anthropogenic sources upstream of the modeled reach (e.g., CAFO associated waste from the Northeast Cape Fear River; large BOD point sources upstream of the modeled reach). It would be helpful if the management plan included a path forward on how to improve lower Cape Fear River DO concentrations through watershed-wide waste load modeling, land use planning, and permitting so water quality restoration is linked to the reclassification.
- 4) The management plan should discuss how DO use support determinations will be made if there is no lower bound on the frequency and magnitude of DO concentrations. It would help to explain how natural conditions will be differentiated from other conditions such that DO impairments can be identified and remedied. In short, some way to define a new floor with which to evaluate monitoring and compliance data should be established.

There are no federally- listed threatened or endangered species under Service jurisdiction in the affected reach. Shortnose sturgeon and Atlantic sturgeon are under the jurisdiction of NOAA Fisheries' Protected Species Division and may be affected by the action, so we encourage your continued coordination with them.

We will be glad to further explore these suggestions so that the outcome results in restoration of water quality for the benefit of fish and people. If you would like additional detail on any of our recommendations, please contact me at 919-856-4520 x.21.

Sincerely,

  
Tom Augspurger  
Ecologist

**Memo to: NC Division of Water Resources, and NC Environmental Management Commission**

**From: Dr. Michael A. Mallin, Research Professor, Center for Marine Sciences, University of North Carolina Wilmington, Wilmington, NC, 28409**

**Date: February 9, 2015**

**Subject: Comment on the proposed reclassification of the lower Cape Fear River and Estuary to Class Sc-Swamp (Sw) classification.**

- 1) I am very supportive of the statement in the reclassification proposal that states that any further municipal point sources will require the highest level of treatment in North Carolina. I would ask for more specifics regarding industrial discharges – at the least setting some limits on biochemical oxygen demanding agents such as biochemical oxygen demand (BOD), ammonia, total nitrogen (TN) and total phosphorus (TP).
- 2) An important statement that needs to be clarified is found in the narrative standards where it states that DO should not be less than 5.0 mg/L except that “swamp waters, poorly flushed tidally influenced streams or embayments, or estuarine bottom waters may have lower values if caused by natural conditions” . The issue that requires clarification is who decides, and by what criteria, if such a deviation is caused by “natural” conditions.
- 3) The proposed CFR reclassification does not adequately address non-point contributions of BOD or nutrients (which lead to BOD increases). If focus on non-point sources potentially contributing to oxygen depletion is continued to be addressed by on-going water quality programs; based on the summer blue-green algal blooms that occurred annually from 2009-2012, this approach has been inadequate and will continue to be inadequate.
- 4) In the lower Cape Fear River and Estuary, peer-reviewed research published in *Limnology and Oceanography* has demonstrated that BOD is driven by a number of biological and chemical factors (Mallin et al. 2004; Tables 4, 5 and 6) see the following:
  - Chlorophyll *a* (the principal measure of algal bloom strength) has been positively correlated with BOD5 in the mainstem river at Lock and Dam #1 ( $r = 0.55$ ,  $p = 0.0001$ ), Browns Creek ( $r = 0.45$ ,  $p = 0.007$ ), Hammond Creek ( $r = 0.45$ ,  $p = 0.004$ ), Great Coharie Creek ( $r = 0.51$ ,  $p = 0.001$ ), Colly Creek ( $r = 0.64$ ,  $p = 0.0001$ ), Barnards Creek ( $r = 0.37$ ,  $p = 0.040$ ), Motts Creek ( $r = 0.42$ ,  $p = 0.020$ ), and Smith Creek ( $r = 0.57$ ,  $p = 0.0009$ ). I note that Browns, Hammond, Barnards and Smith Creeks drain directly into the mainstem river or estuary, while Colly and Great Coharie creeks drain into the lower Black River, a major 5<sup>th</sup> order tributary of the 6<sup>th</sup> order Cape Fear River.
  - TN has been positively correlated with either BOD5 or BOD20 or both in the 5<sup>th</sup>-order Northeast Cape Fear River ( $r = 0.30$ ,  $p = 0.02$ ), the Black River ( $r = 0.45$ ,  $p = 0.0003$ ), Hammond Creek ( $r = 0.47$ ,  $p = 0.0003$ ), Six Runs Creek ( $r = 0.54$ ,  $p = 0.0005$ ), Great

Coharie Creek ( $r = 0.44$ ,  $p = 0.006$ ), Little Coharie Creek ( $r = 0.52$ ,  $p = 0.0008$ ), and Colly Creek ( $r = 0.54$ ,  $p = 0.0005$ ).

- TP has been positively correlated with either BOD5, BOD20 or both in the Northeast Cape Fear River ( $r = 0.34$ ,  $p = 0.008$ ) the Black River ( $r = 0.33$ ,  $p = 0.010$ ), Browns Creek ( $r = 0.40$ ,  $p = 0.012$ ), Hammond Creek ( $r = 0.42$ ,  $p = 0.009$ ), Six Runs Creek ( $r = 0.49$ ,  $p = 0.002$ ), Great Coharie Creek ( $r = 0.66$ ,  $p = 0.0001$ ), and Colly Creek ( $r = 0.39$ ,  $p = 0.015$ ).
  - Chlorophyll *a* represents algal blooms, which upon death and decomposition become highly labile sources of BOD. Nutrients drive BOD in two ways: directly and indirectly. A peer-reviewed article in *Ecological Applications* by Mallin et al. (2004) showed that for streams in the Black and Northeast Cape Fear River basins, inputs of dissolved phosphorus directly stimulate BOD5 and BOD20, as well as natural bacteria abundance (the direct driver of BOD). The data also showed that inputs of dissolved nitrogen (nitrate ammonium, and urea) significantly stimulate algal growth, which in turn significantly stimulates BOD. Thus, the correlation between nutrient loading and BOD is not surprising.
- 5) The proposed reclassification is based on the Bowen (2009) model predicting DO concentrations in the lower Cape Fear River Estuary
- The Bowen model concludes that further reduction of current point sources would have little effect on DO concentrations – I will accept the model’s conclusions on that matter.
  - But, Bowen’s model shows that reducing nutrient, carbon and BOD loads from the incoming rivers, creeks and wetlands by 30% and 70% would increase median DO from 5.6 mg/L to 5.85 and 6.2 mg/L, respectively – and this assumes sediment oxygen demand (SOD) stays the same regardless of reductions! See Bowen (2009) pages 6-4, 6-8, and 6-22 in particular for more on this topic.
  - Assuming that such BOD load reduction would similarly reduce SOD, than the model says summer DO violations would decrease from 45% to 22% violations (30% reduction case), down to 7% (with 50% reduction) and down to only 1% violations (70% reduction case).
  - I further note that SOD cannot simply be considered “natural” only. A year-long study of several tidal creeks in New Hanover County was published in the peer-reviewed journal *Hydrobiologia* (MacPherson et al. 2007). Results demonstrated that chlorophyll *a* concentrations were positively correlated with SOD ( $r = 0.35$ ,  $p < 0.05$ ), as well as BOD5 ( $r = 0.50$ ,  $p < 0.05$ ).
- 6) I note that Bowen does not discuss non-point source pollution sources specifically.
- 7) Yet, non-point runoff plays a major role in the middle to lower basin of the mainstem Cape Fear River, from crop agriculture, urban runoff and some livestock production. In the lower Cape Fear system I note that livestock waste pollution and crop agriculture are the predominant non-point nutrient and BOD sources in the Black and Northeast Cape Fear River basins.
- 8) Livestock manures as waste inputs were *not even mentioned* in Bowen’s model! However, 2012 livestock counts for Brunswick, Pender, Duplin, Sampson, Cumberland

and parts of Bladen and Onslow Counties (Cape Fear lower watershed) are as follows (information for counties that are partially within the basin, Bladen and Onslow, are estimates):

- Hogs: approximately 5,000,000
- Turkeys: approximately 21,500,000
- Broiler chickens: > 122,000,000
- Other chickens: > 870,000
- Cattle: approximately 72,000

(from NCDA website September 2014)

Livestock wastes are clearly the largest source of BOD-forcing pollutants in the Cape Fear Basin – and remain virtually unregulated (i.e. no required streamside buffers, no required control of ammonia off gassing, etc.).

- 9) Industrialized swine farms (CAFOs) are a source of large-scale chronic nitrogen and phosphorus loading to nearby soils and receiving water bodies, nutrients which have been directly correlated to BOD in the blackwater streams and rivers of the Cape Fear Basin (Mallin et al. 2006). A peer-reviewed analysis by Cahoon et al. (1999) published in *Environmental Science and Technology* found that vast quantities of nitrogen and phosphorus feed are imported into the watershed annually to feed swine, poultry, and cattle in production facilities (CAFOs), which in turn annually load large quantities of nutrients as waste into the watershed. This analysis found that for the Cape Fear River basin alone, CAFOs produce 82,700 tons of nitrogen and 25,950 tons of phosphorus annually into this watershed. Thus, N and P enter the state as animal feed from elsewhere, but much of it leaves the livestock as manure (or carcasses) and enters soils or waters of the Coastal Plain.
- 10) Finally, swine waste lagoons, as well as lagoons servicing egg-laying poultry CAFOs, produce copious amounts of ammonia to the atmosphere; NC Division of Air Quality estimates a swine ammonia emission factor of 9.21 kg/hog-year.  $9.21 \times 5,000,000$  head of swine = 46,050,000 kg or 46,050 metric tons of ammonia released to the airshed of the Cape Fear River basin (and coastal ocean) per year, much of which comes to earth within 60 miles of the source (Walker et al. 2000; Costanza et al. 2008). Ammonia is well-known in the environmental engineering literature to exert an oxygen demand (nitrogenous BOD) on waters – that is why it is regulated in wastewater discharges (Clark et al. 1977). Efforts need to be made to control this major source of oxygen-demanding wastes to the Cape Fear system as well.
- 11) Clearly, non-point sources of BOD, nitrogen, and phosphorus entering the waters of the lower Cape Fear River system are very large and lead to reduced dissolved oxygen levels.

I conclude that the proposed reclassification, as it stands, will be inadequate to produce or maintain proper dissolved oxygen concentrations in the lower Cape Fear River and Estuary due to the lack of attention to non-point sources of nutrients and BOD. The source of much of this pollution is industrial livestock production, along with unknown inputs from traditional agriculture, and some urban runoff in the Fayetteville and Wilmington areas. **Any**

**proposed reclassification of the lower Cape Fear River and Estuary must include strong language specifically aimed at reducing such non-point sources of pollution.**

Literature Cited

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**Kountis, Elizabeth**

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**From:** Ashley Daniels <AshleyNDaniels@gmail.com>  
**Sent:** Tuesday, February 24, 2015 5:43 PM  
**To:** Kountis, Elizabeth  
**Subject:** I live here and this is my home.

Dear Ms. Elizabeth Kountis,

I was born in Southeastern North Carolina and still as an adult I call this place my home. I am shocked and appalled by the decline in our concern for the land on which we all depend and hopefully our children will be able to depend.

I understand no one can have everything they want all of the time, compromise is necessary but some things simply cannot be compromised.

Classifying the water in lower Cape fear River as swap water would be temporary solution to a permanent problem. This decision will effect the popluations of people who sail paddle and fish in this area. Surely we can't think that simply changing the name will change the consequences that will surely come. I implore you to do the right thing. Act responsibly in your position, clean up our river.

Sincerely,

Ashley Daniels

823 Strickland Pl  
Apt 1  
Wilmington, NC 28403



## North Carolina Department of Environment and Natural Resources

Pat McCrory  
GovernorDonald R. van der Vaart  
Secretary

## MEMORANDUM:

TO: Elizabeth Kountis, Division of Water Resources, Planning Section

FROM: Shane Staples, DCM Fisheries Resource Specialist

SUBJECT: Proposed Cape Fear Water Quality Resignation from SC to SW

DATE: 3/3/15

A North Carolina Division of Coastal Management (DCM) Fisheries Resource Specialist has reviewed the proposed swamp reclassification of the Cape Fear River from the mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut where the Intracoastal Waterway meets the river. This reach of the Cape Fear River is currently classified SC and is experiencing impairments in the form of high levels of fecal coliforms and at times low dissolved oxygen levels that can be detrimental to fish and shellfish in the river. Much of the area is closed to shell fishing due to pollution that can be attributed to the highly developed watershed. The Cape Fear River is used by nearly all species of estuarine fish and shellfish found in North Carolina including the federally endangered shortnose sturgeon and Atlantic sturgeon.

Reducing water quality standards in this reach of the river could have negative effects on fish and shell fish that use the Cape Fear River. As well as being known habitat for both federally endangered sturgeon species it is also classified as a Primary Nursery Area (PNA) by the North Carolina Division of Marine Fisheries. Water bodies classified as PNA's are habitats that are essential to larval and juvenile fish and shellfish survival and recruitment. The number and diversity of juvenile fish collected in NDMF sampling in this section of the Cape Fear show this area to be highly productive; reductions in the water quality standards for this area could impair its function as a nursery area. Fish kills caused by low dissolved oxygen levels are a normal summer occurrence in NC estuaries due to already impaired conditions, reducing the dissolved oxygen standard could exacerbate this problem. Additionally, even though many of the shellfish harvest closures in the area are due to pollutant runoff the proposed change in water quality standards could possibly lead to expanded closures in the Cape Fear.

Contact Shane Staples at (252) 948-3950 or [shane.staples@ncdenr.gov](mailto:shane.staples@ncdenr.gov) with further questions or concerns.

## Comments on the Proposed Reclassification of the Lower Cape Fear River and Estuary to a Class Sc (Sw) Swamp

Prepared for Waterkeeper Alliance by JoAnn M. Burkholder, Ph.D., March 3, 2015

### I. Overview

Since 1998, the lower Cape Fear River Estuary (LCFRE) segment from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been on North Carolina's 303(d) list of officially "impaired" (degraded) waters due to low dissolved oxygen (DO). In 2006, the state added impairment for pH, copper and turbidity to the 303(d) list for this segment. Throughout the past several decades, a subset of regulated point sources (i.e., with wastes mainly discharged to surface waters through one or more pipes) have been the state's focus for water quality improvement. In 2014, the North Carolina Division of Water Resources within the Department of Environment and Natural Resources (NCDENR-DWR) received a request from a group including various point source dischargers to reclassify the LCFRE from Class Sc to Class Sc-Swamp (Sw) (May 2014). The rationale given for the request included two points - first, that a recent modeling effort (Bowen et al. 2009) had assessed the 20 largest point sources in the lower Cape Fear River basin and concluded that the sources have little influence on water-column DO concentrations in the LCFRE; and second, the group asserted that significant reductions in pollutant loading from other sources which they call "background" loads would not achieve attainment for certain periods of the summer. The request specifically stated,

...modeling results indicate that [the 20 assessed] point-source discharges have a relatively minor impact on DO levels, and that even significant reductions in background (both natural and nonpoint source) loads would not result in attainment of the current standard for considerable periods of time during the summer. - May (2014)

Based on this request and information, NCDENR-DWR recently proposed to reclassify the LCFRE to a swamp (Sw) based on the misleading claim that, since the LCFRE cannot meet its present DO standard ( $\geq 5$  mg/L) by controlling the 20 identified point sources alone as assessed in Bowen et al.'s (2009) model, a TMDL (total maximum daily load) to achieve the DO standard would be inappropriate. The proposed reclassification of the LCFRE to a swamp is not consistent with sound science or the law for three reasons:

1. The available evidence shows that the major sources of oxygen-demanding materials in the LCFRE are due to pollution from human activities which are subject to regulation and can be controlled. The major sources of oxygen-demanding materials are **not** natural wetland drainage or other natural background sources. Natural wetland drainage appears to add only a fraction of the massive contribution of oxygen-demanding materials, high levels of toxic copper, high turbidity, and many other pollutants that are being contributed by pollution from point sources, other regulated sources and nonpoint sources (see Sections IIID-E of these Comments).

2. Under the Clean Water Act, the required TMDL for the LCFRE must address **all** pollution sources, including point sources, other regulated sources, and nonpoint sources, in the watershed (see Section IIID of these Comments). In its proposed action, NCDENR-DWR has *not* considered ~22 NPDES-permitted point sources in the lower Cape Fear basin, or *any* of the ~153 NPDES-permitted point sources in the upper and middle Cape Fear River basin, which contribute to the impaired (degraded) water quality of the LCFRE which is at the receiving, lower end of the basin. NCDENR-DWR *also* failed to consider the impact of the nearly 1,000 industrial-scale swine Animal Feeding Operations as well as an unknown number of industrial-scale poultry Animal Feeding Operations, many of which are Concentrated (Confined) Animal Feeding Operations (CAFOs) and, thus, point sources under the Clean Water Act. These sources were also omitted from specific analysis in the Bowen et al. (2009) model, although many of the industrial facilities are located in the lower basin (see Section IIIE of these Comments). As a scientist, I first approached their inclusion in these Comments by checking the formal definition of CAFOs in the Clean Water Act (Section 502(14)). *CAFOs are formally defined there as point sources.* They are supposed to be regulated using National Pollution Elimination Discharge System (NPDES) permits, as other industrial point sources are regulated. There are about five million swine in the Cape Fear basin. Each swine produces, on average, about four times more sewage than one person (see Section IIIE). Therefore, the swine CAFO point sources, which are predominantly in the lower Cape Fear basin, contribute roughly the same amount of sewage to that relatively small area, *per year*, as 15 million people. Moreover, swine wastes are much richer in oxygen-demanding materials than human sewage. Industrialized poultry production, also massive in the Cape Fear River basin, contributes to oxygen-demanding materials and other water quality degradation of the LCFRE as well (see Section IIIE). Overall, ~175 NPDES-permitted point sources in the Cape Fear River watershed, and nearly 1,000 swine CAFO point sources as well as an unknown number of poultry CAFOs, were not identified and appropriately evaluated by Bowen et al. (2009) and NCDENR-DWR. These sources are not simply “background” as misleadingly characterized in the materials underlying the NCDENR-DWQ Proposal to reclassify the LCFRE and in the Proposal itself. Collectively, and often individually, these facilities are **extreme**, chronic pollution sources of oxygen-demanding materials to the LCFRE. They can be, and should be, addressed through state regulatory programs, the Clean Water Act and a TMDL for the LCFRE.
3. *Significant reductions in the erroneously termed “background” loads would achieve attainment of the present DO standard in the LCFRE segment.* As explained above, what was misleadingly and inaccurately called “background” in the lower Cape Fear basin includes the point source pollution from ~175 NPDES-permitted point sources in the Cape Fear River watershed, and from nearly 1,000 swine CAFOs and an unknown number of poultry CAFOs. All of these pollution sources were not among the 20 considered by Bowen et al. (2009) as the main point source contribution to the LCFRE. These sources were, at least, tacitly included in Bowen et al.’s (2009) model within a category called “tributary inputs.” The model predicts that a reduction of 30% of the “tributary inputs” would result in median DO levels in the LCFRE that exceed 5 mg/L -- that is, higher than the state standard -- and that a

70% reduction in the “tributary inputs” and the internal oxygen demand (below) largely resulting from these inputs would bring the LCFRE into compliance 99% of the time.

If the proposed reclassification occurs, NCDENR-DWR will accomplish a contrived, highly artificial “official change” of a major, strongly flowing estuary of national importance to a “swamp” with no scientific basis. Rather than providing cleanup and protection of the impaired segment -- which has been officially designated as impaired and in need of improved protection for nearly two decades -- this action would allow much more pollution to occur there, in violation of the Clean Water Act. Consequently, NCDENR-DWR’s proposed reclassification would jeopardize the designated uses of the LCFRE. The LCFRE should *not* be reclassified as a swamp.

The scientific facts briefly mentioned above, which accurately describe the status of the LCFRE and the pollution affecting it, are explained in detail in the following comments, supported by peer-reviewed science literature and findings from federal agencies such as the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (USEPA).

## II. The Mighty Cape Fear River

The Cape Fear River basin, completely contained within North Carolina, is the largest watershed in the state, covering ~16.5% (~9,324 square miles) of total land area. It also contains the largest number of stream miles (6,204) in North Carolina (Lin et al. 2006, Bowen et al. 2009 and references therein). The 26 counties within or overlapping the watershed are expected to grow from 3 million to about 5 million people over the next 20 years.<sup>1</sup> There presently are about 1.7 hogs per person in the Cape Fear basin, and industrialized swine production as well as turkey production in the lower basin are among the most concentrated in the world (Mallin et al. 2003).

The LCFRE is “extremely important... because of its function as a nursery for juvenile fish, crabs, and shrimp . . . The river is also an important natural resource that supports many uses including industry, transportation, recreation, drinking water, and aesthetic enjoyment” (Bowen et al. 2009). On a popular tourism website<sup>2</sup> are quotes such as the following about the LCFRE (emphasis added):

- Hard to review a river! It's *wild, powerful*, beautiful in all seasons....
- Amazing to walk down on the observation area and look at *how fast the river moves through this area*. You can understand how and why it got its name.
- *Cape Fear river current is very swift and strong*.

Thus, casual observers can discern that this segment of the LCFRE is highly river-influenced with strong flow. Bowen et al. (2009, p. 2-4) wrote, “[f]rom a hydrodynamic perspective,

<sup>1</sup> (NDENR) [http://www.eenorthcarolina.org/images/River%20Basin%20Images/final\\_web\\_capefear.pdf](http://www.eenorthcarolina.org/images/River%20Basin%20Images/final_web_capefear.pdf).

<sup>2</sup> ([http://www.tripadvisor.com/ShowUserReviews-g49673-d107702-r242913110-Cape\\_Fear\\_River-Wilmington\\_North\\_Carolina.html#REVIEWS](http://www.tripadvisor.com/ShowUserReviews-g49673-d107702-r242913110-Cape_Fear_River-Wilmington_North_Carolina.html#REVIEWS))

the Cape Fear has approximately a two-meter [~6-foot] tide range and strong tidal currents (> 0.5 meter per second) in the navigational channel of the open estuary and in the narrower tidal river channels of the three major tributaries (the mainstem freshwater river, and the Northeast Cape Fear and Black Rivers).” The LCFRE system is, in fact, documented in the science literature as strongly flowing down to its confluence with the Atlantic Ocean (e.g. Ensign et al. 2004, Lin et al. 2006, Becker et al. 2010). The strong flow minimizes stagnant areas and helps to add oxygen from the overlying air (Wetzel 2001).

It has been erroneously suggested in the NCDENR-DWQ Proposal and supporting materials that this strongly flowing, high-volume river is so strongly influenced by oxygen-demanding materials from natural drainage of freshwater wetlands and saltmarshes that the LCFRE is “swamp-like” with respect to DO conditions. Slowly flowing blackwater streams with instream wetlands in the Coastal Plain of the southeastern U.S. *can* receive high inputs of DO-demanding materials from the wetlands, and DO can range from 4-6 mg/L (Mallin 2000, Todd et al. 2009, and references therein). However, *such characteristics of slow flow and in-stream wetlands do not characterize most of the LCFRE system*. One area of the estuary north of Wilmington which receives major influx of swine wastes from CAFOs, near the junction of the Cape Fear, Black, and Northeast Cape Fear Rivers, has been described as prone to low DO levels during summer-early fall, but the low DO levels there have been related to *high anthropogenic pollution* along with inputs of natural organic materials (Mallin et al. 2003). Water quality in that area, as throughout the segment, would be greatly improved by reducing the high anthropogenic pollution coming into the segment from the many regulated pollution sources in the Cape Fear watershed that were inappropriately excluded from consideration or lumped in with background sources in the NCDENR-DWR Proposal and supporting materials.

### III. Sources of Water Quality Impairment

#### A. Historic Background, Assessments, and Erroneous Assertions

Historically, the LCFRE system was considered non-eutrophic because of its rapid flushing (Ensign et al. 2004). In the upper and middle Cape Fear River during 1955-1980, Crawford (1985) noted that DO concentrations at Lock 1 averaged 8.2-8.4 mg/L depending on the data source, and that on only two occasions from 1975 to 1980, DO samples were above 4 mg/L but less than 5 mg/L. Similarly, NCDENR (1999) described the upper portions of the estuary in the 1990s as rarely having sustained low DO levels that caused problems (assumed to refer to problems for aquatic life). The present-day LCFRE, however, is impaired due to major pollution from the upper, middle, and lower watershed (Cahoon et al. 1999, Mallin 2000, Mallin et al. 2003). As a result of declining water quality due to many pollution sources, for the past ~15 years the Cape Fear Estuary has been characterized as moderately eutrophic (= moderately nutrient-polluted; Bricker et al. 1999).

As described by NCDENR (2005),

The [Cape Fear] watershed (about 9,149 square miles) is the most heavily industrialized in North Carolina with 244 permitted wastewater discharges and (as of 2000) over 1.83 million people residing in the basin....

Approximately 24% of the land use in the watershed is devoted to agriculture and livestock production.

Historically, post-European settlement, the lower Cape Fear River and Estuary received mostly raw (untreated) or partially treated wastes from the Riegel Paper Corporation (in Wilmington; became Federal Paperboard Company, and then International Paper from 1996 to the present) and the various, relatively small human population centers that developed along it (State Stream Sanitation Committee 1957, CH2MHill 2014a - Technical Memo 1 in May 2014, used to support the request for reclassification of the LCFRE segment). CH2MHill (2014a) described the previous situation as "significant impacts from untreated and poorly treated wastewater under low to moderate flow conditions in the river" prior to improvements in waste treatment. In the mid-1950s on one date (August 30, 1955), low DO (1.3-2 mg/L) and low pH (5-6) were measured in the Northeast Cape Fear and Black Rivers, the two main tributaries to the Cape Fear Estuary other than the mainstem Cape Fear River as mentioned. On two dates (July 23-24, 1956) during moderate flows from these two tributaries and high flow from the mainstem Cape Fear River, DO and pH in the lower river were 2.8-4.9 mg/L and 6.8-7.2, respectively. The interpretation from this sparse information (three dates, ~60 years ago) was that "*under some situations, swamp drainage conditions could significantly influence DO and pH conditions in the river. . .*" (emphasis added) (State Stream Sanitation Committee 1957, CH2MHill 2014a).

From there, however, a major "leap" occurred in CH2MHill's (2014a) writing (p.D-15 in May 2014): Riparian wetlands -- that is, natural wetland drainage -- were described, without any other supporting data, as the "significant contributors to the tremendous loads of oxygen-demanding materials." CH2MHill (2014a, p.D-15) secondarily acknowledged that inputs of biochemical oxygen demand (BOD) have also been contributed by raw and partially treated sewage, and from swine wastes, although CH2MHill mistakenly stated that swine wastes only contribute pollution to the LCFRE when cess pits breach. As corrective information, swine wastes *routinely* contaminate the LCFRE (see Section III E of these Comments), and researchers have evaluated swine CAFO wastes as a major source of BOD in the LCFRE (e.g. Mallin et al. 1997, 2006; Mallin 2000). Yet, the remainder of CH2MHill's (2014a) writing implicated natural drainage from wetlands as the major contributor of oxygen-demanding materials to the LCFRE. In the 1950s, the Cape Fear basin had less industrialization and fewer point sources (including no CAFOs), but the present reality is far different. As explained above, the Cape Fear River basin is *now* described as the largest, most industrialized watershed in North Carolina (Mallin et al. 2003, NCDENR 2005).

TetraTech (2014 - Technical Memo 2 in May 2014, used to support the request for reclassification) considered BOD loads from three specific point sources, which they erroneously described as contributing about 90% of all point source loads to the LCFRE. In reality, these three point sources contribute only a small fraction of the total point source loads - see Section III D-E of these Comments. Based on data from the previous 20 years, TetraTech reported a significant downward trend (~23% decrease over time) in oxygen-demanding pollutant loads from the three selected point sources, without a corresponding decrease in water-column DO. The lack of a corresponding decrease in average DO should have been expected, considering that TetraTech *did not* assess ~1,194 other regulated sources in the Cape Fear watershed that are contributing oxygen-demanding materials and other pollution to the LCFRE. Over the same 20-year period in the Cape Fear River basin,

the human population increased by ~0.66 million and swine production increased by ~5 million animals per year (compiled from U.S. Census Bureau data, Burkholder et al. 1997, and Cahoon et al. 1999). Yet, TetraTech (2014) implicated wetlands as the major contributor to oxygen-demanding materials in the the LCFRE. TetraTech stated that the information from its recent analysis supported its previous assessments of the LCFRE (TetraTech 2001, 2003), and erroneously maintained that its assessment supported reclassification of the LCFRE segment to a swamp.

CH2MHill (2014b - Technical Memo 4 in May 2014, used to support the request for reclassification) described an analysis of surface water quality conditions in summer (which was defined as April-October) at main inflows to the Cape Fear River Estuary including the Middle Cape Fear River, the Black River, and the Northeast Cape Fear River. Importantly, *the Northeast Cape Fear River and the Black River stations were erroneously described as characteristic of "water quality as water leaves areas currently classified as swamps."* These segments are classified as swamps, but their present water quality reflects massive pollution, not natural wetland inputs (see Section IIID, p.18 below). During the early to mid-1990s, the relatively small areas of the Northeast Cape Fear and Black River watersheds sustained an influx of more than 800 swine CAFOs with more than 3 million swine produced per year (NCDENR 2005; and *Figures 1 and 2*). They contribute roughly the same amount of wastes as 12 million people, and the wastes are poorly regulated (see Section IIID).

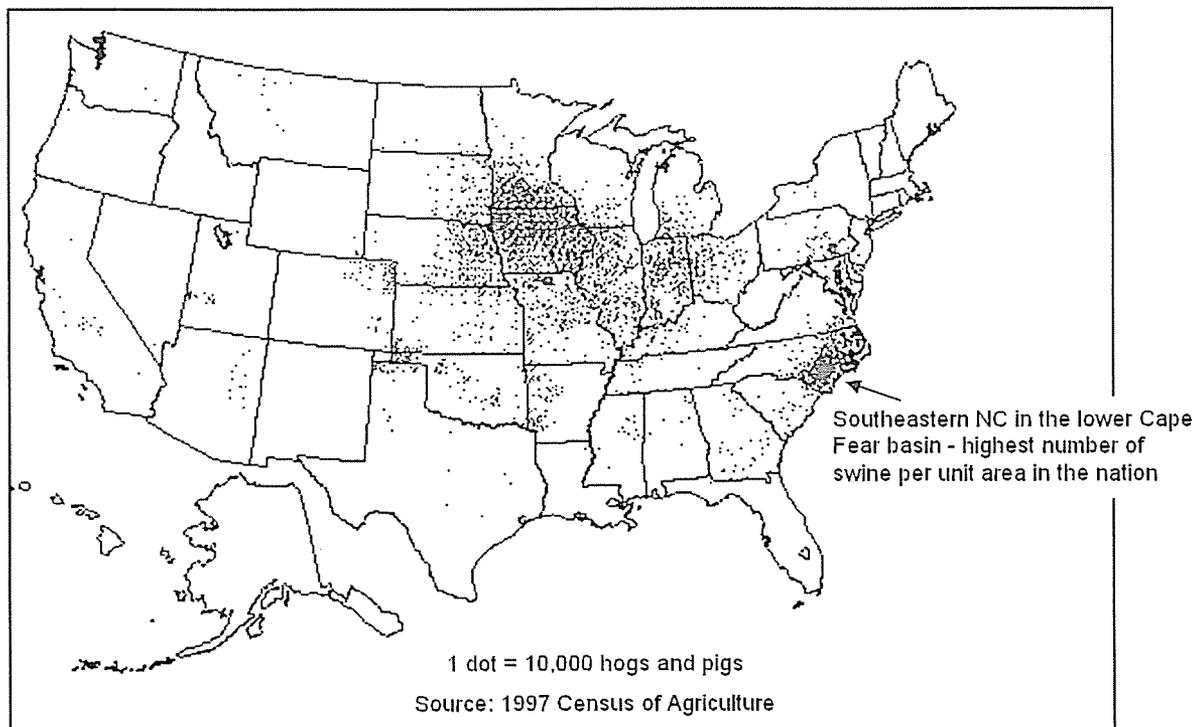
Bowen et al. (2009) tacitly included pollution from swine feeding operations in "tributary inputs" although they were not specifically mentioned. CH2MHill (2014b) and TetraTech (2014) not only failed to mention them (and in CH2MHill 2014a, there was only one, partly inaccurate mention of swine operations as described above), but also omitted them from consideration. All of the other point source contributions from the upper and middle watershed were not considered as well. The omission of CAFO wastes and most other point sources in the watershed from consideration in assessments of oxygen demand in the LCFRE is irrational rather than science-based. The extreme error of omission in those reports is compounded by an equally extreme error of co-mission - repeatedly attributing to natural wetland drainage the massive oxygen-demanding pollution known to be contributed by other sources including CAFOs (e.g. Dewi et al. 1994, Burkholder et al. 2007 and references therein; see Section IIID below). Similarly, NCDENR was described by May (2014, p.D-3) as having stated, erroneously, that "changes in the classification of the LCFRE might be appropriate to recognize the influence of natural drainage from riverine and saltwater marsh systems in the watershed on DO concentration."

*There is no basis in fact - no data - supporting major attribution to natural freshwater wetlands and saltmarshes of what CH2MHill (2014a) described as "tremendous" loads of oxygen-demanding materials in the LCFRE, while "overlooking" the massive pollution from ~98% of the point and other regulated sources in the watershed.*

## **B. Processes Influencing DO Conditions, and Available Information for the LCFRE**

Several major processes influence water-column DO concentration in rivers (*Figure 3*). Oxygen demand from two general sources controls water-column DO: *external* (incoming)

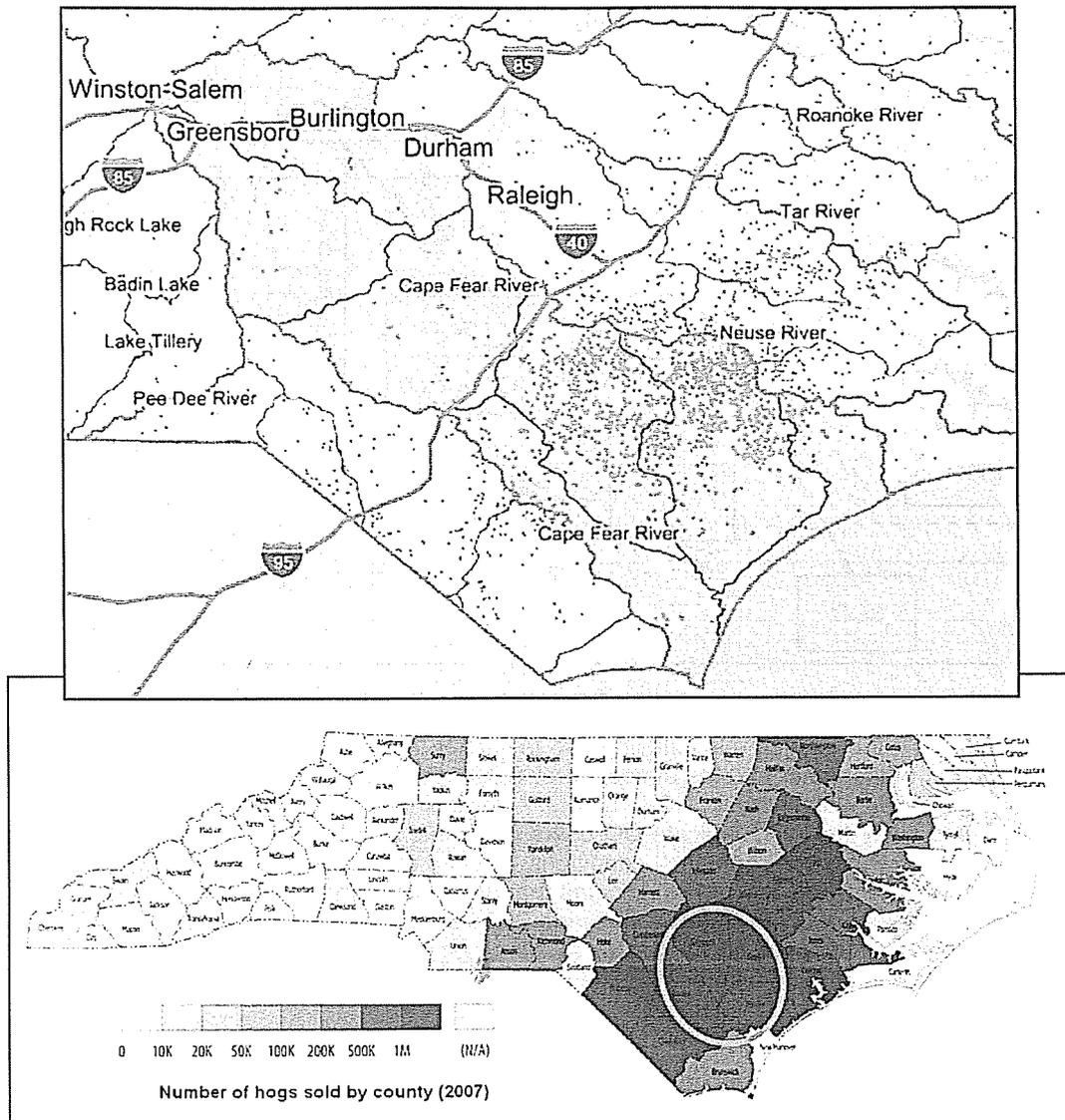
materials from land-based sources, upstream waters and the overlying airshed, usually referred to as the BOD in the water column, and the “*internal*” oxygen demand from biota respiration and river bottom sediments, usually called the sediment oxygen demand (SOD).



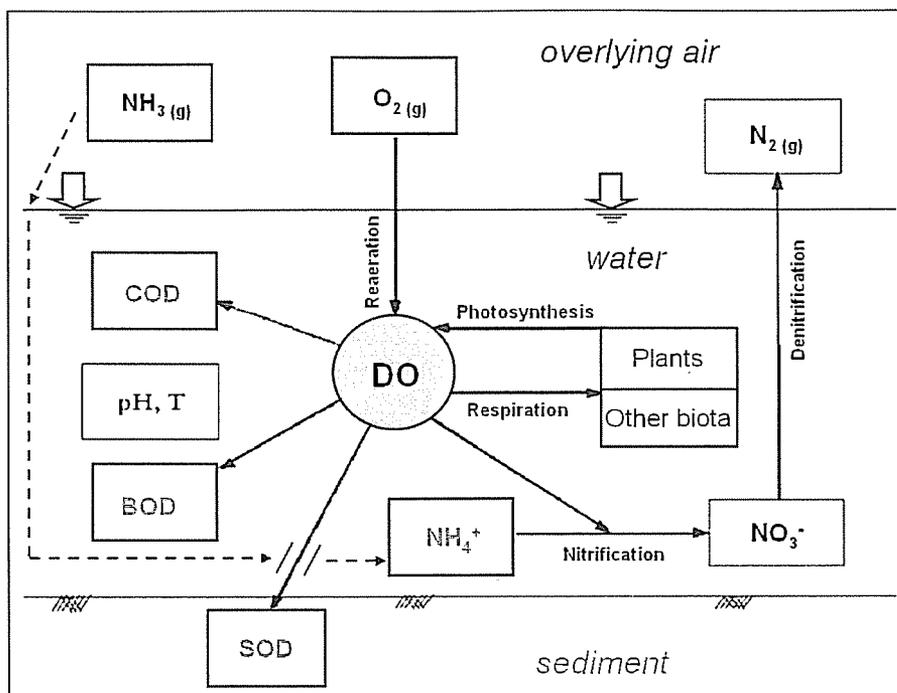
**Figure 1.** Map showing the number swine in southeastern North Carolina, with most CAFOs in the lower Cape Fear River basin area (source: [http://scorecard.goodguide.com/env-releases/aw/nc-riverbasin.tcl?image\\_id=030300&huc6=030300](http://scorecard.goodguide.com/env-releases/aw/nc-riverbasin.tcl?image_id=030300&huc6=030300)). This map, produced by the USDA based on 1997, data, is supported by a more recent map, available at [http://www.agcensus.usda.gov/Publications/2012/Online\\_Resources/Ag\\_Atlas\\_Maps/Economics/Market\\_Value\\_of\\_Agricultural\\_Products\\_Sold/12-M030.php](http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Ag_Atlas_Maps/Economics/Market_Value_of_Agricultural_Products_Sold/12-M030.php), which shows the value of hogs and pigs sold in 2012 as the percent of the total market value. The highest concentration of swine per unit surface area across the nation is in the lower Cape Fear River basin.

BOD (units, milligrams per liter, mg/L) is the sum of carbonaceous and nitrogenous oxygen demands; it is a measure of the molecular oxygen used in the water column during a specific incubation period, usually 5 days, for the biochemical degradation of organic material (carbonaceous demand) and the oxygen used to oxidize inorganic material (nitrogenous demand), as well as the amount of oxygen used to reduce forms of nitrogen (Eaton et al.1995, MacPherson 2003).

SOD (units, grams of molecular oxygen per square meter per day, g O<sub>2</sub> /m<sup>2</sup>/day) is defined as the rate of DO removal from the water column due to the decomposition of organic matter in the bottom sediments (Hatcher 1986). It consists of biological sediment oxygen demand (usually at the sediment surface, dominated by bacteria that consume organic materials) and chemical sediment oxygen demand (usually ~2 inches down in the sediment, where anaerobic



**Figure 2.** Upper panel - map showing the locations of swine CAFOs in North Carolina, indicating the preponderance of CAFOs in the lower Cape Fear River basin (source: [http://scorecard.goodguide.com/env-releases/aw/nc-riverbasin.tcl?image\\_id=030300&huc6=030300](http://scorecard.goodguide.com/env-releases/aw/nc-riverbasin.tcl?image_id=030300&huc6=030300), last accessed in February 2015). Lower panel: Map showing the numbers of hogs sold in North Carolina counties during 2007 (K  $\equiv$  thousands, M  $\equiv$  millions; U.S. Census data), modified from Learn NC, a program of the University of North Carolina School of Education (available at <http://www.learnnc.org/lp/editions/nchist-recent/6257>, last accessed in August 2014). The darker area "down east" on the Coastal Plain of the state has, as mentioned, the highest concentration of swine per unit area in the nation (National Hog Farmer 2014.).



**Figure 3.** A schematic of the major processes influencing the water-column (“water”) DO concentration in rivers:  $O_2$  = the oxygen gas diffusing into the water from the atmosphere;  $N_2$  - the nitrogen gas diffusing out of the water into the atmosphere; COD - the immediate chemical oxygen demand; T - temperature;  $NH_4^+$  - ammonium;  $NO_3^-$  - nitrate. Arrows directed toward DO indicate DO sources; arrows directed away from DO indicate DO users (consumers or “sinks”). Parameters in red are oxygen-demanding. Other environmental conditions that can affect DO are represented by pH and temperature (T). The dashed-line arrow indicates that ammonia from the overlying airshed, largely contributed in southeastern North Carolina by swine CAFOs (Walker et al. 2000, Aneja et al. 2003), is mostly ionized to ammonium in neutral to alkaline waters and becomes a source of nitrogenous oxygen demand in forming nitrate. Modified from Cox (2003).

anaerobic bacteria degrade organic matter in a process that produces reduced ions that react with oxygen when they diffuse upward to an oxidized area (Walker and Snodgrass 1986).

The organic materials contributing to SOD can come from outside the system (such as leaf litter or settling of organic particles from human or animal wastes), or from within the system (such as decomposing algae). SOD is positively related to the amount of organic carbon content (i.e., bioavailable organic materials) in the sediment (MacPherson 2003 and references therein). Basically, the rate at which the sediment community consumes oxygen indicates whether the sediment area is degraded by too much organic matter (Massachusetts Water Resources Authority 2002). Once organic material reaches the bottom sediments of the river segment, SOD is influenced by two different processes: the rate at which oxygen diffuses into the sediments and is consumed there, and the rate at which reduced organic substances move into the water column and are then oxidized (Bowie et al. 1985, Todd et al. 2009).

Thus, SOD is the combination of the respiration of bottom-dwelling organisms in the sediment from decomposition of organic matter, and chemical oxidation of reduced substances in the sediment (Todd et al. 2009, and references therein). SOD can create oxygen deficits by reducing the amount of available oxygen in the overlying water (Seiki et al. 1994), and it can be a significant percentage of the total oxygen consumed in a given river or estuary (Caldwell and Doyle 1995). SOD rates serve as proxies for the effects of pollution on the biological activity of the bottom (benthic) community; for example, a nutrient-polluted system generally has an increased demand for oxygen (Natural Research Council 2000). Extreme levels of SOD ( $\sim 20 \text{ g/m}^2/\text{day}$ ) can occur from oxygen consumption by animal wastes or sewage materials that settled out to the bottom (Davis 1950). Reduction in the amount of incoming organic materials from such pollution can lower the SOD as the system recovers (see Massachusetts Water Resources Authority 2002).

The sophisticated three-dimensional, Environmental Fluid Dynamics Code model used by Bowen et al. (2009) requires extensive information for the many factors needed to construct (parameterize) it for a specific river segment (Hamrick 1992; Bowen et al. 2009 - see p.v, Table 1, and Figure 2 in that document). Adequate measurements from the LCFRE for many of these factors were/are not available, and they vary considerably from river to river (Hamrick 1992, Todd et al. 2009, and references therein). The required missing or sparse (inadequate) information includes oxygen fluxes between the water column and the bottom sediment of the river. The information was instead “prescribed” (estimated, or taken from general literature not specific to the LCFRE) (Bowen et al. 2009, p.2-1). Bowen et al.’s (2009) model development revealed that, as in many if not most lower rivers along coastlands, SOD has an especially significant impact on DO concentrations. *SOD varies by as much as three orders of magnitude (1,000-fold) from river to river*, with rates ranging from  $\sim 0.1$  to 18 grams of oxygen [demand] per square meter per day ( $\text{g/m}^2/\text{day}$ ) (Rolley and Owens 1967, Chapra 1997, Todd et al. 2009). Importantly,

The effect of SOD on the oxygen budget of an entire river system should not be underestimated, as it can be a critical sink of DO (Wu 1990). Indeed, in some rivers SOD can account for over half of the total oxygen demand and can play a primary role in the water quality....[Yet] this parameter is often assumed (or estimated) in water quality models (Hatcher 1986, Matlock et al. 2003). Errors in this measurement could lead to inaccurate models for the stream environment, at great biological and financial cost. - Todd et al. (2009)

Only sparse, dated SOD information was available for the LCFRE, taken more than a decade ago by the former NCDENR – DWQ (Division of Water Quality) at five locations on only five dates during summer/fall of one year, 2003 (Bowen et al. 2009, pp. 2-14, 2-15). At a given location, SOD is known to vary substantially by season and from year to year (Hatcher 1986, MacPherson 2003 and references therein). Lacking sufficient data and, thus, finding these sparse data to be a poor fit for the model overall, Bowen et al. (2009) “selected” SOD values until they found one that best fit their model for predicting water-column DO data, which had been constructed using available water-column DO measurements. In other words, Bowen et al. knew what the water-column DO had been because it had been measured during the period of focus, so they tried different SOD values until the model generally “fit” the water-column DO data. The SOD value (adjusted in an attempt to allow

for seasonal changes) was applied to most of the LCFRE; a second, nearly four-fold higher value for SOD was applied to the Northeast Cape Fear River which is heavily influenced by swine CAFOs (see p.18 below). Bowen et al.'s (2009) approach to estimate SOD technically requires that all rates except SOD have been accurately determined based on data for the specific system (Cox 2003). In reality, some of the data needed to accurately estimate the major rates of processes shown in *Figure 3* of these Comments (photosynthesis, respiration, nitrification, denitrification, reaeration) are lacking at representative points along the LCFRE system. Such data should include at least monthly measurements from April through October during dry, average-precipitation, and wet years (Hatcher 1986 and references therein).

### **C. The Model Predicted 90% Control of LCFRE DO Levels by the "Tributary Inputs," and Compliance with the DO Standard by Reducing Those Inputs**

Despite the above-described weaknesses, Bowen et al.'s (2009) model *did* predict - as would be expected from knowledge of pollution sources in the LCFRE basin - that the 20 point sources they considered had only a small effect on the water-column DO concentrations. In contrast, "tributary inputs," loosely defined as excluding the 20 point sources, were evaluated as the major controlling influence on DO. Importantly, when Bowen et al. artificially forced SOD to remain constant over time despite imposing reductions of 30%, 50%, or 70% in BOD loads from the "tributary inputs," the model predicted that the BOD decreases alone would increase median DO concentrations to well above the present DO standard of 5 mg/L. In addition, if BOD from tributary inputs and SOD were both reduced by 30%, the model predicted that summer DO violations would decrease from 45% to 22%, down to only 7% with a 50% reduction, and down to 1% with a 70% reduction. Such a scenario of decreasing BOD and SOD is realistic, as SOD is known to decrease over time with decreasing water-column BOD inputs, and related decreases in the bioavailability of organic matter that settles out to the sediments (Hatcher 1986, MacPherson 2003 and references therein).

Bowen et al. (2009) did not attempt to address the predominant sources in the "tributary inputs." They aptly noted (pp. vii-viii) that their model indicated the importance of benthic fluxes of oxygen. They also aptly recommended additional work to assess SOD and also, importantly, to separately consider the effects of wetland (natural) versus "riverine" (pollution carried by the river and tributaries) loadings to DO conditions in the estuary. The subsequent work in support of this proposal did not conduct these evaluations.

### **D. Point Source Pollution from NPDES-Permitted Facilities Upstream from the LCFRE**

Given the above predictions from Bowen et al.'s (2009) model, control of "tributary inputs" *would* allow the LCFRE to attain the present DO standard. Therefore, a TMDL for the LCFRE segment is entirely appropriate. Moreover, as stated, the available scientific information indicates that human-related pollution - not natural wetland drainage - is the major source of oxygen-demanding materials to this segment (see pp. 18-19 below).

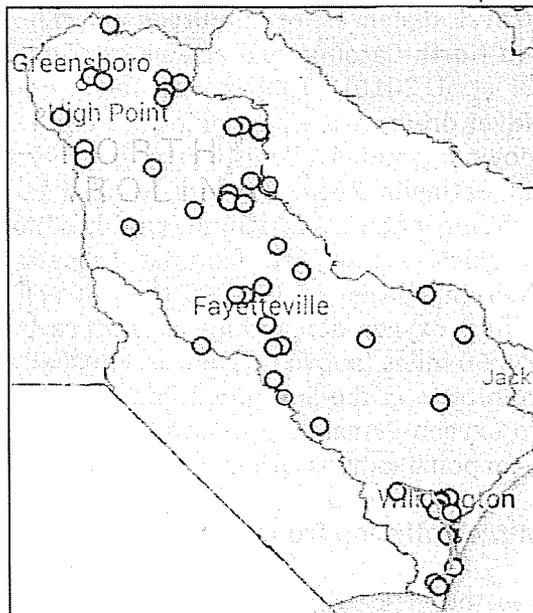
The U.S. EPA states that:<sup>3</sup>

<sup>3</sup> <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overviewoftmdl.cfm#tmdlrequired>

the objective of a TMDL is to determine the loading capacity of a given water body and to allocate that load among different pollutant sources so that the appropriate control actions can be taken and water quality standards achieved....**All contributing sources of the pollutants** (point and nonpoint sources) are identified, and they are allocated a portion of the allowable load...." (emphasis added).

Thus, a TMDL for the LCFRE should consider the entire watershed above that segment as potentially contributing to pollution in that segment. According to NC DENR<sup>4</sup>, the upper-middle Cape Fear basin has 38 major point sources (discharging  $\geq 1$  mgd; *Figure 4*) and ~115 minor point sources ( $< 1$  mgd) with NPDES permits. The lower Cape Fear basin contains 10 major point sources and 33 minor point sources with NPDES permits. Thus, the river sustains loading from 195 NPDES-permitted point sources including nearly 50 major NPDES-permitted point sources and nearly 150 minor NPDES-permitted point sources. Consider the following example of a major point source that was not among the 20 specifically assessed by Bowen et al. (2009):

The Smithfield Packing Company at Tar Heel in the mid-Cape Fear River basin, ~60 miles upstream from the LCFRE (location indicated by the red dot in *Figure 4*), is permitted to discharge up to 3 mgd of effluent containing up to 250 pounds of BOD<sub>5</sub> per day during April - October as a monthly average, and up to 500 pounds of BOD<sub>5</sub> as a daily maximum (NC DENR permit #NC0078344). During November-March, the plant is permitted to discharge double those amounts (i.e., 500 pounds per day, monthly average; 1,000 pounds per day, daily maximum, equivalent to 45 mg of biochemical oxygen-demanding materials/L). Rivers are considered to be stressed with too much BOD<sub>5</sub> if concentrations exceed 3 mg/L (Mallin et al. 2006). The plant is also permitted to discharge 30 pounds of ammonia-N/day as a monthly average during April-October, and 60 pounds of ammonia-N per day (7.5 mg/L) as a daily maximum. In November-March, these numbers, as pounds per day, can double. As explained, ammonia is oxygen-demanding, highly toxic to sensitive aquatic life, and a form of inorganic nitrogen that, at concentrations of only 0.1-0.2 mg/L, can stimulate noxious and toxic algal outbreaks (Bricker et al. 1999 and references therein, Mallin 2000). Other inorganic nitrogen forms, nitrate+nitrite, in discharges from the plant can be up to ~120 mg/L as a monthly average, and up to ~185 mg/L as a daily maximum. As stated,



**Figure 4.** Map showing the locations of major point sources with NPDES permits from NC DENR in the Cape Fear River basin (red dot, Smithfield Packing Company; red line - approximate location of the LCFRE segment proposed for reclassification). Modified from NC DENR (see websites given in footnote 4).

<sup>4</sup> 2014 - <http://portal.ncdenr.org/web/wq/npdes-major-facility-map>, and <http://portal.ncdenr.org/web/wq/npdes-minor-facility-map>.

only 0.1-0.2 mg/L of inorganic nitrogen is needed to stimulate noxious and toxic algal outbreaks. Thus, extremely high oxygen-demanding materials and inorganic nitrogen nutrient forms are permitted for discharge by this major point source.

Overall, nearly 150 NPDES-permitted point sources in the Cape Fear River watershed are upstream from or adjacent to the LCFRE. Some pollutants from these point sources, such as the highly soluble nitrogen species, nitrate, are highly soluble; nitrate, for example, is known to travel distances of hundreds of miles downstream from upper to lower watersheds in North Carolina and elsewhere (Mallin et al. 1993, Houser and Richardson 2010, Houser et al. 2010). That is why, for example, various pollutants from the upper Mississippi River drainage are known to contribute to the "dead zone" of little or no oxygen all the way down in southern Louisiana, near the river's confluence with the Gulf of Mexico (Goolsby and Battaglin 2001, Jacobson et al. 2011). Nutrient pollution contributes to oxygen-demanding materials by stimulating algal blooms that die and are then decomposed by bacteria which use oxygen for that process (Burkholder and Glibert 2013, and references therein). Based on the fact that nitrate, much less soluble pollutants such as phosphorus, and oxygen-demanding organic carbon materials can travel much longer distances than 60 miles (above references, Minshall et al. 1983, Meyer and Edwards 1990), the excessive nitrate in the Smithfield Packing Company discharge should be expected to contribute to oxygen-demanding materials in the LCFRE ecosystem. The same is true of other upstream point sources, other regulated sources and nonpoint sources.

#### **E. Point Source Pollution from Animal Production in the Lower Cape Fear Basin**

In addition to the ~150 NPDES-permitted point sources that should be considered by NCDENR in developing a TMDL to improve DO in the LCFRE, there are nearly 1,000 swine CAFO point sources in the lower Cape Fear basin (and an unknown number of poultry CAFOs, based on Mallin 2014). The available scientific information shows that swine CAFO point sources are the major source of water quality impairment in the lower Cape Fear basin.

Major degradation of the natural resources in the lower Cape Fear basin due to swine CAFO point sources -- encompassing degradation to the airshed, soils, groundwaters, and surface waters -- has been well-documented and is briefly summarized below. It merits mention that, throughout these Comments, the focus when considering CAFOs is on swine production because relatively little information about poultry production is available to scientists or other members of the general public (e.g. see Rothenberger et al. 2009a). North Carolina is second in poultry production among the states, but nearly all of the operations have fewer animals than are defined by the state legislature as a poultry CAFO, and most information is allowed to the general public only for poultry CAFOs. Thus, most information given below for industrialized animal production in the Cape Fear basin is substantially underestimated because it focuses only on swine.

The available information *does* show that poultry production is a major source of pollution in the Cape Fear watershed (Cahoon et al. 1999). According to the North Carolina Department of Agriculture (<http://www.ncagr.gov/stats/coest/Index.htm>), in 2012 the lower Cape Fear basin (Brunswick, Pender, Duplin, Sampson, and Cumberland Counties, and estimates for parts of Bladen and Onslow Counties) contained about 5 million swine,

21.5 million poultry, 123 million chickens, and 72,000 cattle. The facilities which produce these animals are *not* required to have streamside buffers, or to control of ammonia or hydrogen sulfide emissions etc. They *are* required to have what can only be described as grossly inadequate waste management because it clearly does not prevent major impacts to public trust natural resources (below). Cahoon et al. (1999) provided the following estimates for the Cape Fear River basin (recall that most swine production occurs in the lower basin):

- Swine: more than 7 million tons of fresh manure per year added to the lower basin;
- Poultry: 2.18 million tons of fresh manure per year;
- Cattle: 2.08 million tons of fresh manure per year;
- Total from this animal production: 82,700 tons of nitrogen (N) and 25,950 tons of phosphorus (P) (Cahoon et al. 1999), the two nutrients that are known to cause major noxious algal outbreaks (Burkholder and Glibert 2013).

Cahoon et al. (1999) concluded that:

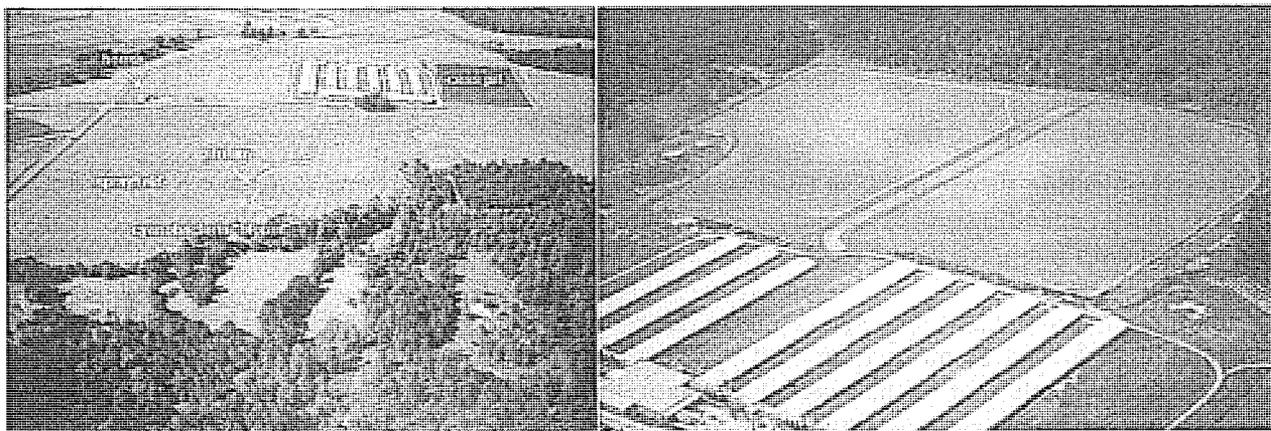
The eutrophication threat to these river basins [which included the Cape Fear River basin]... with expanding animal populations from the potential large nutrient loadings associated with intensive livestock operations is substantial.

Many contaminants are present in swine CAFO wastes and runoff, including extremely high levels of nutrients N and P, more than 100 microbes known to cause human disease, pharmaceutical chemicals that harm beneficial aquatic life, toxic heavy metals (especially copper and zinc), and pesticides such as toxic dithiocarbamates from sprayfield applications (Barker and Zublena 1995; Burkholder et al. 1997, 2007 and references therein, Iowa State University and The University of Iowa Study Group 2002, Extension Toxicology Network 2003). These contaminants can enter the surrounding environment through pathways such as leakage from poorly constructed cesspits, or during major precipitation events that cause cess pit overflow and runoff from recent sprayfield application, or atmospheric deposition followed by wet or dry fallout (Burkholder et al. 2007 and references therein). The magnitude and direction of transport depends on factors such as soil properties, contaminant properties, hydraulic loading characteristics, and crop management practices. Over-application of swine wastes to sprayfields can result in contaminants leaching through permeable soils into vulnerable aquifers (see Section III E - Groundwater Degradation from Swine CAFO Point Sources, below).

Contamination of surrounding public-trust surface waters such as the LCFRE in southeastern North Carolina is a common, routine problem *at recommended application rates* as well (e.g. Barker and Zublena 1995; Westerman et al. 1995; Zublena et al. 1995; Stone et al. 1995, 1998; Walker et al. 2000; Aneja et al. 2001, 2003). Improper disposal of animal carcasses and abandoned swine CAFO facilities also contribute to water quality problems. Siting of CAFOs in areas prone to flooding or where there is a shallow water table, such as in the lower Cape Fear basin, increases the potential for contamination of public trust natural resources as well.

**Swine CAFO point sources in the lower Cape Fear basin** - Swine CAFOs in southeastern North Carolina mostly were installed from the late 1980s through 1995. These CAFOs store

animal wastes in large cess pits (which the industry calls “lagoons”) (*Figure 5*). After the solids mostly settle out, the liquid wastes are applied to relatively small sprayfields. The soils in the area are mainly sandy and shallow; the water table is only about three feet from the land surface (Burkholder et al. 1997 and references therein). The shallow, sandy soils simply cannot absorb the massive amounts of waste applied to them by the CAFOs, time after time per season, year after year (see example in *Figure 4*). Waste that is applied to the fields mostly percolates into the shallow groundwater and then moves to receiving streams and rivers (e.g. Evans et al. 1984). Most cess pits for these swine CAFOs were installed in North Carolina prior to 1993, when linings of clay or other materials were not required (Burkholder 1997 and references therein).



**Figure 5.** Left: A swine CAFO in the lower Cape Fear River basin, showing (from top to bottom) a house (noted for scale), the buildings that contain about 5,000 animals, the adjacent cess pit, the sprayfield, a stream that has been transformed to a gully conveying wastes from the field into a wetland, and a dense bloom of cyanobacteria (blue-green algae), potentially toxic to humans, that was fueled by the high nutrients in the CAFO wastes (see Burkholder et al. 1997, 2007 for supporting information). Thus, clearly the wastes were moving off-site to contaminate adjacent natural resources. This relatively small field with a shallow layer of soil above the water table, and the cess pit, are “supposed to” adequately treat the liquid wastes, year after year, from 5,000 swine per year, equivalent to the amount of wastes produced by 20,000 people (1 swine produces the equivalent amount of wastes, roughly, of 4 people; see below). Photo: M. Mallin. Right: Two swine CAFO cess pits (the car is circled for scale). The pinkish color is due to anaerobic sulfur bacteria and is suggestive of very high levels of hydrogen sulfide gas, which is toxic to humans (Burkholder et al. 1997, and references therein). Photo: R. Dove, Waterkeeper Alliance.

The general situation was described as follows:

[CAFO] technology, originally designed for application in upland areas with adequate soil depth above the water table, was embraced in counties where 60-80% of the area put into production was originally low-lying wetlands adjacent to rivers and estuaries. The operations were exempt from land zoning laws and mandatory inspection programs. Waste lagoons were not required to have leakage-reducing liners; some were constructed below the water table less than 20 m [50 feet] from neighboring homes and wells . . . The NC Division of Water

Quality, charged with water resources management, lacked the personnel and resources necessary to adequately monitor surface or groundwater quality. More fundamentally, the North Carolina Department of Agriculture legally refused to provide the Division of Water Quality with basic data such as the location and number of existing and planned animal operations . . . After considerable effort the North Carolina Environmental Management Commission . . . passed rules in 1993 for design of animal waste lagoons and effluent treatment. These rules mandated use of clay or other suitable liners in future construction of lagoons associated with [CAFOs with] 250 or more swine. They included a grandfather clause to exempt existing operations from having to alter their lagoon design . . .(Burkholder et al. (1997; references included therein).

The information presented below for airshed, soil and groundwater contamination is included because pollution of those natural resources by swine CAFOs can substantially contribute to surface water contamination, which is the main subject of these Comments regarding the state's classification of the LCFRE segment.

#### **Airshed degradation from swine CAFO point sources**

Swine CAFOs emit copious air pollutants known to adversely impact human health and, indirectly, surface waters. For example, ammonia and hydrogen sulfide are emitted at levels toxic to humans (U.S. EPA 1998; also Aneja et al. 2001, Liu et al. 2014). Within a 60-mile radius from where it is emitted, the volatilized ammonia tends to return to the land and surface waters with rain (Aneja et al. 2003), where it can adversely affect river ecosystems (below; e.g. Rothenberger et al. 2009b).

Swine CAFO production in the lower Cape Fear basin has caused a significant increase in air pollutants such as ammonia (Aneja et al. 2003, Wing et al. 2012 and references therein). Surface waters and groundwater are also being adversely impacted; Burkholder et al. (2006) documented a significant increase in ammonia concentrations within the lower Cape Fear River where swine CAFOs are highly concentrated. Cahoon et al. (1999) wrote,

Aerial deposition of nitrogen, principally ammonia-nitrogen, is recognized as a contributing threat to coastal water quality . . . Some studies estimate that up to 90% of the manure nitrogen produced by swine volatilizes and is deposited downwind [to the land and surface waters] (NC DENR Division of Air Quality 1997).

Sampson County (946 square miles), in the Cape Fear River basin, had 1.8 million swine as of 1998. The National Atmospheric Deposition Program has monitored atmospheric ammonia there since 1978. Mallin (2000) noted that during the 1988-1998 decade, there was a concurrent rise in atmospheric ammonia and the swine population; and that from linear regression analysis, 72% of the variability in airborne ammonia could be explained by changes in the county swine population alone. Upwind in the North Carolina Piedmont, counties with low swine populations showed no ammonia increase during the same period.

#### **Soil degradation from swine CAFO point sources**

Swine feed contains metals such as copper act as micronutrients in low concentrations, but

as toxic substances at higher levels. The metals persist in the extremely high amounts of swine wastes (Cahoon et al. 1999; see p.10 of these Comments), which are then applied to fields. Sensitive crops often cannot withdraw the metal in the soil, and leave it behind to accumulate. Research done in eastern North Carolina has explained how waste application contributes to metals pollution in field and, importantly, also has shown that as long ago as the mid-1990s, several counties in the lower Cape Fear River basin could no longer be used to grow metal-sensitive crops and would not need to fertilize with nitrogen or phosphorus for decades (Barker and Zublena 1995, Zublena et al. 1995). Runoff from the contaminated soil during/following precipitation events adds some of these toxic pollutants to adjacent surface waters.

### Groundwater degradation from swine CAFO point sources

Areas around the cess pits of swine CAFOs in eastern North Carolina have been shown to receive leakage high in contaminant levels. Wells and subsurface seepage near the cess pits can be contaminated with extremely high levels of nitrate and ammonia (e.g. Huffman and Westerman 1995, Westerman et al. 1995, Ham and DeSutter 2000). The high nitrate levels are a result of the high ammonia levels because the ammonia is oxidized to nitrate as it moves away from the waste sources (see Burkholder et al. 1997, 2007, and references therein). High concentrations of nitrate are hazardous to human health, especially for babies and small children (who can be afflicted with methemoglobinemia or 'blue-baby syndrome'), because nitrate competes with oxygen for hemoglobin in the human bloodstream (Smith 2009, Knobeloch et al. 2010).

Many North Carolinians in the Coastal Plain area rely upon groundwater as their drinking water source (North Carolina Groundwater Association, <http://www.ncgwa.org>). North Carolina's drinking water standard for nitrate is less than 10 milligrams per liter (mg/L).<sup>5</sup> The available data suggest that many unlined swine effluent cess pits in eastern North Carolina cause nitrate pollution to nearby wells at levels that violate the 10 mg/L drinking water standard (e.g. Huffman 2004, Huffman and Westerman 1995, Westerman et al. 1995). Working in Sampson County within the Cape Fear River basin, Westerman et al.'s (1995, p.1749) study illustrates high contamination from unlined cess pit leakage:

Two swine manure, anaerobic lagoons located in sandy, coastal plain soil were investigated. Both continued to have significant seepage after 3.5 to 5 years of receiving waste. Monitoring wells indicated *broad seepage plumes* [emphasis added], and much variation in concentrations of several parameters with well location, time, and depth of well . . . In some cases, ammonia and chloride concentrations in well samples were as high or higher than the lagoon liquid.

The last sentence of the above quote is especially of concern - that nearby monitoring wells had ammonia concentrations even higher than the lagoon liquid swine waste. Such

<sup>5</sup> (NC DENR Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina, NC Admin. Code Section 15A NCAC 2B .0200, Environmental Management Commission, Raleigh, NC; [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=ad77b198-aa3d-4874-9723-54ce730b3a8d&groupId=38364](http://portal.ncdenr.org/c/document_library/get_file?uuid=ad77b198-aa3d-4874-9723-54ce730b3a8d&groupId=38364)).

information points to a major threat to shallow drinking water wells located only short distances, as little as 50 feet, from a swine lagoon cess pit.

Based on the available science literature, substantial groundwater contamination also is contributed by lined cess pits if not properly operated, as described by Westerman et al. (1985, p.1750):

Ritter and Chirnside (1987) . . . reported high concentrations of  $\text{NH}_3\text{-N}$  and  $\text{NO}_3\text{-N}$  in groundwater monitoring wells near a clay-lined anaerobic lagoon for a hog-finishing unit. Some of the high  $\text{NH}_3\text{-N}$  concentrations were possibly due to lagoon overflow, which occurred several times. They suggested that the lagoon management of completely emptying the lagoon twice a year led to drying and cracking of the clay liner, resulting in seepage. They concluded that if clay-lined lagoons are not operated properly, they will have a serious impact on groundwater quality in loamy sand or sandy loam soils.

Ritter and Chirnside (1990) also reported extreme *average* ammonia-N concentrations, up to 1,000 mg/L, and extreme average nitrate-N up to 50 mg/L, in some wells near a clay-lined swine waste cess pit on the Delmarva Peninsula.

Swine CAFOs (both the land application practices and cess pit leakage) additionally pose a significant threat to well water via contamination by other harmful substances and pathogenic microbes (e.g. Stone et al. 1998, Krapac et al. 2002). Moreover, much lower concentrations of nitrate and ammonia can cause disease and death of beneficial aquatic life in receiving surface waters (see below). During summer low flow conditions on the North Carolina Coastal Plain, at least half of stream and river flow can be contributed by groundwater (Garrett et al. 2012 and references therein). Thus, groundwater contamination by swine CAFOs can contribute significantly to surface water contamination. Cahoon et al. (1999, p.414) wrote,

An important water quality problem in North Carolina deriving from animal waste inputs is nitrogen loading to surface and groundwaters. Nitrogen frequently limits phytoplankton production in North Carolina's coastal waters, so increased nitrogen loads have stimulated noxious and toxic algal blooms and helped cause fish kills.

### Surface water degradation from swine CAFOs

The wastes applied to sprayfields, emitted to the overlying airshed during the spraying activity, or leached into groundwater can make their way into surface waters as explained above. In addition, when the sprayfield soils are saturated with contaminants or with water during moderate to high precipitation periods, or due to over-application, the additional applied wastes rapidly move overland, through tile drains, and through the many ditches in the area to nearby surface waters. Thus, working in eastern North Carolina, Westerman et al. (1985) found high levels of nitrate (3-6 mg/L) in surface runoff from swine CAFO sprayfields that received swine waste effluent *at recommended rates* - that is, as a result of routine, accepted practices. For comparison, ~0.1 mg/L of nitrate (and ~0.08

mg/L of phosphorus - below) can cause noxious algal blooms (Mallin 2000, Wetzel 2001, and references therein). Working in Duplin County within the Cape Fear River basin, Stone et al. (1995) measured 6-8 mg of total inorganic nitrogen/L (= nitrate + nitrite + ammonia or ammonium) and 0.7-1.3 mg of phosphorus/L, another important nutrient that can fuel noxious and toxic algal outbreaks (Burkholder 2009), in a stream adjacent to swine effluent sprayfields:

Mean nitrate-N concentrations of water leaving the [two] watershed outlet[s] were two- and four-times higher than background concentrations . . . Daily mean nitrate-N concentrations [at a tributary adjacent to a swine CAFO] sometimes exceeded 10 mg/L and frequently exceeded 6 mg/L. Over-applied swine lagoon effluent and undersized, overloaded lagoons were likely contributors . . . Mean ammonium-N concentrations . . . were approximately two- and four-times higher than background concentrations. Ammonium-N concentrations [at one watershed outlet] exceeded limits considered harmful to humans (0.5 mg/L) and fish (2.5 mg/L) (U.S. EPA 1973). During the first month of the sampling period, daily ammonium-N concentrations ranged from 6 to 12 mg/L . . . These high concentrations indicated that a significant discharge of animal waste products into the waterway had occurred . . . while storm flows are contributing to the total flux of nitrate-N, the majority of the nitrate-N flux is coming directly from the base flow [in other words, the high contamination occurred with and without precipitation/runoff]. - Stone et al. (1995)

Evans et al. (1984) reported 7-30 mg nitrate/L in subsurface flow draining a sprayfield for swine wastes that were applied at recommended rates:

The potential for nutrient transport was much greater for subsurface drainage [than for surface drainage] . . . Nitrogen application at the recommended rate resulted in phosphorus application at nearly three times the recommended rate. Although this soil fixes [adsorbs] phosphorus, there was evidence of phosphorus movement in subsurface runoff by the fifth year of waste application at a higher rate. Continued phosphorus application even at the low [recommended] rate would eventually result in movement of P in subsurface runoff as the soil's assimilatory capacity for phosphorus would eventually be exceeded. - Evans et al. (1984)

These reports all describe *excessive* levels of inorganic nitrogen and phosphorus in comparison to what is needed to fuel a noxious or harmful algal outbreak. Evans et al. (1984) highlighted another problem -- that recommended rates of nitrogen application resulted in major excesses of phosphorus that, within a relatively short time, would saturate the soil and contaminate receiving adjacent surface- and ground-waters.

As mentioned, the extremely high nitrate in surface waters and groundwater near swine CAFOs comes from the high ammonia in swine wastes that combines with oxygen. Much lower nitrate levels (0.25-0.28 mg/L) than found in the above-described studies can cause disease and death of beneficial aquatic life (Camargo et al. 2005, Camargo and Alonso 2006). Nitrate can interfere with steroid hormone synthesis, adversely affect sperm

motility and viability, depress fecundity, and can be toxic to embryos (Edwards et al. 2004). It can also decrease immune response, act as an endocrine disruptor, and induce harmful hematological and biochemical changes in beneficial aquatic life (Guillette and Edwards 2005).

Although much of the ammonia which contaminates surface waters from swine CAFOs is oxidized to nitrate, before that occurs the ammonia can cause high toxicity to beneficial aquatic life, or can stimulate noxious algal outbreaks. Ammonia is a preferred form of nitrogen for many algal species including various harmful algae that can cause serious human illness (compiled from Bollos and Berge, Twomy et al. 2005, Herndon and Cochlan 2006, Burkholder 2009). Burkholder et al. (1997) reported ammonia concentrations as high as ~40 mg/L in a stream contaminated by a swine cess pit rupture. Such concentrations can be highly toxic to aquatic life (Camargo et al. 2005, Camargo and Alonso 2006), and would also be expected to stimulate noxious/harmful algal growth as the concentration became more dilute downstream (as was observed by Burkholder et al. 1997 and Mallin et al. 1997).

Swine CAFOs can cause other major surface water impacts from suspended solids loads and turbidity. The water near swine CAFOs is often dark and murky, and inhibits beneficial plant growth (Burkholder et al. 1997, Mallin 2000, and references therein). Swine wastes are acidic (pH ~6.5 - Zu et al. 2001 and references therein) and can impart acidity to receiving surface waters, although the lower mainstem Cape Fear River is well buffered due to the ocean's influence. Toxic levels of metals such as copper occur in runoff from swine effluent sprayfields because copper and other "trace elements" are added to swine feed to promote growth and control disease (Payne et al. 1988). These toxic substances can accumulate in sediments, water, and biota, to levels that are toxic to plants and lead to reproductive impairment, poor body condition, and immune system suppression in beneficial animals (Stubbs and Cathey 1999). Copper from swine and other livestock operations can be added to surface waters via overland discharge and groundwater leachate (U.S. EPA 2013).

Many impacts on surface waters from swine CAFOs are only beginning to be examined. Surface waters in Duplin County, also within the Cape Fear River basin, were recently assessed for fecal indicator bacteria (fecal coliforms, *Escherichia coli*, and *Enterococcus*) and candidate swine-specific microbial source-tracking bacteria over an annual period, both upstream and downstream from swine CAFO sprayfields. The authors noted, importantly, that the proximal "upstream" locations were potentially influenced by numerous upstream swine CAFO sprayfields, and also by poultry CAFO dry litter land application sites. The highest fecal indicator bacteria concentrations were found immediately downstream from swine CAFO sprayfields in spring and summer. The findings were summarized as follows:

Testing of 187 samples showed high fecal indicator bacteria concentrations at both up- and downstream sites . . . Overall, 40%, 23%, and 61% of samples exceeded state [criteria] and federal recreational water quality guidelines for fecal coliforms, *E. coli*, and *Enterococcus*, respectively. Two swine indicator bacteria were 2.30 to 2.47 times as prevalent proximal down- than proximal upstream of swine CAFOs . . . *Results suggest diffuse and overall poor sanitary*

*quality of surface waters where swine CAFO density is high [emphasis added].*  
 - Heaney et al. (2015)

The water column of receiving rivers is not the only area affected by CAFO contamination. Burkholder et al. (1997) tracked surface water impacts from a swine cess pit rupture upstream from the New River Estuary near of the Cape Fear River basin. Fecal coliform bacteria densities were in the millions of colony-forming units [CFU] per 100 mL, whereas the state standard for safe human contact of the water is 200 CFU/100 mL. The state does not monitor contamination of bottom sediments by CAFO wastes. After 14 days, water-column fecal coliforms along the surface of the bottom sediments mostly yielded 10,000 CFU/100 mL, one to two orders of magnitude higher than elsewhere in the system. Even after 60 days, fecal bacterial densities in the surficial sediments of the affected area were at 1,000-10,000 CFU/100 mL. The data showed that bottom sediments contaminated by CAFO wastes can function as a repository source of fecal coliform bacteria and, likely, for co-occurring harmful microbes, for weeks to more than a month after a waste spill. The organic materials from the wastes that settled out would have been expected to greatly increase the SOD as well.

**Surface waters presently classified as C (Sw) waters in areas draining swine and poultry CAFOs in the lower Cape Fear basin are extremely degraded**

There is presently ongoing, persistent, extreme degradation of surface waters in the lower Cape Fear basin due to allowed practices of swine and poultry production. A recent description of a Class C (Sw) stream illustrates this reality:

Stocking Head Creek (8-digit Hydrologic Unit Code 003030007), a second-order tributary of the Northeast Cape Fear River, is presently classified by DWR as Class C (Sw) waters. This small stream (length 13.7 miles) drains 7.6 square miles of area containing 40 swine CAFOs and an estimated 11 poultry CAFOs, with total capacity for more than 94,000 swine and more than 1.3 million broiler chickens; it also includes some unconfined cattle (Mallin et al. 2014). Seven sites along the stream were sampled on 5 dates each in a 30-day period in summer and in fall of 2013. The data indicate a situation of persistent, extreme water quality degradation regardless of weather conditions; the excessive pollutant levels were similar whether the stream was sampled in dry or wet (rainy) periods.

*The water quality conditions documented in Stocking Head Creek consistently were hazardous to human health at most stations.* Geometric means for fecal coliform bacteria were in the thousands (as colony-forming units per 100 milliliters, CFU/100 mL) at 5 of the 7 sites. The state standard for safe human contact is less than 200 CFU of fecal coliform bacteria/100 mL (geometric mean, based on at least 5 consecutive samples during any 30-day period); and surface waters are supposed to have fewer than 400 CFU of fecal coliform bacteria/100 mL in at least 80% of samples examined during the 30-day period. At 5 of the 7 sites on Stocking Head Creek, fecal coliform bacteria exceeded 400 CFU/100 mL on all, or nearly all, sampling dates.

*Nutrient levels also demonstrated extreme water quality degradation.* Some samples had more than 10 mg of nitrate/L. By comparison, the U.S. EPA (2000) recommends that nitrate should be 0.04 mg/L or less in streams within level III nutrient sub-ecoregion #63,

which includes southeastern North Carolina. The maximum ammonium concentration was 38 mg/L near swine waste sprayfields. BOD (5-day) exceeded 10 mg/L in 11 of 70 stream samples, with a maximum at 88 mg/L. Average total phosphorus (TP) per site ranged from 0.15 to 2.83 mg/L. By comparison, the U.S. EPA (2000) recommends that stream TP concentrations should be less than 0.052 mg/L for streams in this area.

Based on more than 30 years of experience as a water quality specialist, I assess these conditions, ongoing and persistent in this representative stream in the Northeast Cape Fear River basin upstream from the LCFRE segment, as comparable to the filthy conditions that occur just downstream from raw sewage discharge.

### **Swine CAFO wastes versus the 20 point source wastes and wetlands in the lower Cape Fear basin**

Swine wastes are very rich in organic, oxygen-demanding materials in comparison to human wastes. Treated and raw domestic sewage contains ~20-60 mg BOD/L and ~300-400 mg BOD/L, respectively; swine waste slurries contain ~20,000-30,000 mg BOD/L (Webb and Archer 1994; also see Spellman and Whiting 2007). Surface waters contaminated with these wastes rapidly become oxygen-depleted, causing fish to suffocate to death (Burkholder et al. 1997, U.S. EPA 1998, Mallin 2000).

The contribution of oxygen-demanding materials from nearly 1,000 swine CAFO sources, mostly in the lower Cape Fear basin, clearly overwhelms the contribution from the 20 point sources considered by DWR. As stated, about 5 million swine are produced annually in the lower Cape Fear basin in CAFOs (Cahoon et al. 1999). It has been estimated that each animal contributes roughly the equivalent amount of waste -- much richer in oxygen-demanding materials -- of four people (derived from U.S. EPA 2004; see *Table 1* below). The population of the City of Wilmington as of 2014 was ~112,000 people. Overall in the lower Cape Fear basin, the 5 million swine produced per year in CAFOs produce ~179 times more wastes than the largest human population center, Wilmington. Moreover, pound for pound the swine wastes, conservatively estimated, contain about 10 times more oxygen-demanding materials than treated human wastes. Thus, in the lower Cape Fear basin, swine CAFO point sources are estimated to produce three orders of magnitude (~1,790 times) more oxygen-demanding materials than treated human wastes.

These Comments have several times referred to the Northeast Cape Fear River and Black River as having sustained major impacts from swine CAFOs. According to NCDENR (2005), the small sub-watersheds drained by the Northeast Cape Fear River and the Black River, alone, have 896 CAFOS that contain ~3,764,121 animals, roughly the same amount of sewage as more than 15 million people. Stocking Head Creek illustrates the surface water quality of streams draining such areas.

Based on the available information, *the massive contribution of organic-rich, oxygen-demanding materials from swine CAFOs also overwhelms the potential contribution from natural wetlands in the LCFRE.* The sparse available SOD data for the LCFRE (give in Bowen et al. 2009, p.3-20) ranged from 0.1900 to 0.6951 grams of oxygen demand per square meter per day (g/m<sup>2</sup>/day). The highest values measured were near swine CAFOs, 0.5189 to

**Table 1.** Manure production per 1,000 pounds (lb) live weight on an annual basis. According to this information from the U.S. EPA (2004, Table 3.3), one 250-lb pig produces 7,250 lb of manure per year (19.86 lb/day), whereas one 150-lb human produces 183 lb of manure/yr (0.5 lb/day). A swine CAFO with 1,000 animals thus would produce about the same amount of waste as a city of 39,617 people. As the U.S. EPA (2004) wrote,

The important difference lies in the fact that human waste is treated before discharge into the environment, but animal waste is either not treated at all or minimally treated....

It has been argued that swine wastes are about 10-fold more liquid than human wastes; if that dilution factor is taken into account, 1 animal would produce about the same amount of waste of 3.96 people, rounded to a ratio of 1:4.

Animal Species	Manure produced lbs./yr	Typical Handling System
Swine	29,000	Liquid
Poultry		
Broilers	28,000	Solid
Layers	22,000	Liquid
Turkeys	16,000	Solid
Beef	21,000	Solid
Dairy	30,000	Liquid
Humans	1,223 <sup>1</sup>	Liquid

<sup>1</sup> Based on 150 lb avg. wt. per person producing 0.5 lb of fecal material per day

0.6951 g/m<sup>2</sup>/day; even areas near urban Wilmington had lower SOD (0.4440 to 0.4679 g/m<sup>2</sup>/day). Bowen et al. (p.4-42) used an estimated SOD of ~0.4 g/m<sup>2</sup>/day except for an area heavily influenced by swine CAFOs, the Northeast Cape Fear River sub-basin, where they used an estimated SOD of 1.5 g/m<sup>2</sup>/day. This information suggests that the swine CAFO-rich Northeast Cape Fear River alone, contributes excessive SOD in comparison to the rest of the LCFRE, expected since that small sub-watershed contains 502 swine CAFOs with 2,021,000 animals, or the equivalent amount of more than 8 million people's wastes per year (NCDENR 2005).

### III. Summary and Recommendations

These Comments have explained the following main points regarding DWR's proposed reclassification of a segment of the LCFRE, from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut, from Class Sc waters to Class Sc (Sw) (= swamp):

- ✓ NCDENR-DWR has proposed to reclassify the lower reaches of one of the most powerful rivers in the nation, a portion of the LCFRE, as a swamp because the agency's efforts to control the relatively small amount of pollution from 20 point sources will not allow that segment to meet present standard for DO (or for pH, turbidity, and toxic copper). This was based on a recent modeling effort (Bowen et al. 2009) which predicted that

the 20 arbitrarily selected point sources have little effect on DO levels in the LCFRE segment. In addition, the segment was described as inappropriate for development of a TMDL, based on two erroneous claims -- that natural wetland drainage is the major contributor of oxygen-demanding materials to the LCFRE segment, and that significant reductions in "background" sources of oxygen-demanding materials would not allow the LCFRE segment to meet the present DO standard.

- ✓ According to the U.S. EPA, assessment of whether a TMDL is needed to improve DO in the LCFRE segment is supposed to consider all point and nonpoint sources in the watershed. In focusing on only 20 point sources, DWR omitted consideration of massive pollution that could be reduced in the so-called "background" loads, including 175 NPDES-permitted, upstream and adjacent point sources in the Cape Fear River basin, and nearly 1,000 swine CAFOs (as well as an unknown number of poultry CAFOs) which are formally defined by the Clean Water Act as point sources. The ~5 million swine produced in the lower Cape Fear River basin contribute the equivalent of ~20 million people's wastes per year, and the massive wastes are much richer in oxygen-demanding materials than human wastes.
- ✓ The available evidence shows that pollution from human activities, not natural drainage from wetlands, is the major source of oxygen-demanding materials to the LCFRE segment, and that the massive pollution also contributes low pH, toxic copper, high turbidity, fecal bacteria, and many other contaminants to the LCFRE segment.
- ✓ The recent modeling effort by Bowen et al. (2009) tacitly included the many other NPDES-permitted point sources and swine/poultry CAFOs within a modeling category called "tributary inputs." The model predicted that a reduction of only 30% of the "tributary inputs" would result in median DO levels higher than the state standard; and that a 70% reduction in the "tributary inputs" would bring the LCFRE into compliance 99% of the time. Thus, reducing the massive pollution from other sources **would** enable the LCFRE segment to attain compliance with its present DO standard.

To protect the health of many North Carolinians of all ages who depend upon this river and estuary to meet its present designated uses, and to protect the LCFRE surface water segment of focus as well as other public trust natural resources in the lower Cape Fear basin, the LCFRE segment should not be reclassified as a Class Sc Swamp (Sw). Instead, DWR should be directed toward efforts to meaningfully reduce the massive pollution from swine\_CAFOs and NPDES-permitted point sources in the lower Cape Fear Basin (and from poultry production as well, which are a major pollution source with much less available information), which would make it possible for the LCFRE to meet the presently applicable DO standard, and would also enable the LCFRE to improve in water quality with respect to pH, copper levels, and turbidity.

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JoAnn M. Burkholder

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March 3, 2015

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RE: Comments on Proposed reclassification of portions of the Cape Fear River

Dear Ms. Kountis:

On behalf of the Cape Fear River Watch, Cape Fear Riverkeeper and Waterkeeper Alliance, we are submitting the following comments pursuant to the Notice issued by your office for the proposal captioned "Proposed Swamp Reclassification with Water Quality Management Plan for Part of Cape Fear River." This proposed reclassification apparently originated from a request on behalf of persons who had been meeting to discuss the development and implementation of a Total Maximum Daily Load for the Lower Cape Fear River.<sup>1</sup> Based upon review of the materials presented, as well as readily available peer-reviewed literature, this proposal suffers the following deficits: constitutes an unlawful attempt to evade the Clean Water Act's directives to correct water quality problems through implementation of Total Maximum Daily Load requirements and to prevent backsliding on Water Quality Standards once they are set; violates the policy declared by the State's constitution and implementing statutory directives to the North Carolina Environmental Management Commission (Commission) and the North Carolina Department of Environment and Natural Resources (Department) to protect and conserve the waters of the state for the benefit of all its citizens; fails to correct the water pollution created by Animal Operations under the regulatory authority of the Commission and CAFOs as regulated by the Clean Water Act, which together are causing impairments for copper, turbidity, pH and low dissolved oxygen (DO); lacks scientific support; and does not comply with the requirements of the North Carolina Administrative Procedures Act (APA).

<sup>1</sup> The letterhead of the request is the Lower Cape Fear River Program, but the request is signed by Chris May, identified as the Executive Director of the Cape Fear Council of Governments. We raise this issue in order to preserve, in any subsequent appeal, the question as to whether Mr. May was acting with actual authority on behalf of a person with legal power to make the request.

## **I. The Clean Water Act Requires the State of North Carolina to Implement a Total Maximum Daily Load Allocation in the Cape Fear River**

The Lower Cape Fear River (LCFR) presents the classic situation that the Clean Water Act (CWA) provisions on Total Maximum Daily Load (TMDL) were designed to address: chronic violations of water quality standards that NPDES-imposed effluent limitations alone are unable to correct. The modern-day CWA was first passed in 1972 in response to growing concern about the continued degradation of many major rivers under inadequate state regulatory schemes. The CWA's stated objective is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." CWA § 101(a). To achieve this objective, the CWA lays out several goals, including the elimination of the discharge of pollutants into navigable waters. The statute sets up several programs to achieve these goals, including the TMDL process.

### **A. State Water Quality Standards Must Meet CWA Minimum Requirements and Protect Designated Uses**

State water quality standards must be approved by the United States Environmental Protection Agency under § 303 of the Clean Water Act, 33 U.S.C. § 1313. Under the Clean Water Act, water quality standards consist of three elements: (1) one or more existing or designated "uses" of a water body (such as fish and aquatic life, fishing, boating, aesthetic quality, irrigation and water supply), (2) water quality "criteria" indicating the amount of a pollutant that may be present in the water body while still protecting the uses, and (3) a provision restricting degradation of certain types of waters. When met, these standards must be stringent enough to protect the designated uses. States are responsible for enforcing their water quality standards on intrastate waters. See 33 U.S.C. § 1319(a).

### **B. North Carolina's General Statutes Require More Protection of Uses than the CWA Minimum Requirements**

Under the provisions of Article 21 of Chapter 143, the North Carolina General Assembly has set forth guidelines for the Commission to use when enacting water quality standards and specifically sets forth criteria more stringent and more specific than the Clean Water Act. North Carolina's standards must be designed to:

- 1) protect human health,
- 2) prevent injury to plant and animal life,
- 3) prevent damage to public and private property,
- 4) insure the continued enjoyment of the natural attractions of the State,
- 5) encourage the expansion of employment opportunities,
- 6) provide a permanent foundation for healthy industrial development,
- 7) secure for the people of North Carolina, now and in the future, the beneficial uses of these great natural resources.

See N.C. Gen. Stat. § 143-211(c).

State water quality standards established under § 303 provide an important “supplementary basis . . . so that numerous point sources, despite individual compliance with effluent limitations, may be further regulated to prevent water quality from falling below acceptable levels.” EPA v. California ex rel. State Water Res. Control Bd., 426 U.S. 200, 205 n.12 (1976). States therefore may impose more stringent water quality controls. See 33 U.S.C. § 1311(b)(1)(c). The CWA standards are a floor, but states are expected to set standards to protect uses based on the water quality issues in their waters. For example, North Carolina requires that water quality standards ensure “the ability of an aquatic ecosystem to support and maintain a balanced and indigenous community of organisms . . . .” 15A NCAC § 2B.0202(11).

Numerous state water quality issues are implicated within the Cape Fear River basin and the State has adopted a broad array of requirements affecting water quality to protect the public welfare and serve the purposes of the Clean Water Act. For the portions of the Cape Fear River system classified as Class SC waters, state regulations provide specific water quality criteria implicated by these classifications. These include chlorophyll, dissolved oxygen, solids or sludge attributable to wastes, dissolved gases, fecal coliform, pH, oils, temperature, turbidity, toxic substances, pesticides, and metals, among others. See 15A NCAC § 02B .0220 The Lower Cape Fear River fails to meet the standards imposed for DO, pH, turbidity, and copper. Consequently, the state is required to identify the sources that contribute to these violations and then take corrective action. “[S]ources of water pollution which preclude any of these uses on either a short-term or long-term basis shall be considered to be violating a water quality standard.” 15A NCAC § 2B.0211(2).

### C. CWA Requires North Carolina to Allocate Pollutant Loading From Point Sources, Including CAFOs, and From Nonpoint Sources Under TMDL

The CWA requires states to address both point sources<sup>2</sup> and nonpoint sources in order to protect designated uses. Under the CWA scheme, states must designate uses for waterbodies within the state and then develop water quality standards for those waterbodies to ensure achievement of the designated uses. Effluent limitations must be imposed on every point source discharger, including concentrated animal feeding operations (CAFOs),<sup>3</sup> in an effort to meet the water quality standards and maintain the designated uses. Waterbodies that do not meet their standards are placed on the 303(d) list of impaired waters. For those waterbodies, the states must develop TMDLs for the contaminant(s) causing the violation to return the waters to the standards appropriate for the designated use. To achieve a TMDL, CWA § 303 requires the state to undergo a

<sup>2</sup> CWA § 502(14) defines “point source” as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.”

<sup>3</sup>As discussed more in Section III, North Carolina also regulates all Animal Operations activities involving Animal Waste, even when these operations have not been designated as CAFOs. We do not endorse the Department’s decision to use general permits for Animal Operations in this basin and have previously commented on the inadequacy of those permits to prevent the types of problems seen in the LCFR.

continuing planning process and determine appropriate load allocations for all sources, whether categorized as point or nonpoint. The TMDL must consider point and nonpoint sources contributing to impairment and not merely those adjacent to the impaired stretch. The state must incorporate the TMDL waste load allocations into the NPDES permits for each point source discharger and the load allocation for nonpoint sources are to be implemented through regulatory, non-regulatory and voluntary compliance mechanisms depending on the source.

Since 1998, the LCFR segment from upstream of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut has been on North Carolina's 303(d) list of impaired waters due to low dissolved oxygen (DO). In 2006, the state added impairment for pH, copper, and turbidity to the 303(d) list for this segment. The CWA requires the state to develop a TMDL for the impairing pollutants and then incorporate the TMDL into NPDES permits for point sources and controls on nonpoint sources necessary to meet the loading limits in the state plans.<sup>4</sup> For example, TMDLs are to be incorporated into the state's Water Quality Management Plan, which must also include effluent limitations and the regulatory, non-regulatory, and other mechanisms necessary to control nonpoint sources and meet water quality standards. The proposed reclassification would avoid this process and allow the waterbody to violate the 5 mg/L DO standard. In doing so, it fails to further the goals of the CWA and violates its express provisions.

The CWA intends for TMDLs to cover pollution from point and nonpoint sources. The TMDL program sets the total amount of a pollutant that a waterbody can assimilate while still achieving its designated uses. The state must set the TMDL with an eye toward the designated use, and then must manage its contributing point and nonpoint sources to meet the TMDL. The CWA requires states to incorporate the TMDL into NPDES permits for point sources and into the regulatory, non-regulatory and other actions in state plans for nonpoint sources. Thus, the TMDL process should comprehensively consider all sources, which this proposed reclassification fails to do by ignoring CAFOs and nonpoint sources. Further, CAFOs are defined as point sources within the CWA (and in more detail by EPA regulations). So, the statute is clearly and explicitly intended for the TMDL process to cover discharges from CAFOs. The proposed reclassification entirely ignores the discharges from these sources, even though there are millions of hogs, poultry, turkeys, and cattle in the basin that contribute to the violations of applicable water quality standards. The proposed reclassification is thus impermissible.

<sup>4</sup> See, e.g. 33 U.S.C. §§1313(e) and 1319; *Pronsolino v. Nastro*, 291 F. 3d. 1123 (9<sup>th</sup> Cir. 2002) (Upholding EPA's TMDL for a waterbody impaired solely by nonpoint source pollution); U.S. EPA What is a TMDL? <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overviewoftmdl.cfm> (“Load allocations (LAs) are implemented by nonpoint sources through a wide variety of state, local, and federal programs (which may be regulatory, non-regulatory, or incentive-based, depending on the program), as well as voluntary action by citizens.”);

#### D. The Proposed Reclassification Violates the Anti-Degradation Provisions in Both State and Federal Law

The CWA also includes anti-degradation provisions that prohibit the states from allowing the degradation of navigable waters by lowering the standards to achieve compliance. See 33 U.S.C. § 1313(d)(4). Under the federal antidegradation policy, the states are required to develop and adopt statewide antidegradation policies that ensure that “existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.” 40 C.F.R. § 131.12. North Carolina has incorporated this requirement by reference into its water quality standards, and further adopted the requirement that “[e]xisting uses, as defined by Rule .0202 of this Section, and the water quality to protect such uses shall be protected by properly classifying surface waters and having standards to protect these uses.” 15A NCAC 02B § .0201 (a) and (b). Existing uses are defined as: “uses actually attained in the water body, in a significant and not incidental manner, on or after November 28, 1975, whether or not they are included in the water quality standards, which either have been actually available to the public or are uses deemed attainable by the Environmental Management Commission. At a minimum, uses shall be deemed attainable if they can be achieved by the imposition of effluent limits and cost-effective and reasonable best management practices (BMPs) for nonpoint source control.” See 15A NCAC 02B § .0202(30). The proposed reclassification violates both the CWA and the state’s supplemental antidegradation policy regulations because it will not protect and maintain the existing uses in the LCFR, would weaken water quality standards and would allow for further degradation of water quality.

Additionally, EPA regulations prohibit the removal of a designated use where that use is an existing use, which the EPA regulations define as uses “actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.” 40 C.F.R. § 131.10(h)(1). The EPA regulations deem a use attainable if it “can be achieved by the imposition of effluent limits required [for point sources] under sections 301(b) and 306 of the Act and cost-effective and reasonable best management practices for nonpoint source control.” 40 C.F.R. § 131.10(d). The EPA regulations also prohibit removing a designated use where “[s]uch uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices for nonpoint source control.” 40 C.F.R. § 131.10 (h)(2). As demonstrated by materials submitted by the proponents of this reclassification and the comments of Dr. Burkholder set forth below, the SW classification protects an existing use and the designated uses for the LCFR can be achieved through reasonable pollution controls.

If these prohibitions did not apply, a state could seek to remove a designated use where naturally occurring pollutant concentrations prevent the attainment of the use: “States may remove a designated use which is not an existing use, as defined in § 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because: (1) Naturally occurring pollutant concentrations prevent

the attainment of the use.” See 40 C.F.R. § 131.10(g)(1). The supplemental Sw “Swamp” classification is an example of such a sub-category of use for SC waters of the LCFR. NC law builds upon these restrictions with supplemental provisions, allowing revision to the water quality standards if the naturally occurring pollutant concentrations are the result of natural background conditions.

Under NC law, “any person subject to the provisions of G.S. 143-215.1 may petition the Commission for a hearing pursuant to G.S. 143-215.4 for a revision to water quality standards adopted pursuant to G.S. 143-214.1 as such water quality standards may apply to a specific stream segment into which the petitioner discharges or proposes to discharge.” See N.C. Gen. Stat. § 143-214.3. This section also sets forth the procedure and burdens of proof needed in making such a request. However, the provision specifies that revisions to water quality standards are permitted only when the proponent meets particular criteria, including proving that “natural background conditions on the stream segment preclude the attainment of the applicable water quality standards.” As we set forth in Sections III and IV, the proposed reclassification does not meet that burden.

The Commission must also consider several matters prior to granting a reclassification request, including the following factors: “the use and value of State waters for public water supply, propagation of fish and wildlife, recreation, agriculture, industrial and other purposes, use and value for navigation, and ... an estimate ... of the environmental impact, the economic and social costs necessary to achieve the proposed standards, the economic and social benefits of such achievement and an estimate of the date of such achievement.” N.C. Gen. Stat. § 143-214.1(d)(4). Since the CWA and its rules set the minimum requirements, this provision is supplemental to that which is required by the CWA’s anti-degradation policy. It does not appear that the proponent has provided any support for the Commission to conduct such an analysis.

Thus, under the state and federal regulations, DWR would have to establish that the use is not an existing use, that the use cannot be attained by implementing effluent limits and nonpoint source controls, and that low DO in the LCFR is being caused by naturally occurring pollutant concentrations that make attainment of the use infeasible. This is a burden that cannot be met as set forth in greater detail below in Section III and IV, as well as attached comments by Dr. Joann Burkholder, Ph.D. In any event, because the SC classification includes uses that are specified in CWA Section 101(a)(2), the state cannot remove a designated use or adopt subcategories of uses that require less stringent criteria without conducting a Use Attainability Analysis. See 40 CFR 131.10(j) and 131.3(g). The state has not done so in this instance and, thus, the Commission may not proceed with the reclassification.

## II. North Carolina Law Requires the Environmental Management Commission to Correct Impairments Including Low Dissolved Oxygen in LCFR

North Carolina's Constitution and its General Statutes require the Commission to correct pollution in the Cape Fear River to support fish and other aquatic life. The fisheries resources are public trust assets, as are the waters of the Cape Fear River itself. Now that the Commission has designated uses for the Cape Fear River, studied the causes of its impairment and evaluated measures for correcting the same, the Commission must act to correct the problems identified. Reclassifying the Cape Fear River to swamp waters does not fulfill the duties entrusted to the Commission by North Carolina's laws.

More generally, a reclassification and a codification of rules that allow for worsened water quality clearly violate North Carolina's Constitution, which imposes a duty of water quality protection upon this Commission:

“It shall be the policy of this State to conserve and protect its lands and waters for the benefit of all its citizenry, and to this end it shall be a proper function of the State of North Carolina and its political subdivisions to acquire and preserve park, recreational, and scenic areas, to control and limit the pollution of our air and water, to control excessive noise, and in every other appropriate way to preserve as a part of the common heritage of this State its forests, wetlands, estuaries, beaches, historical sites, openlands, and places of beauty.” N.C. Const. Art. XIV, § 5.

The Commission must remember that the people have enshrined this duty in the Constitution of North Carolina. Limiting and controlling pollution is a duty of the State and all its political subdivisions. This provision imposes a duty on the Commission to carry out its powers to protect the lands and waters for the benefit of all its citizenry.

Forty years ago, our General Assembly advanced this Constitutional mission by enacting the General Statutes which protect these values, including the laws which empower the Department and the Commission, such as Chapters: 113, 113A, 113B, 130A, 130B, 132, 139, 143, 143B, 146, 150B, 156, 159, 159A, 159B, 159C, 159G and 162A. Among this comprehensive system of laws is found Article 21 of Chapter 143, captioned, “Water and Air Resources.” Within Article 21, the General Assembly declares its intent for those laws: “to achieve and to maintain for the citizens of the State a total environment of superior quality. **Recognizing that the water and air resources of the State belong to the people, the General Assembly affirms the State's ultimate responsibility for the preservation and development of these resources** in the best interest of all its citizens and declares the prudent utilization of these resources to be essential to the general welfare.” N.C. Gen. Stat. § 143-211(a) (emphasis added).

The General Assembly's enactments clearly show their intent to clarify the legal points that (a) water and wildlife resources belong to the people and (b) the State bears responsibility to preserve and develop these resources as a public trust. This trust may

not be devolved to private interests through permits or approvals that give perpetual rights to pollute and degrade the public trust resources of the people. See N.C. Const. art. I, §§ 32 and 34.

Under the provisions of Article 21 of Chapter 143, the North Carolina General Assembly has set forth the guidelines for the Commission to use when enacting these standards and specifically sets forth criteria more stringent and more specific than the Clean Water Act. At the core of EPA-approved state water quality standards under 33 U.S.C. § 1313, states are responsible for enforcing their water quality standards on intrastate waters. See 33 U.S.C. § 1319(a).

In setting water quality standards, the General Assembly directed the following be considered: “Standards of water and air purity shall be designed to protect human health, to prevent injury to plant and animal life, to prevent damage to public and private property, to insure the continued enjoyment of the natural attractions of the State, to encourage the expansion of employment opportunities, **to provide a permanent foundation for healthy industrial development and to secure for the people of North Carolina, now and in the future, the beneficial uses of these great natural resources.**” N.C. Gen. Stat. § 143-211(c) (emphasis added). These provisions clearly show the recognition of a duty to protect uses of our state’s waters for the benefit of today’s users and those in the future. Removing the protections from the Lower Cape Fear River does not meet the purposes of North Carolina’s Constitution, Law or Rules.

### **III. Neither the Low DO Conditions Nor the Animal Wastes That Cause Them are Naturally Occurring**

As stated above, the proposed reclassification violates numerous provisions of state and federal laws relating to TMDLs, water quality standards, antidegradation policies, and the requirements for removing and establishing designated uses. These hurdles cannot be overcome. However, assuming for the sake of discussion that they could, under North Carolina and federal law, the Commission would have to determine that natural background conditions on the stream segment preclude the attainment of the use in order to consider the proposal. N.C. Gen. Stat. § 143-214.3; 40 C.F.R. 131.10(g)(1). The burden of proof is on the applicant to prove this to the Commission. Neither the applicant nor the Commission can meet this burden, and in any event, the Commission could not classify the LCFR as “swamp waters” as the river does not meet the regulatory definition which requires low velocities, among other things. See 15A NCAC 02B .0101(e)(2), 15A NCAC 02B .0202(62), 15A NCAC 02B .0301(c), and Comments of Dr. Burkholder.

A. North Carolina's Statutes Regulate Animal Operations, Feedlots and Animal Waste, Even When Not Designated as CAFOs, and Legally Recognize the Water Quality Problems Created by Livestock Manure<sup>5</sup>

North Carolina's General Assembly adopted laws to regulate Animal Operations and Feedlots in response to concerns that growth in the numbers of Animal Operations harmed water quality. As the General Assembly found, "The growth of animal operations in recent years has increased the importance of good animal waste management practices to protect water quality. It is critical that the State balance growth with prudent environmental safeguards." N.C. Gen. Stat. § 143-215.10A.

In addition, the General Assembly found the need to control and limit nutrients leaving the Animal Operations by specifying that Animal Waste be applied with careful attention to the both nitrogen and phosphorus as rate limiting elements for applying Animal Waste to land. See N.C. Gen. Stat. § 143-215.10C. The General Assembly also declared that zinc and copper levels in the soils shall be monitored, and alternative crop sites shall be used when these metals approach excess levels. These legislative requirements reflect specific legislative findings as to the water quality problems caused by excess nitrogen, phosphorus, zinc and copper.

These North Carolina legislative findings of fact are supported by studies from federal agencies. The United States Environmental Protection Agency ("EPA") and United States Department of Agriculture's ("USDA") have identified livestock manure as the largest cause of water quality impairment in the country's rivers, streams, lakes, ponds, and reservoirs, and the fifth leading contributor to impairment of estuaries.<sup>6</sup> They contribute to the impairment of approximately 37% of the nation's surveyed rivers and streams.<sup>7</sup>

North Carolina law defines Animal Waste to include livestock or poultry waste. N.C. Gen. Stat. § 143-215.10B. A feedlot is defined as a lot or building or combination intended for the confined feeding, breeding, raising, or holding of animals. N.C. Gen. Stat. § 143-215.10B. An Animal Operation is defined as a feedlot involving 250 or more swine, 100 or more confined cattle, 75 or more horses, 1,000 or more sheep, or 30,000 or

<sup>5</sup> North Carolina and the federal government provide different definitions for CAFOs, but these specific definitions and thresholds do not change the underlying arguments about the shortcomings of the current proposal. Just because the state has not identified something as a CAFO through its case-by-case assessment does not mean that it is not one.

<sup>6</sup> CLAUDIA COPELAND, CONG. RESEARCH SERV., RL31851, ANIMAL WASTE AND WATER QUALITY: EPA REGULATION OF CONCENTRATED ANIMAL FEEDING OPERATIONS (CAFOS) 4 (2002) (citing U.S. EPA, EPA-841-R-08-001, NATIONAL WATER QUALITY INVENTORY: REPORT TO CONGRESS FOR THE 2004 REPORTING CYCLE 18–19 (2009)).

<sup>7</sup> Stephen Harden, Characterization of Surface-Water Quality Associated with Swine CAFOs in Eastern North Carolina, Proposal submitted to the N.C. DEP'T OF ENV'T AND NATURAL RES., DIV. OF WATER QUALITY 1, 3 (May 9, 2011) (citing the EPA's 2002 National Water Quality Inventory).

more confined poultry with liquid waste handling. N.C. Gen. Stat. § 143-215.10B. Thus, any Feedlot with more than 250 swine is an Animal Operation subject to the Commission’s regulatory authority as related to its handling of Animal Waste. The Commission has the regulatory authority and a duty to act to reduce the impact of livestock manure on the LCFR through its regulation of Animal Operations and Animal Waste. This must also be done through a TMDL in order to correct low DO in the Lower Cape Fear River.

#### B. Prior to 1999, the LCFR Experienced Explosive Growth in Animal Operations

The LCFR was not listed as impaired until large numbers of Animal Operations had been built in the basin. North Carolina in general, and the Cape Fear River basin in particular, experienced dramatic increases in the number and size of Animal Operations from the mid-1980s through the late-1990s. During that time, the swine population in the counties in the basin increased fourfold, turkey production doubled, chickens increased by 50%, and beef cattle by 25%. According to a study by scientists from the University of North Carolina at Wilmington, the Cape Fear River basin houses more than half the hog population in North Carolina.<sup>8</sup> The surplus nutrients are excreted in the livestock manure, which in turn feeds nutrients into the Cape Fear River through its tributaries.

The situation in the basin is so severe that analysts with the USDA’s Natural Resources Conservation Service (“NRCS”) found that the Cape Fear River basin and surrounding land area was the number one priority watershed in the United States based on its vulnerability to livestock manure nutrient pollution.<sup>9</sup> This finding is consistent with an earlier NRCS review as well.<sup>10</sup>

The proliferation of CAFOs in the Cape Fear River watershed is the best explanation for the low DO levels in the lower portion of the river, and this explanation is supported by the science. Research from the University of North Carolina at Wilmington shows that ammonium levels have increased in the river since the mid-1990s.<sup>11</sup> Ammonium is a form of nitrogen in swine and poultry waste that can be transported via runoff, subsoil movement, and volatilization and deposition.<sup>12</sup> This ammonium can be transported downstream to the section of the LCFR at issue here, where it can cause algal

<sup>8</sup> See “Nitrogen and Phosphorus Imports to the Cape Fear and Neuse River Basins to Support Intensive Livestock Production” by Lawrence B. Cahoon, Jill A. Mikucki, and Michael A. Mallin *Environ. Sci. Technol.*, 1999, 33 (3), pp 410–415.

<sup>9</sup> See “Potential Priority Watersheds for Protection from Manure Nutrients” by Robert Kellogg, available online at: [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_012227.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012227.pdf) (Accessed Feb, 17, 2015)

<sup>10</sup> See “Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States” by Robert Kellogg et al., available online at: [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_012133.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012133.pdf) (Accessed Feb. 17, 2015)

<sup>11</sup> Michael A. Mallin & Lawrence B. Cahoon, *Industrialized Animal Production—A Major Source of Nutrient and Microbial Pollution to Aquatic Ecosystems*, 24 *POPULATION & ENVT.* 369, 376 (2003) (internal citations omitted).

<sup>12</sup> *Id.*

blooms.<sup>13</sup> These algal blooms eventually die, and feed bacteria, generating a high biological oxygen demand (BOD), which in turn causes low DO.<sup>14</sup>

The single major land use change that could account for this increase in ammonia concentrations (and drop in DO) is the rapid growth of CAFOs during the 1980s and 1990s.<sup>15, 16</sup> This research reinforces the NRCS's finding that this area should be a priority watershed for protecting against nutrients from livestock manure. Trends showed a significant importation of these nutrients to the Cape Fear River basin from feed grown outside the basin.<sup>17</sup> (Early studies by UNC-W's Center for Marine Science also found a correlation between fecal coliform indicators and biological oxygen demand in the River.)<sup>18</sup> The Cape Fear River Basinwide Assessment Report of 1996 went even further, finding in 1995 that nitrogen and phosphorous from livestock manure exceeded the assimilative capacity of cropland by more than 400% in several counties within the watershed.<sup>19</sup> This troubling data caused DENR's analysts to state:

“It should be noted that these figures do not take into account commercial fertilizer applications in the counties. It is clear based on this information, that animal waste management in a number of counties in the basin is becoming a critical issue, and that the animal carrying capacity of these lands (from a waste disposal standpoint) needs to be closely examined. Alternatives to cropland application need to be considered in these counties such as application on forest land or transportation/distribution of the collectable manure to counties that have capacity and could use this nutrient source in lieu of commercial fertilizers.”<sup>20</sup>

Nutrients imported to the basin in the form of grain to feed the swine create a nutrient imbalance that this Commission must address.

Of course, since 1995, the numbers of swine, turkeys, layers and cattle have only increased in the Cape Fear River Basin. Their numbers are not a naturally occurring condition and their manure is not a naturally occurring pollutant. The record shows the DO violations are caused by animal feeding operations and other upstream sources, and not by naturally occurring conditions. Accordingly, the Commission must reject the proposed reclassification, and instead take measures to control pollution from animal

<sup>13</sup> *Id.* at 378, and Figure 2.

<sup>14</sup> *Id.*

<sup>15</sup> *Id.*

<sup>16</sup> We are not suggesting that CAFOs are the only source of the DO problem, but the state has the obligation to control the contributions of CAFOs rather than move forward with the reclassification.

<sup>17</sup> See “Nitrogen and Phosphorus Imports to the Cape Fear and Neuse River Basins to Support Intensive Livestock Production” by Lawrence B. Cahoon, Jill A. Mikucki, and Michael A. Mallin *Environ. Sci. Technol.*, 1999, 33 (3), pp 410–415..

<sup>18</sup> See “Environmental Assessment of the Lower Cape Fear River System: 2002-2003” by Michael Mallin et al. CMS Report 03-03 (2003).

<sup>19</sup> See “Cape Fear River Basinwide Water Quality Plan” by NC DENR (1996). Available online at: <http://portal.ncdenr.org/web/wq/ps/bpu/basin/capefear/1996> (Accessed Feb. 17, 2015)

<sup>20</sup> *Id.* at 3-17 through 3-19 and referenced figure.

waste at animal feeding operations and other upstream sources in order to restore water quality.

#### **IV. The Technical Memoranda Do Not Carry the Burden of Proof on Naturally-Occurring Pollutant or Condition Causing the LCFR Impairments**

The proponent for reclassification argues that natural conditions result in levels of DO and pH that excuse the violations of water quality standards and offers four Technical Memoranda (“TM”) as factual support for the proposal. These TM are grossly deficient and misleading, and they omit significant information. While water quality in the Cape Fear River is influenced by the conditions found in the swamp and estuarine areas, low DO accompanied by high copper levels can be explained only by the contribution of animal waste and other upstream sources.

##### **A. Experts Have Shown the Correlation Between Animal Operations and Eutrophication in the Lower Cape Fear**

Dr. Joann Burkholder directs the Center for Applied Aquatic Ecology at North Carolina State University. An internationally recognized expert in her field, Dr. Burkholder has studied and published articles in peer-reviewed journals on topics directly relevant to assessing the causes of impairment in the LCFR: chronic effects of nutrient over-enrichment and other chemical environmental contaminants on aquatic plants; the impacts of cyanobacteria, dinoflagellates, haptophytes, and raphidophytes on aquatic ecosystems; and influences of long-term changes in watershed land use and pollution sources on surface water quality.

Dr. Burkholder reviewed the proposed reclassification, surveyed past literature and research and provided comments regarding the TM and the merits of the proposal itself. These comments, which constitute expert opinion, show that Animal Waste, Animal Operations and CAFOs are the primary cause of impairments for DO, pH, copper and turbidity. A copy of Dr. Burkholder’s review is attached to these Comments and is incorporated by reference.

Dr. Burkholder notes that CAFOs are also point sources, and that they should be treated as such in the modelling, but were not evaluated this way. Even though CAFOs in the LCFR are the most concentrated per unit surface area in the entire nation, they are not addressed in the TM. Further, even though supporting data and research showing their contribution to low DO was readily available from peer-reviewed literature, they were not mentioned, evaluated or considered. The TM did not use the best science available, but rather singled-out the information which supported the proposal. The weight of science contradicts the TM and this Commission should reject the Proposal. The applicants have failed to meet their burden of proof to support a reclassification.

## B. Impairment for Copper in the LCFR and the TMDL Trigger for those Impairments Also Point to Animal Waste as the Cause

The TM selectively present information to support the proposed reclassification, but the record of research in the Cape Fear Basin demonstrates that manure nutrients from Animal Waste are both contributing to the DO deficit and are subject to the Commission's control. Copper is recommended to be added to animal feeds to promote growth.<sup>21</sup> Professors working at North Carolina State University studied the composition of Animal Waste using samples and the statistics on statewide inventories of livestock animals.<sup>22</sup> In this study, Dr. Barker and Dr. Zublena totaled all the nutrients found in all of the Animal Waste in all of North Carolina's Animal Operations as they existed in 1993. Their published findings show that more than 290 tons of copper per year were present in the Animal Waste produced by North Carolina's Animal Operations. Subsequent studies showed that nitrogen concentrations had slightly declined between 1995 and 2005, but that copper and zinc values have remained steady, with the highest concentration found in liquid animal waste produced at dairies and swine operations, followed by litters produced at broiler and turkey operations.<sup>23 24</sup> In 2012, North Carolina reported more than 300 miles of streams as impaired for copper on the CWA 303(d) list. The LCFR is part of those stream miles, from just outside Navassa into the area covered by the proposal. A TMDL is needed to address the impairment caused by excess copper.

Neither swamps nor estuaries contribute copper as a naturally occurring pollutant, whereas the scientific literature shows that copper is supplemented in feed to livestock and that hundreds of tons of it are excreted in Animal Waste produced by Animal Operations. Copper impairment on the Cape Fear River is thus a red flag, a fact that the four TM conveniently omit. Coupled with the impairments for low pH and turbidity, and the TMDL previously identified as needed for the LCFR, all signs point to Animal Waste as a primary cause. (The only exception is mercury impairment). Despite this evidence, the four TM omit any information about the contribution of Animal Waste to impairment; to the extent they insist that DO problems in the LCFR are caused by "natural conditions," they are misusing that term.

<sup>21</sup> See "Swine Feeding Suggestions" by Clemson University Extension, Circular 505 (1995), available online at: <http://www.clemson.edu/psapublishing/pages/ADV5/EC509.PDF> (last accessed Feb. 26, 2015)

<sup>22</sup> See "Livestock Manure Nutrients in North Carolina" by Dr. J.C. Barker and J.P. Zublena (1996), available online at: <http://www.bae.ncsu.edu/programs/extension/evans/assess.html> (last accessed Feb. 26, 2015)

<sup>23</sup> See "North Carolina Trends in Animal Waste Nutrient Concentrations" by Casteel, S., B. Cleveland, D. Osmond, and C. Hudak-Wise. 2007. In Proc. Soil Science Society of America Natl. Conf. – New Orleans, LA.

<sup>24</sup> Researchers and policymakers for the European Commission looking at allowable concentrations of copper supplements in livestock feed found that copper had negligible benefits to animal health except for piglets and recommended research to evaluate environmental impacts of copper excreted in livestock manure. See "Opinion of the Scientific Committee for Animal Nutrition on the use of copper in feedingstuffs" by the European Commission's Health and Consumer Protection's Directorate-General (2003) available online at: [http://ec.europa.eu/food/fs/sc/scan/out115\\_en.pdf](http://ec.europa.eu/food/fs/sc/scan/out115_en.pdf) (last accessed Feb. 26, 2015)

C. A Proper Interpretation of the Bowen Model Supports the Use of TMDL to Reduce Loading to the LCFR from sources in the Cape Fear River, Black River and Northeast Cape Fear, Including Animal Operations

The modeling effort for predicting how decreasing loading of pollution to the LCFR would impact DO levels was conducted by Dr. Jim Bowen at UNC- Charlotte (Bowen Model).<sup>25</sup> The Bowen Model ran several scenarios that incorporated assumptions obscuring the impacts of loadings from Animal Operations, including CAFOs. Pollution from Animal Operations, including CAFOs, was treated as given input to the modelling. The Bowen Model lumped together all upstream sources, both natural and anthropogenic, in waste load figures from the three major rivers upstream of the LCFR. Thus, the pollutant load from all sources discharging pollutants into the Northeast Cape Fear River above the LCFR model segment were lumped together into a single pollutant source. This single pollutant load is a combination of types of sources. In developing the load allocations for a TMDL, each of the upstream rivers should be evaluated further to document the contribution from each type of source, including naturally occurring conditions, whether classified as non-point or point sources. There are several NPDES-permitted facilities, including CAFOs, upstream of the LCFR.<sup>26</sup> Just because the Bowen Model lumps these loads into input categories labeled by the name of their original subbasin, the supporters of the reclassification lumps together with all other upstream sources as “natural.” These permitted facilities are obviously not natural sources and should be addressed by the state through the TMDL process.

In the case of the Northeast Cape Fear River, the Bowen Model labeled the upstream pollutant load under the category upstream river source number 20. Likewise the Cape Fear River and Black River were treated as source numbers 18 and 19, respectively. (See Bowen Model, Table 9, p. 47) Based on this assumption, no attempt was made to identify the sources of loadings to the Northeast Cape Fear River, Cape Fear River or the Black River. The model did not consider how much of the loads from these upstream rivers came from naturally-occurring pollutants and how much came from NPDES-permitted discharges or from Animal Waste. Thus, the Bowen Model cannot be used to support any determination that conditions are the result of naturally-occurring pollutants because it lumped the naturally-occurring and anthropogenic pollutants together in each of the three major rivers that flow into the LCFR.

<sup>25</sup> See: “Development and Use of a Three-Dimensional Water Quality Model to Predict Dissolved Oxygen Concentrations in the Lower Cape Fear River Estuary, North Carolina available online at: [http://webpages.uncc.edu/~jdbowen/LCFR/LCFR\\_DOModelReport\\_Final.pdf](http://webpages.uncc.edu/~jdbowen/LCFR/LCFR_DOModelReport_Final.pdf) (last accessed Feb. 26, 2015)

<sup>26</sup>For example, the following permits appear as NPDES permitted facilities run in connection with livestock operations upstream of LCFR: Godwin Farms Permit no. NCA282225; Dixie Chops, Inc. Permit No. NCA282143; Timothy Smith Farm Permit No. NCA231656; and Troy Sloan Farm Permit No. NCA231655. In addition, the Smithfield Packing Company holds Permit No. NC0078344 allowing up to 3 million gallons per day of water contaminated with pollutants such as those responsible for causing the types of impairments observed in LCFR. In addition, hundreds of Animal Operations in the basin operate under state level permits for handling animal waste. These sources are not naturally occurring and the Bowen Model does not make them such based on its inputs labelling scheme.

The Bowen Model also treated the estuarine tributaries in the same fashion as the three major rivers. Therefore, the Bowen Model cannot be used to support any determination that conditions there are the result of naturally-occurring pollutants because it lumped the naturally-occurring and anthropogenic pollutants together for these tributaries. A total of 20 wastewater treatment plants (WWTPs) with NPDES permits were also evaluated. The Bowen Model concluded that reducing loadings from these 20 WWTPs would not correct DO impairment, although they did have an effect on the amount of DO impairment. The Bowen Model can be interpreted to say that reduced loadings from these 20 WWTPs will not correct DO in the LCFR, but stretching the Bowen Model to prove that the LCFR are swamp waters is unsupported scientifically and is a misreading of the Bowen Model.

Significantly, the Bowen Model did conclude that reducing the combined loading from the Northeast Cape Fear River, Cape Fear River, the Black River and the estuarine tributaries would produce significant DO improvement. This Scenario was dubbed the “Clean River” Scenario. The Report states:

“The load reductions of riverine, creek, and wetland inputs were found to have a significant impact on the estimated dissolved oxygen concentrations during the summer months in the impaired region of the Lower Cape Fear River Estuary. At the 10th percentile level, DO concentrations for the three load reduction scenarios increased by 0.2, 0.3, and 0.4 mg/L respectively, from 4.3 mg/l to either 4.5, 4.6, or 4.7 mg/L (Figure 80). Unlike the scenarios described in the previous section in which wastewater loading decreases were investigated, the level of increase in DO concentration was maintained at the higher percentiles when reductions in the river, creek, and wetland loadings were made. In fact, for this “clean river” scenario, the median DO concentration increased to even a greater extent than the 10th percentile value, increasing from 5.6 to 5.85 mg/L for the 30% reduction (an increase of 0.25 mg/L), and from 5.6 to 6.2 mg/L (an increase of 0.6 mg/L) for the 70% reduction scenario (Figure 80).” See Bowen Model at page 142, Scenario 6-3.

The Bowen Model then concluded that cleaning up the riverine and estuarine tributaries was still not enough to meet the DO standard. But that was not the end of the modelling efforts. The Bowen team recognized that lowering the inputs from the Black River, Cape Fear River and Northeast Cape Fear River would reduce accumulation of organic materials in the sediments and thus would also reduce Sediment Oxygen Demand (SOD). In most of the model runs, the Bowen Model had held SOD contribution as constant and as uniform. Dr. Burkholder rightly critiques this assumption as a flaw in the model.

To test whether reducing both loadings from SOD and from the Black River, Cape Fear River and Northeast Cape Fear River would meet DO standards, they ran

another scenario, dubbed a “Clean River Scenario.” They found that by reducing the loadings from both SOD and upstream riverine and estuarine sources, 99% of the values achieved compliance with the DO standard. As the Bowen Model report noted:

“In this scenario we examine what conditions would be necessary to produce summertime DO concentrations above 5.0 mg/L. In addition, one limitation of the analysis done previously is that it ignores possible changes that might occur in the benthos if organic matter loadings were reduced. For instance, it is likely that a reduction of 30% or 50% or 70% in organic matter loading would in the long-term also result in lower sediment oxygen demands. The cumulative effect of decreasing both organic matter loading and sediment oxygen demand are examined in this scenario.” See Bowen Model at page 146, Scenario 6-5.

The Bowen Model thus shows that a TMDL would work and the designated uses can be protected. These model runs demonstrated that a reduction in the loadings from the Cape Fear River, the Black River and the Northeast Cape Fear River, and the Estuarine Tributaries would reduce loading to SOD. Taken together, this approach would correct DO and achieve compliance. Under the Clean Rivers scenario, DO would exceed the standard 99% of the time. Dr. Bowen’s team writes:

“The 50% reduction case had an even lower rate of water quality violations, but these were not completely eliminated. With both SOD and oxygen demanding wastes decreased, approximately 7% of summertime DO concentrations in the impaired region are below 5.0 mg/L, as compared to 27% when only the oxygen demanding wastes are decreased (Figure 82). There is also a large increase in the minimum predicted DO concentration for this case. The base case had a minimum predicted DO concentration of approximately 3.2 mg/L, whereas the minimum when SOD and oxygen demanding wastes are reduced by 50% is approximately 4.6 mg/L (Figure 82). A decrease in SOD of 70% and a reduction in river load of 70%, however, does almost completely eliminate dissolved oxygen concentrations below 5.0 mg/L (Figure 82). For this case, only about 1% of the predicted dissolved oxygen concentrations are below the water quality standard value.” See Bowen Model at page 142, Scenario 6-5.

The TM erred in their use of the Bowen Model by treating the Cape Fear River, Black River and Northeast Cape Fear River inputs as naturally-occurring conditions. This faulty position fails to acknowledge that each of these rivers receive large loadings from pollutant sources – mainly Animal Operations and CAFOs themselves. Once you unpack the assumptions built into the Bowen Model, you see that it actually supports a TMDL effort to reduce the loading impact from the Cape Fear River, Black River and Northeast Cape Fear River to correct the low DO in the LCFR. Loading from Animal Operations, including CAFOs, in these three tributary rivers clearly have caused an increase in LCFR DO concentrations.

#### D. The TM Are Incorrect in Ascribing Large Loading of Pollution to the LCFR from Riparian Wetlands

Dr. Burkholder further noted that the data do not support the assertion that inputs from riparian wetlands are “significant contributors to the tremendous loads of oxygen-demanding materials.” While the Bowen Model treated loadings from the three major rivers and the estuarine tributaries as if they were discharges from giant WWTPs, the Bowen Model does not attempt to distinguish between the pollutant loading caused by anthropogenic activities and those from naturally-occurring pollutants or conditions. Riparian wetlands often act to reduce the impact of pollutants to surface waters.

Other experts have identified Animal Waste as especially significant for Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) from ammonia, in the Northeast Cape Fear River system (e.g., Mallin et al. 1997). Dr. Burkholder points out that TetraTech focused on the three largest NPDES permitted dischargers and showed that reducing loading from these sources would not correct the problem. Once again, this does not prove natural conditions. Rather, it proves that the problem can be corrected only by reducing the impact of Animal Waste and the loading coming to LCFR from the Cape Fear River, Black River and the North East Cape Fear River as supported by the Bowen Model.

Similarly, the TM authored by CH2M HILL contains a description of surface water quality conditions in summer that omits any discussion of the massive contribution of organic-rich, oxygen-demanding materials from Animal Waste. Dr. Burkholder’s research, and that of her cited colleagues, shows that Animal Waste is a cause of the impairments currently found in the LCFR: copper, pH, turbidity and low DO. All available data show that past pollution must be dealt with if the Cape Fear River is to continue to serve its role as a public resource. In order to uphold its duty to the people of this State, the Commission and Department must deny the request.

#### V. Other Issues Prevent this Commission from Approving the Proposal as Submitted

Other problems with this proposal prevent the Commission from proceeding as proposed and require that the sidetracked TMDL proceed again to a conclusion. Even if a reclassification were an appropriate substitute for a TMDL in this case, two oversights would have to be corrected first: (1) the state failed to perform a Use Attainability Analysis (UAA) which could be approved only if the state can show that the current designated use is in fact unattainable; and (2) the fiscal assessment is grossly inadequate.

Under EPA regulations, the state must conduct a UAA if it is removing a designated use or adopting subcategories that impose less stringent water quality criteria. 40 CFR 131.10(j). The proposed reclassification would create a new subcategory for this waterbody, an action that plainly requires the completion of a UAA to demonstrate that attainment of the designated uses is not feasible. The state has not performed a UAA for

this section of the LCFR, so it has not met its obligations under EPA regulations. If the state elects to continue pursuing this reclassification, it must perform a UAA before submitting a reclassification proposal.

In addition, the state is required to prepare a fiscal note under the NC Administrative Procedures Act (APA). The current fiscal analysis claims that there will be no “quantifiable” impacts, positive or negative, of the proposal. No factual support or analysis is made for this claim. Where the extent and quantification of fiscal impacts is uncertain, the agency is forbidden from just assuming that there are none. “If an agency is not sure whether a proposed rule change would have a substantial economic impact, the agency shall ask the Office of State Budget and Management to determine whether the proposed rule change has a substantial economic impact. Failure to prepare or obtain approval of the fiscal note as required by this subsection shall be a basis for objection to the rule under G.S. 150B-21.9 (a)(4).” N.C. Gen. Stat. § 150B-21.4. The fiscal analysis provided for this proposal is plainly insufficient to meet APA requirements.

Here, we provide a few examples of the substantive inadequacies of the current fiscal analysis. First, there would be costs to the implementing agencies, as they would be required to apply the narrative swamp standards and determine whether violations were caused by natural conditions or dischargers. This would be time-intensive, and therefore costly, for the implementing agencies. Second, this proposal poses clear threats to the environment and ecosystem of the LCFR. These include negative impacts on the fish populations (and the fishing and recreation economies of the area) from the permission of decreased DO concentrations (from the reclassification that will potentially allow more lenient permits based on “natural” conditions and from the codification that will allow new permits to result in a 0.1mg/L drop in DO).

Third, the benefits associated with future planning are created by the codification component of the proposal, and entirely unrelated to the reclassification element of the proposal. Indeed, the reclassification might have the opposite effect because it will be difficult to anticipate how the state will apply the narrative standard for swamp waters. Fourth, there will plainly be economic benefits to dischargers who will have the option of dropping the DO concentration (based on the proposed codification) and the opportunity to argue that the natural conditions now being recognized also should have been considered at the time of their original permit issuance, making them eligible for an exception to the anti-backsliding policies (based on the reclassification). The economic analysis even admits that “[d]ischarges (sic) may in the future be granted additional wasteload allocations.” Fifth, there is no discussion of the benefits to CAFOs, Animal Operations and Feedlots. CAFOs and Animal Operations may benefit by avoiding their federal and state obligations under NPDES or under a mandatory state TMDL program.

The Commission is not excused from its duties under the APA when impacts are difficult to quantify. It is simple to understand where the weight of the impacts resides -- doing nothing allows continued harm to the river and allows those who are polluting under the status quo to continue their behaviors. Without quantifying the impacts, it is clear that the reclassification part of the proposal is harming the local communities and

the environment, while it is benefiting the Animal Operations that are the original source of the problem. The reclassification is not economically justifiable and should be abandoned. In addition, the current document combines the fiscal analysis of the reclassification and codification components of the proposal. These should be analyzed separately, as they could be separated by the EMC, legislature, or RRC since neither one is necessary for the other. If the proposals are separated in the future, it will be important to understand if they are independently economically justifiable. The current analysis sheds no light on this issue.

## **VI. Starting a Conversation or Stopping it Cold**

A representative from the LCFRP participated in the oral comment process and mentioned that this proposal was meant to “start the conversation” about problems on the LCFR. The actual proposal will not start a conversation, but end it. Once approved, this proposal will put an end to any discussions of the DO water quality of the LCFR. Once the existing NPDES permit holders are off-the-hook, we should expect new NPDES applicants to demand the same consideration and eliminate the management protections as the next step. In addition, low DO will continue to worsen as nutrient cycling creates a worse situation in the sediments. The current proposal is an illegal end-run around the TMDL process, which is squarely counter to the CWA’s objectives and scheme. The end point of the CWA was never to surrender to water quality degradation, but to fight for clean water. Our law requires the Commission to reject this proposal.

Very Truly Yours,

/s/

Ryke Longest, Director  
Duke Environmental Law and Policy Clinic

cc: EPA Region IV Administrator

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 March 3, 2015

***VIA ELECTRONIC MAIL***

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**Re: Proposed Cape Fear River swamp classification and management plan**

Dear Ms. Kountis:

The Southern Environmental Law Center appreciates the opportunity to comment on the proposed classification and management plan on behalf of American Rivers, Cape Fear River Watch, and the North Carolina Conservation Network. Together, these organizations represent thousands of North Carolinians who drink, fish, swim, and paddle the state's rivers, including the Cape Fear; who place a high value on the quality of North Carolina's water resources; and who will be adversely affected by the degradation of water quality in the Cape Fear River.

The comments that follow explain and detail our objections to these proposals. Section I emphasizes changes in the goals of environmental protection that led the State to protect waters for use by aquatic life. Section II addresses the relationship between classifications that identify the uses for which waters must be protected and water quality standards designed to afford the desired protection. Section III focuses on the classification and standards applicable to swamp waters. The remaining sections state specific objections to the proposals under consideration, which we believe would ignore the best usage of the Cape Fear River and further impair use of this water body by aquatic life by, among other things, authorizing persistent lower dissolved pH and dissolved oxygen concentrations that would not be protective of species inhabiting the affected segment of the river.

**I. Evolution of Protected Uses of North Carolina's Waters**

The content of laws protecting North Carolina's waters has always been tied to the use for which our leaders sought to protect these natural resources. Between the colonial era and the 19<sup>th</sup> century, state and federal laws were enacted primarily to ensure use of water for drinking, navigation, and hydropower.<sup>1</sup> Although some 19<sup>th</sup>-century enactments designed to protect

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<sup>1</sup> For instance, in 1899 Congress, primarily concerned with threats to the commercial use of interstate waterways, outlawed the "dumping of refuse that would obstruct navigation of navigable waters, except under a federal permit." River and Harbors Act of 1899, ch. 425, 30 Stat. 1121 (1899) (codified at 33 U.S.C. § 401-467). In North Carolina, the "first legislative acts concerning streams of the state were acts of the early colonial assembly to encourage

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commerce or public health collaterally benefited aquatic life,<sup>2</sup> the primary legislative focus was on preserving the public's water supply source, and "[l]ittle or no protection was yet afforded other uses of surface waters."<sup>3</sup>

The enactment of pollution controls to protect drinking water continued into the 20<sup>th</sup> century.<sup>4</sup> Even laws reflecting consideration of the use of waters by aquatic life remained focused on protecting commerce or public health.<sup>5</sup> Between the Great Depression and World War II,<sup>6</sup> the focus on commerce and public health persisted, and relatively few advances in state water-pollution law occurred in that period.

After the war, federal and state governments returned their attention to controlling water pollution,<sup>7</sup> and the law increasingly recognized the need to protect water for reasons other than commerce and public health. In 1951, the North Carolina General Assembly enacted the State Stream Sanitation Act, observing that the "best interest of the people" was served when water resources were protected for a variety of uses, including use by aquatic life.<sup>8</sup> The Act created the State Stream Sanitation Committee (SSSC) and empowered it to "establish methods designed to protect the water requirement for health, recreation, fishing, agriculture, industry, and animal life."<sup>9</sup> This expanded approach to water pollution control was advanced by the federal Clean Water Act (CWA),<sup>10</sup> which sought to develop pollution-control programs to conserve water for

navigation." David H. Howells, *Quest for Clean Streams in North Carolina: An Historical Account of Stream Pollution Control in North Carolina*, 258 *Water Resources Res. Inst. of the Univ. of N.C.* 3 (1990).

<sup>2</sup> See, e.g., Public Laws and Resolutions, N.C. General Assembly 1883, ch. 290 (making it "unlawful for any person to put any poisonous substance or matter for the purpose of catching, killing, or driving of any fish in any of the waters of any creek or river within the state."); Public Laws and Resolutions, N.C. General Assembly 1889, ch. 52 (prohibiting sawmill owners from dumping sawdust "into any river, creek, or stream of water, whereby the channel may be obstructed or damage done to any oyster bed, or the health of any person may be impaired").

<sup>3</sup> Howells, *supra* n.1 at 7.

<sup>4</sup> See, e.g., Public Laws and Resolutions, N.C. General Assembly 1903, ch. 159 (criminalizing the pollution of "any well, spring, drain, branch, brook or creek, or other source of public water supply used for drinking purposes."). Notably, the same law prohibited the discharge of raw sewage and spurred statewide advances in municipal sanitation. Howells, *supra* n.1 at 13.

<sup>5</sup> For instance, the Fisheries Commission Board was created in 1915 with the power to enforce new laws prohibiting the discharge of certain substances harmful to commercial fishing. Howells, *supra* n.1 at 17. Another law followed in 1927 prohibiting discharge of substances poisonous to fish in designated fish-producing waters, but "there were no prosecutions under either the 1915 or 1927 acts." *Id.* at 21-22 (noting that "the antipollution provision was never enforced by the board"). Later, in the 1920s, the State Board of Health began restricting shellfish areas where bacteriological contamination rendered harvested shellfish unsafe for human consumption. *Id.* at 18.

<sup>6</sup> By 1944, the State Board of Health claimed that stream sanitation was "becoming more critical each year." *Id.* at 41.

<sup>7</sup> The U.S. Congress enacted the Water Pollution Control Act of 1948 to provide technical and financial assistance to states for the creation of state water pollution control programs. Water Pollution Control Act, Pub. L. No. 80-845, 62 Stat. 1155 (1948).

<sup>8</sup> Session Laws and Resolutions, N.C. General Assembly 1951 ch. 606.

<sup>9</sup> *Id.*

<sup>10</sup> 33 U.S.C. § 1251(a). The Act sought to develop pollution control programs by giving "due regard" to the improvements necessary to conserve waters "for the protection and propagation of fish and aquatic life and wildlife, recreational purposes, and the withdrawal of such water for public water supply, agricultural, industrial, and other purposes." 33 U.S.C. § 1252(a).

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various uses, including “the protection and propagation of fish and aquatic life and wildlife, recreational purposes, and the withdrawal of such water for public water supply, agricultural, industrial, and other purposes.”<sup>11</sup>

Both federal and state leaders realized the need to categorize water resources by reference to the uses that they sought to protect by law. Accordingly, the North Carolina General Assembly required the SSSC to identify the “best usage” of the state’s water resources, then to adopt associated water quality standards to protect those uses.<sup>12</sup> Regulations adopted to implement the CWA similarly required each state to “specify appropriate water uses to be achieved and protected” before adopting water quality standards.<sup>13</sup>

The early evolution of water pollution control in North Carolina serves as an important reminder that the use for which the law seeks to preserve our waters is the primary driver of the standards imposed on the regulated community. As explained below, one problem with the proposal to reclassify a portion of the Cape Fear River as a swamp is that it materially alters an important use for which the river is currently protected. In Section II, we examine the connection between use classifications and associated quality standards.

## II. “Best Usage” and Classification of Water Bodies

Today, each state has a duty to adopt water quality standards under the CWA in order to protect public health or welfare, enhance the quality of water, and otherwise serve the purposes of the CWA.<sup>14</sup> As part of this first step in setting appropriately protective water quality standards, states must assign classifications to surface waters within their borders that identify the uses that each water body must support, and then set criteria necessary to protect the uses.

Accordingly, the uses for which the North Carolina Environmental Management Commission (EMC)<sup>15</sup> intends to protect North Carolina’s waters are reflected in its assignment of water body classifications. The classification of a water body dictates the applicable water quality standards, which are in turn designed to protect the “best usage” of the waters with that classification.<sup>16</sup> The law requires the EMC to consider multiple factors before determining the classifications of waters. First, it must consider physical characteristics, including “the size, depth, surface area covered, volume, direction and rate of flow, stream gradient and temperature

<sup>11</sup> *Id.* § 1252(a). North Carolina’s water quality classifications must be consistent with the requirements of the CWA.

<sup>12</sup> Session Laws and Resolutions, N.C. General Assembly 1951 ch. 606.

<sup>13</sup> 40 C.F.R. § 131.10(a).

<sup>14</sup> 40 C.F.R. § 131.2.

<sup>15</sup> Many duties originally assigned to the State Stream Sanitation Committee, including those related to the classification of waters, were conferred on the Board of Water and Air Resources in 1967, 1967 N.C. Sess. Laws 1967-892 (1967), and then on the EMC in 1973, 1973 N.C. Sess. Laws 1973-1262 § 19 (1973).

<sup>16</sup> See N.C. Gen. Stat. 143-214.1(a)(1) (directing the EMC to develop “a series of classifications and the standards applicable to each such classification”); 15A N.C. Admin. Code 2B .0201 (“Existing uses . . . and the water quality to protect such uses shall be protected by properly classifying surface waters and having standards sufficient to protect these uses.”); see also 40 C.F.R. § 131.11(a)(1) (“States must adopt those water quality criteria that protect the designated use. . . . For waters with multiple use designations, the criteria shall support the most sensitive use.”)

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of water.”<sup>17</sup> It must also consider whether the “character of the district bordering said water” evinces suitability for, or established economic interest in, a particular use of the water.<sup>18</sup> Most importantly, the EMC must consider the uses that “have been made, are being made, or may in the future be made” of the water.<sup>19</sup> Ultimately, the EMC must adopt classifications and the associated standards “with primary reference to the best usage to be made of the waters to which such classification will be assigned.”<sup>20</sup>

Pursuant to this statutory guidance, the EMC developed eight freshwater classifications, four saltwater classifications, and seven supplemental classifications for potential assignment to waters of the state.<sup>21</sup> Some classifications are based on the type of human use for which waters are protected.<sup>22</sup> Some classifications recognize that use of waters by aquatic life requires different protection in freshwater and saltwater.<sup>23</sup> Other classifications, particularly those designed to protect sources of drinking water, are based on the degree of development in the watershed.<sup>24</sup> And some of the primary classifications, like the two reserved for wetlands (Class WL for freshwater; Class SWL for saltwater) reference specific physical characteristics of the waters. The variety of available water body classifications demonstrates that the EMC realized that different uses require different protections. While these broad classifications are often sufficient to protect the best usage of waters, sometimes a more nuanced approach, involving the application of supplemental classifications, is required.

<sup>17</sup> N.C. Gen. Stat. § 143-214.1.

<sup>18</sup> *Id.* § 143-214.1(d)(2).

<sup>19</sup> *Id.* § 143-214.1(d)(3) (requiring the EMC to consider “[t]he uses and extent thereof which have been made, are being made, or may in the future be made, of such water for domestic consumption, bathing, fish or wildlife and their culture, industrial consumption, transportation, fire prevention, power generation, scientific or research uses, the disposal of sewage, industrial wastes and other wastes, or any other uses”); *see also* 15A N.C. Admin. Code 2B .0101 (requiring consideration, in addition to the uses listed in G.S. 143-214.1(d), of “all existing uses” of the water body in question).

<sup>20</sup> N.C. Gen. Stat. § 143-214.1(b).

<sup>21</sup> 15A N.C. Admin. Code 2B .0101.

<sup>22</sup> For example, while waters in classes C, B, SC, and SB are all protected for “secondary recreation, fishing, aquatic life including propagation and survival, and wildlife,” 15A N.C. Admin. Code 2B .0101(c)(1), (2); 15A N.C. Admin. Code 2B .0101(d)(1), (2), Class B and SB waters are also “protected for primary recreation.” *Id.* 2B .0220(c)(1)-(2); *id.* 2B .0220(d)(1)-(2). “Primary recreation” contemplates uses “involving human body contact . . . on a frequent basis,” *id.* 2B .0202(52), while “secondary recreation” contemplates uses “involving human body contact with water . . . on an infrequent, unorganized, or incidental basis,” *id.* 2B .0202(57).

<sup>23</sup> For fresh water, the default classification is Class C. 15A N.C. Admin. Code 2B .0211 (“The water quality standards for all fresh surface waters shall be the basic standards applicable to Class C waters. . . . Additional and more stringent standards applicable to other specific freshwater classifications are specified [elsewhere in] this Section.”). For salt water, the default classification is Class SC. 15A N.C. Admin. Code 2B .0220 (“The water quality standards for all tidal salt waters shall be the basic standards applicable to Class SC waters. Additional and more stringent standards applicable to other specific tidal salt water classifications are specified in Rules .0221 and .0222 of this Section.”).

<sup>24</sup> *See* 15A N.C. Admin. Code 2B .0101(c)(3)-(6) (listing different classifications for water supplies in “natural and undeveloped watersheds,” “predominantly undeveloped watersheds,” “low to moderately developed watersheds,” “moderately to highly developed watersheds,” and “moderately to highly developed watersheds”).

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Supplemental classifications are used to focus pollution control narrowly by enhancing protection in accordance with specific features of a water body. Many supplemental classifications are therefore based on the water body's physical, biological, or chemical characteristics. For instance, the "Nutrient Sensitive Waters" or "NSW" classification is reserved for "waters subject to growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs,"<sup>25</sup> and it requires development of strategies to control eutrophication "so that existing and designated uses of the water body are protected or restored."<sup>26</sup> Likewise, waters classified as trout waters (i.e., those that will "sustain and allow for trout propagation and survival of stocked trout on a year-round basis"<sup>27</sup>) are afforded additional protection against pollutants harmful to those fish.<sup>28</sup> Of particular relevance to the proposal under consideration, "waters which have low velocities and other natural characteristics which are different from adjacent streams" may be assigned a supplemental classification as "swamp waters."<sup>29</sup>

### III. "Swamp Waters" Classification

The "swamp waters" classification is intended to protect the unique aquatic community adapted to natural conditions found in swamps. Accordingly, the water quality standards associated with the "swamp waters" classification are designed to protect the use of waters for aquatic life propagation and survival that naturally occur in swamp waters.<sup>30</sup> Specifically, the EMC allows certain swamp waters to have higher acidity (i.e., low pH) and lower dissolved oxygen (DO) concentrations.<sup>31</sup>

This is significant because the use of waters for the survival and propagation of aquatic life (i.e., aspects of the "best usage" of Class SC and Class C waters that are not also classified as swamp waters) usually requires *higher* pH and DO levels. Fish production is generally higher in more alkaline waters (i.e., those with high pH),<sup>32</sup> and low pH can limit development and survival

<sup>25</sup> *Id.* 2B .0101(e)(3).

<sup>26</sup> 15A N.C. Admin. Code 2B .0223(e).

<sup>27</sup> 15A N.C. Admin. Code 2B .0202(65).

<sup>28</sup> *See, e.g.*, 15A N.C. Admin. Code 2B .0211 (stating different standards for chlorophyll-a, dissolved oxygen, cadmium, temperature, and turbidity for designated trout waters).

<sup>29</sup> *Id.* 2B .0101(e)(2).

<sup>30</sup> In contrast, other supplemental classifications result in application of more stringent water quality standards. *See, e.g.*, 15A N.C. Admin. Code 2B .0211(4) (more stringent freshwater chlorophyll-a standards for nutrient-sensitive waters and trout waters); *id.* 2B.011(6) (more stringent DO standards for trout waters); *id.* 2B .0211(19) (toluene standard applicable only to trout waters); *id.* 2B .0211(21) (more stringent turbidity standard for trout waters); *id.* 2B .0220(3) (more stringent saltwater chlorophyll-a standards for nutrient sensitive waters and trout waters); *id.* 2B .0223 (requiring development of nutrient control strategies in nutrient sensitive waters); *id.* 2B .0224 (stating standards applicable to high-quality waters); *id.* 2B .0225 (stating standards for outstanding resource waters). The State's antidegradation policy is also stricter for waters classified as high-quality waters or outstanding resource waters. *Id.* 2B .0201.

<sup>31</sup> 15A N.C. Admin. Code 2B .0211(6), (14) (permitting lower pH and DO standards for Class C waters with the supplemental "swamp waters" classification); 15A N.C. Admin. Code 2B .0220(5), (12) (permitting lower pH and DO standards for Class SC waters with the supplemental "swamp waters" classification).

<sup>32</sup> Louis A. Helfrich et al, *Liming Acidified Lakes and Ponds*, Virginia Cooperative Extension Pub. 420-254 (2009).

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of shellfish by inhibiting shell development.<sup>33</sup> In addition, pH affects the solubility and biological availability of nutrients and heavy metals.<sup>34</sup> Low pH can therefore limit the nutrients available for plant growth and increase the toxicity of metals.

Similarly, DO is critical to the survival of fish and other aquatic life, and lower concentrations are typically detrimental.<sup>35</sup> The EMC recognized this fact when requiring higher DO concentrations in trout waters.<sup>36</sup> In waters with low levels of DO, finfish and mobile macroinvertebrates can experience negative impacts ranging from mortality to impaired reproduction, immune responses, and growth.<sup>37</sup> DO is also critical to the decomposition of organic matter in the water and bottom sediments.

In Class SC waters like the lower Cape Fear River, the normal dissolved oxygen standard is 5.0 mg/L.<sup>38</sup> But the law provides that “swamp waters . . . may have lower values if caused by natural conditions.”<sup>39</sup> Similarly, while the pH in Class SC waters should be “normal for waters in the area, which range between 6.8 and 8.5,”<sup>40</sup> Class SC waters with the supplemental “swamp waters” classification “may have a pH as low as 4.3 if it is the result of natural conditions.”<sup>41</sup> Indeed, the primary consequence of a supplemental designation as swamp waters is the lowering of pH and DO levels to ensure that the standards protect natural conditions.

Ultimately, the standards for pH and DO in swamp waters reflect the EMC’s acknowledgment that certain aquatic species have adapted to conditions in relatively stagnant waters, where natural characteristics and processes have combined to alter the chemical composition of the aquatic environment.<sup>42</sup> However, lowering pH and DO where natural conditions have *not* prepared aquatic life for these stressors can have a negative impact on the usage of waters for the propagation and survival of aquatic life. This is why it is only acceptable

<sup>33</sup> Saskia de Melker, *Coral Reefs and Shellfish Battle Acidifying Oceans*, PBS Newshour (Dec. 5, 2012) (“As acidity increases, animals like scallops, oysters, and clams have a harder time extracting the calcium carbonate they need to build their essential shells. Shells become thinner, growth slows down, and death rates rise.”), available at [http://www.pbs.org/newshour/updates/climate-change-july-dec12-acidification\\_12-05/](http://www.pbs.org/newshour/updates/climate-change-july-dec12-acidification_12-05/)

<sup>34</sup> US Geological Survey Water Science School, *ph – Water properties* (2014), available at <http://water.usgs.gov/edu/ph.html>.

<sup>35</sup> US EPA, Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras 4 (Nov. 2000) (“Oxygen is essential in aerobic organisms for the electron transport system of mitochondria. Oxygen insufficiency at the mitochondria results in reduction in cellular energy and a subsequent loss of ion balance in cellular and circulatory fluids.”), available at [http://water.epa.gov/scitech/swguidance/standards/upload/2007\\_03\\_01\\_criteria\\_dissolved\\_docrriteria.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2007_03_01_criteria_dissolved_docrriteria.pdf).

<sup>36</sup> 15A N.C. Admin. Code 2B .0220(6).

<sup>37</sup> Denise L. Brietburg et al, Hypoxia, Nitrogen, and Fisheries: Integrating Effects Across Local and Global Landscapes, 1 Annual Review of Marine Science 333-35 (2009), available at <http://moritz.botany.ut.ee/~olli/eutrsem/Breitburg09.pdf>.

<sup>38</sup> 15A N.C. Admin. Code 2B .0220(5).

<sup>39</sup> *Id.*

<sup>40</sup> 15A N.C. Admin. Code 2B 2B .0220(12).

<sup>41</sup> *Id.*

<sup>42</sup> US EPA, Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras 5 (Nov. 2000) (“Compensatory adaptations are well developed in marine animals that commonly experience hypoxia.”).

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for a water body designated as swamp waters to have lower pH and DO when “caused by” or the “result of” natural conditions.<sup>43</sup>

#### IV. The EMC Must Not Ignore the Defining Characteristics of Swamp Waters

The members of the Lower Cape Fear River Program (Petitioners), a collection of permitted wastewater dischargers, have asked the EMC to reclassify a segment of the Cape Fear River as swamp waters.<sup>44</sup> Although Petitioners argue that pH and DO levels in the Cape Fear River are the result of “natural conditions,” they ignore the fact that the river lacks the natural *characteristics* that define swamp waters. The first problem with the proposal to reclassify this segment is that doing so would be directly contrary to the EMC’s own definition of “swamp waters.”

State regulations provide multiple definitions of “swamp waters,” and in each the defining characteristic is low velocity.<sup>45</sup> Although Petitioners claim to support their reclassification request with “a wealth of research and technical assessment studies,” data about velocity are conspicuously absent from their petition. The lack of velocity data is particularly notable given that Petitioners have a web of monitoring stations, including multiple stations in the affected segment; apparently none of the stations monitors or records velocity data.<sup>46</sup> Yet this is precisely the kind of “data and information required for determining” whether classification of the segment as “swamp waters” is appropriate.<sup>47</sup>

Given the dearth of data provided by Petitioners, it should be noted that data confirm that the Cape Fear River, in fact, has a high velocity. Studies by U.S. Army Corps of Engineers confirm that velocity in the lower Cape Fear River regularly exceeds 2 ft/s.<sup>48</sup> The National

<sup>43</sup> 15A N.C. Admin. Code 2B .0211(6), (14); 15A N.C. Admin. Code 2B .0220(5), (12).

<sup>44</sup> Specifically, Petitioners seek reclassification of a portion of the river consisting of section 19-(71) from upstream of the mouth of Toomers Creek to a line across the river between Lilliput Creek and Snows Cut.

<sup>45</sup> 15A N.C. Admin. Code 02B .0101(e)(2) (“Swamp waters (Sw): waters which have low velocities and other natural characteristics which are different from adjacent streams”); 15A N.C. Admin. Code 02B .0202(62) (“Swamp waters mean those waters which are classified by the Environmental Management Commission and which are topographically located so as to generally have very low velocities and other characteristics which are different from adjacent streams draining steeper topography.”); 15A N.C. Admin. Code 02B .0301(c) (defining swamp waters as “Waters which have low velocities and other natural characteristics which are different from adjacent streams”).

<sup>46</sup> To its credit, the coalition has collected a wealth of data about other parameters, including temperature, pH, dissolved oxygen, conductivity, fecal coliform, enterococcus, turbidity, suspended residue, chlorophyll-a, NH3-N, TKN-N, NO2-NO3, Phosphorus, Cadmium, Chromium, Copper, Nickel, Lead, Zinc, Aluminum, Iron, Manganese, Mercury, Arsenic, and Hardness. <http://lcfpr.uncw.edu/riverdatabase/queryAll.php?type=parameter>.

<sup>47</sup> See 15A N.C. Admin. Code 2B .0101(b) (stating that the EMC may only make a classification determination after “appropriate studies of the identified waters to obtain the data and information required for determining the proper classification of the waters or segments of water are completed”).

<sup>48</sup> Robert T. McAdory, Jr., *Cape Fear-Northeast Cape Fear River, North Carolina, Numerical Model Study* (August 2000), available at <http://acwc.sdp.sirsi.net/client/search/asset/1000633>. Also, data collected by the US Geological Survey (USGS) at Lock & Dam 1 upstream of the affected segment shows that since 1982, the monthly mean discharge has ranged from 9,740 ft<sup>3</sup>/s in March to 2,940 ft<sup>3</sup>/s in August. See USGS, *Monitoring Station 02105769 on the Cape Fear River at Lock #1 near Kelly, NC* (2015),

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Oceanic and Atmospheric Administration predicts that velocities at a monitoring station in the segment of the Cape Fear River proposed for reclassification will reach as high as 2.4 knots (4.1 ft/s) in 2015.<sup>49</sup> For comparison, the average velocity of the Mississippi River is near 1.2 miles per hour (1.8 ft/s) at the headwaters and 3 miles per hour (4.4 ft/s) near New Orleans.<sup>50</sup> Relatively high flow rates have also been documented in studies comparing the Cape Fear River estuary to others in the Southeast.<sup>51</sup> Indeed, the flushing effect of the high-velocity flow of the Cape Fear River has been credited with limiting the prevalence of harmful algal blooms,<sup>52</sup> influencing the migration patterns of local aquatic life,<sup>53</sup> and affecting the location of saltwater intrusion in the estuary.<sup>54</sup>

It would be contrary to the plain language of the law to apply to the fast-moving main stem of the Cape Fear River a “swamp water” classification reserved for waters with “low velocities” or “very low velocities.” The EMC should not ignore the definition of the classification—which, critically, includes the velocity—in order to permit lower standards for DO and pH in a high-velocity segment of the river.<sup>55</sup> Notably, in addition to explicit consideration of velocity, the definition of “swamp waters” contemplates waters with “natural characteristics which are different from adjacent streams.”<sup>56</sup> Yet Petitioners’ argument rests on the alleged *similarity* of natural characteristics in adjacent streams.<sup>57</sup> The EMC should apply its

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[http://waterdata.usgs.gov/nwis/monthly/?search\\_site\\_no=02105769&agency\\_cd=USGS&referred\\_module=sw&format=sites\\_selection\\_links](http://waterdata.usgs.gov/nwis/monthly/?search_site_no=02105769&agency_cd=USGS&referred_module=sw&format=sites_selection_links).

<sup>49</sup> National Oceanic and Atmospheric Association, *Tides and Currents—2015 Tidal Current Predictions* (2015), [http://tidesandcurrents.noaa.gov/get\\_predc.shtml?year=2015&stn=5133+Charleston Harbor&secstn=Wilmington&sbfh=%2B3&sbfm=52&fldh=%2B4&fldm=07&sbeh=%2B2&sbem=48&ebbh=%2B3&ebbm=07&fldr=0.8&ebbr=0.7&fldavgd=337&ebbavgd=153&footnote=](http://tidesandcurrents.noaa.gov/get_predc.shtml?year=2015&stn=5133+CharlestonHarbor&secstn=Wilmington&sbfh=%2B3&sbfm=52&fldh=%2B4&fldm=07&sbeh=%2B2&sbem=48&ebbh=%2B3&ebbm=07&fldr=0.8&ebbr=0.7&fldavgd=337&ebbavgd=153&footnote=)

<sup>50</sup> U.S. National Park Service, *Mississippi River Facts* (2015), <http://www.nps.gov/miss/riverfacts.htm>

<sup>51</sup> Richard Dame et al, *Estuaries of the South Atlantic Coast of North America: Their Geographical Signatures*, 23 *Estuaries* 798 t.1 (2000). Of particular relevance, the data showed higher velocity flows in the Cape Fear estuary than in either the Pamlico or Neuse River estuaries. *Id.*

<sup>52</sup> Michael Mallin et al, *North and South Carolina Coasts*, 41 *Marine Pollution Bulletin* 56, 58 (2000) (“Well-flushed sounds or unconstrained rivers (such as the Cape Fear system) maintain much lower phytoplankton biomass and productivity.”); *id.* at 60 (Well-flushed systems like euhaline sounds, and open rivers like the Cape Fear rarely host algal blooms)

<sup>53</sup> Michael P. Weinstein et al, *Retention of Three Taxa of Postlarval Fishes in an Intensively Flushed Tidal Estuary, Cape Fear River, North Carolina*, 78 *Fishery Bulletin* 419 (1980) (noting that “[t]idal velocities in the Cape Fear are high” and observing behavioral responses that enable fish to “avoid being flushed seaward”), *available at* <http://fishbull.noaa.gov/78-2/weinstein.pdf>.

<sup>54</sup> May Ling Becker, *Hydrodynamic Behavior of the Cape Fear River and Estuarine System: A Synthesis and Observational Investigation of Discharge-Salinity Intrusion Relationships*, 88 *Estuarine, Coastal and Shelf Science* 407 (May 2010).

<sup>55</sup> N.C. Gen. Stat. § 143-214.1.

<sup>56</sup> 15A N.C. Admin. Code 02B .0101(e)(2); 15A N.C. Admin. Code 02B .0301(c); see also 15A N.C. Admin. Code 02B .0202(62) (noting that swamp waters have, other than characteristically low velocity, “other characteristics which are different from adjacent streams draining steeper topography.”).

<sup>57</sup> Petitioners contend that changing the classification of the river would “recognize the influence” of “riverine wetland and salt marsh systems that are ubiquitous” in the region and “be consistent with the classifications of [the] immediate upstream segment of the Cape Fear River and the tributaries which all currently carry the supplemental Sw classification.” Chris May, *Request for Reclassification of a Portion of the Lower Cape Fear River with the Supplemental Swamp Classification* (March 5, 2014).

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own definition of “swamp waters” and reject the proposal to misapply that supplemental classification to the lower Cape Fear River.

V. The EMC Must Not Prioritize Wastewater Discharge over Best Usage

In addition to ignoring the definition of “swamp waters” adopted by the EMC, Petitioners ignore the very purpose of classification: to protect the best usage of the water body. Petitioners make no argument that reclassification would protect the “best usage” of the segment in question. Nor do they challenge the State’s oft-repeated observation that low pH and DO levels have impaired existing use of the river by aquatic life in the segment.<sup>58</sup> Indeed, Petitioners make no attempt to argue that classifying the river as “swamp waters” would adequately protect use of the river by aquatic life.<sup>59</sup>

Instead, Petitioners focus on *their* use of the river. Petitioners want the EMC to relax water quality standards so they can discharge wastewater into the river without implementing additional pollution controls necessary to protect aquatic life.<sup>60</sup> In other words, rather than trying to meet current standards designed to protect the best usage of the waters, Petitioners want the standards changed to accommodate their preferred usage. Since federal law explicitly prohibits the State from adopting “waste assimilation” as a designated use of the Cape Fear River,<sup>61</sup> Petitioners are asking the EMC to reclassify the river in a way that would allow their continued use of the river for precisely that purpose to the detriment of other designated uses.

To be clear, no one is arguing that Petitioners must stop discharging wastewater into the river. The water quality standards in place were drafted in contemplation of the effect of “the discharge of sewage, industrial wastes or other wastes including those from nonpoint sources and other sources of water pollution.”<sup>62</sup> However, reclassification for the purpose of masking the impact of such water pollution on aquatic life is unacceptable.<sup>63</sup> If Petitioners want permission from the EMC to discharge effluent with pH and DO concentrations below those appropriate for class SC waters, they should seek a variance through the permitting process.<sup>64</sup> But the EMC must

<sup>58</sup> See, e.g., NC DENR, *North Carolina 303(d) List-2006 19* (June 19, 2007) (noting impairment of use by aquatic life); NC DENR, *2014 Category 5 Water Quality Assessments-303(d) List 3* (Dec. 19, 2014) (same).

<sup>59</sup> But see 40 C.F.R. § 131.10(a)(1) (“Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.”).

<sup>60</sup> Current impairment of use of the river by aquatic life requires the development and implementation of a TMDL, which would include waste load allocations applicable to Petitioners.

<sup>61</sup> 40 C.F.R. § 131.10 (“In no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the United States.”).

<sup>62</sup> 15A N.C. Admin. Code 2B .0205.

<sup>63</sup> See N.C. Gen. Stat. § 143-214.1(b) (directing the EMC to adopt classifications “with primary reference to the best usage to be made of the waters to which such classification will be assigned”).

<sup>64</sup> N.C. Gen. Stat. § 143-215.3(e); 15A NCAC 2B.0226 (“Variances from applicable standards, revisions to water quality standards or site-specific water quality standards may be granted by the Commission on a case-by-case basis pursuant to G.S. 143-215.3(e), 143-214.3 or 143-214.1.”). That way, their exemption, if granted from existing water quality standards could at least be reviewed as part of the triennial review of water quality standards required under federal law. See 15A N.C. Admin. Code 2B .0226.

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not pretend that the “best usage” of the river is achieved through attainment of uncharacteristically and unnaturally low pH and DO standards that are associated with swamp waters.

Petitioners do not deny that their discharges contribute to the current impairment of the “best usage” of the river by aquatic life. This impairment was first recognized in 1998, when DENR observed that low DO concentrations meant the river was only providing “partial support” for designated use and opined that Petitioners may be to blame.<sup>65</sup> Even the materials offered in support of their petition establish that Petitioners’ discharge contributes to the low pH and DO conditions observed in the river, although Petitioners maintain that their impact is “minor.”<sup>66</sup>

Petitioners cite studies which they believe demonstrate that even with significant reductions in pollutant loads, dissolved oxygen in the lower Cape Fear River would occasionally fall below the current standard during summer months.<sup>67</sup> Petitioners apparently assume that aquatic life cannot be adequately protected if, following implementation of additional pollution controls, occasional seasonal drops in pH and DO are observed.<sup>68</sup> Consequently, they want the EMC to assign to the river a classification that would avoid the need to implement those additional pollution controls. Yet, when classifying the lower Cape Fear River as Class SC waters, the EMC recognized that “natural waters may on occasion, or temporarily, have characteristics outside of the normal range established by the standards” and “water quality standards will not be considered violated when values outside the normal range are caused by natural conditions.”<sup>69</sup> In other words, the current SC classification is designed to protect use of the river for aquatic life propagation and survival *despite* occasional periods of low DO and pH in the summer months caused by natural conditions.<sup>70</sup> Since use of the river for aquatic life propagation and survival is possible with reasonable pollution control, the EMC should reject the proposal to lower water quality standards through reclassification and instead attempt to actually control pollution that is impairing existing use of the river by aquatic life.<sup>71</sup>

<sup>65</sup> NC DENR, North Carolina’s 1998 303(d) List T-6 (May 15, 1998) (Noting that of the 7,500 acres providing only “partial support” of designated uses, 5,000 were impaired by DO and listing wastewater treatment plants as a source of the impairment.), *available at* [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=2284d944-2134-4c57-a2d9-499c58076d4a&groupId=38364](http://portal.ncdenr.org/c/document_library/get_file?uuid=2284d944-2134-4c57-a2d9-499c58076d4a&groupId=38364)

<sup>66</sup> Letter from Chris May, Chair, Lower Cape Fear River Program Advisory Board, to Tom Reeder, Director, DENR-Division of Water Resources D-4 (March 5, 2014).

<sup>67</sup> *Id.* at D-5.

<sup>68</sup> Notably, oxygen solubility decreases with increasing water temperatures, so lower DO in warmer summer months is unremarkable.

<sup>69</sup> 15A N.C. Admin. Code. 2B .0205.

<sup>70</sup> Even if summertime exceedances of WQS could merit reclassification, there may exist reasonable alternatives to lowering the standards for the entire year. See 40 C.F.R. § 131.10(f) (“States may adopt seasonal uses as an alternative to reclassifying a water body or segment thereof to uses requiring less stringent water quality criteria. If seasonal uses are adopted, water quality criteria should be adjusted to reflect the seasonal uses, however, such criteria shall not preclude the attainment and maintenance of a more protective use in another season.”).

<sup>71</sup> 40 C.F.R. § 131.10(d) (stating that “uses are deemed attainable if they can be achieved by the imposition of effluent limits . . . and cost-effective and reasonable best management practices for nonpoint source control”).

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By lowering pH and DO standards through reclassification, the EMC would instead further limit use of the river by aquatic life, the very use that has long been impaired by pH and DO levels, by allowing persistent, rather than occasional, conditions of low pH and DO. Essentially, reclassification would serve to authorize increased water pollution by existing point and nonpoint sources. The EMC must not apply a classification that would effectively remove an existing use.<sup>72</sup>

In sum, the proposal under consideration would see the EMC abandon efforts to protect the best usage of the Cape Fear River by aquatic life and instead substantially lower the applicable water quality standards for pH and DO to appease polluters who would otherwise be required to limit their pollution of North Carolina's waters. Rather than bless the degradation of water quality and wildlife habitat in the river, the EMC should reject the proposal to reclassify the Cape Fear River as swamp waters.

#### VI. The EMC Should Protect Use of the Cape Fear by Aquatic Life

The use of the lower Cape Fear River for the survival and propagation of aquatic life is too important to ignore or restrict through reclassification. Petitioners note that the segment in question was once classified as swamp waters, but fail to mention that the State explicitly admitted that this was the result of inadequate consideration of the best usage of the waters by aquatic life.<sup>73</sup> In 1981, the EMC observed that "a low pH is detrimental to shellfish propagation" and that "it is incompatible to have a classification of SA-Sw" in the lower Cape Fear River.<sup>74</sup> Accordingly, the EMC removed the swamp waters classification from the segment Petitioners now seek to have reclassified, as it was immediately upstream of waters classified for commercial production of shellfish and removal of the swamp waters designation was necessary to prevent impairment of the best usage of those downstream waters.<sup>75</sup>

In other words, swamp water classification was removed from this segment to protect aquatic life; the EMC should not repeat the mistake of ignoring effects on aquatic life by again classifying the river as swamp waters. As noted above, higher pH and DO concentrations are required to protect aquatic species unaccustomed to life in stagnant swamp waters. Low pH is

<sup>72</sup> 40 C.F.R. § 131.10(h)(1) (prohibiting removal of an existing use unless a use requiring more stringent criteria is added). As previously discussed, swamp water classification involves less stringent criteria than are otherwise applicable to SC waters. At minimum, the State should conduct a use attainability analysis before applying a supplemental classification which requires less stringent criteria. 40 C.F.R. § 131.10(j)(2).

<sup>73</sup> N.C. Dep't of Natural Resources and Community Development, Report of Proceedings Concerning the Proposed Reclassification of South Creek in the Tar-Pamlico River Basin and the Removal of the Swamp Water Designation from Waters in the Neuse River Basin and Cape Fear River Basin ii (1981) ("As a low pH is detrimental to shellfish propagation, it is incompatible to have a classification of SA-Sw. When the original classification of all river basins was done, this fact was recognized in all basins except the Neuse and Cape Fear.").

<sup>74</sup> *Id.*

<sup>75</sup> The segment Petitioners now seek to reclassify was immediately upstream of waters classified for commercial production of shellfish and removal of the swamp water designation was necessary prevent impairment of the best usage of those downstream waters. 40 C.F.R. § 131.10(d) ("In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters."); 15A N.C. Admin. Code. 2B .0203.

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particularly dangerous for shellfish, as noted when the EMC classified the segment as Class SC. Moreover, the portion of the river proposed for reclassification plays a critical role in the early life cycles of aquatic life and is home to endangered species.

In late winter, migratory fish including striped bass, Atlantic sturgeon, and American shad migrate from the ocean and lower Cape Fear estuary to spawn upstream in the main stem of the Cape Fear River.<sup>76</sup> Although adult fish return to the ocean or lower estuary after spawning, juveniles remain in nursery habitats through the summer before migrating seaward in late fall.<sup>77</sup> The segment proposed for reclassification includes habitat designated as primary nursery areas by the Division of Marine Fisheries (DMF).<sup>78</sup> Primary nursery areas (PNAs) are those “in the estuarine system where initial post-larval development takes place” and “populations are uniformly early juveniles.”<sup>79</sup> The affected segment is also designated as an anadromous fish spawning area (AFSA) by DMF and the Wildlife Resources Commission.<sup>80</sup> This means “evidence of spawning anadromous fish has been documented in [DMF] sampling records through direct observation of spawning, capture of running ripe females, or capture of eggs or early larvae.”<sup>81</sup>

Although swamp water classification is not entirely inconsistent with labeling waters as a PNA or AFSA, care must be exercised to avoid inappropriate swamp water classification that would impact finfish at early stages of development. Low dissolved oxygen levels can be particularly problematic in spawning and nursery areas because hypoxia “causes substantial mortality of developing embryos.”<sup>82</sup> For this reason, EPA recommends more stringent dissolved oxygen criteria for the early life stages of both coldwater and warmwater fish.<sup>83</sup>

<sup>76</sup> Cape Fear River Partnership, Cape Fear River Basin Action Plan for Migratory Fish 18 (April 2013), available at <http://www.habitat.noaa.gov/protection/capefear/pdf/CapeFearActionPlan.pdf>

<sup>77</sup> *Id.*

<sup>78</sup> 15A N.C. Admin. Code 3R .0103.

<sup>79</sup> 15A N.C. Admin. Code 3I .0101; *see also* 15A N.C. Admin. Code 2B .0202 (“Primary Nursery Areas (PNAs) are tidal saltwaters which provide essential habitat for the early development of commercially important fish and shellfish and are so designated by the Marine Fisheries Commission.”).

<sup>80</sup> 15A N.C. Admin. Code 3R .0115(25); *see also* Division of Marine Fisheries, Anadromous Fish Spawning Areas (AFSA): Cape Fear River Area, Map 7, available at [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=f810ae29-ea4d-4801-a04f-850ff2bc4467&groupId=38337](http://portal.ncdenr.org/c/document_library/get_file?uuid=f810ae29-ea4d-4801-a04f-850ff2bc4467&groupId=38337)

<sup>81</sup> Anadromous fish spawning areas are those “where evidence of spawning anadromous fish has been documented in Division sampling records through direct observation of spawning, capture of running ripe females, or capture of eggs or early larvae.” 15A N.C. Admin. Code 3I .0101(4)(b).

<sup>82</sup> Denise L. Brietburg et al, Hypoxia, Nitrogen, and Fisheries: Integrating Effects Across Local and Global Landscapes, 1 Annual Review of Marine Science 333 (2009)(“Developing embryos are particularly sensitive because they lack the ability to behaviorally respond to low oxygen and because oxygen must diffuse across the chorion that encases the embryo.”), available at <http://moritz.botany.ut.ee/~olli/eutrsem/Breitburg09.pdf>.

<sup>83</sup> US EPA, *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras*, app. I (Nov. 2000), available at [http://water.epa.gov/scitech/swguidance/standards/upload/2007\\_03\\_01\\_criteria\\_dissolved\\_docrteria.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2007_03_01_criteria_dissolved_docrteria.pdf).

Elizabeth Kountis, DENR-DWR Planning Section  
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In addition to playing a role in the life cycles of multiple fish species, the lower Cape Fear River is home to two endangered species of sturgeon, suggesting a need for more stringent environmental protection.<sup>84</sup> “Maintenance and recovery of the water quality conditions required to sustain and recover federally-listed threatened and endangered aquatic animal species contributes to the support and maintenance of a balanced and indigenous community of aquatic organisms and thereby protects the biological integrity of the waters.”<sup>85</sup> As such, the EMC should refrain from classification that could instead prove harmful to endangered aquatic life.

First, the lower Cape Fear is home to the Atlantic sturgeon, a species that NOAA’s National Marine Fisheries Service first listed as endangered in 2012. Although the harvest of Atlantic sturgeon has been banned since 1991, the Atlantic States Marine Fisheries Commission (ASMFC) has stated that fishery management measures alone will not sustain stocks of Atlantic sturgeon without sufficient quality and quantity of habitat. As such, it bears emphasis that the estuarine waters of the lower Cape Fear river are precisely the type where juvenile Atlantic sturgeon “for months to years before emigrating to open ocean.”<sup>86</sup> Moreover, ASMFC studies demonstrate that DO concentration is a “key habitat parameter[] for the structuring of juvenile Atlantic sturgeon habitat.”<sup>87</sup> The EMC should not lower water quality standards in the Cape Fear and thereby further threaten the survival of this species.

The Lower Cape Fear also hosts a population of shortnose sturgeon, a species recognized by the federal government as endangered in 1967 and subject to a fishing moratorium since 1991. Juvenile shortnose sturgeon tend to locate in estuarine waters such as those in the segment proposed for reclassification. Consequently, “protection of essential habitats, especially nursery/summer habitats, from human caused dissolved-oxygen reductions and other impacts is critical.”<sup>88</sup> The EMC should not relax such protection and subject this already endangered species to additional environmental stressors.

Instead, the EMC should hold the line in the fight against degrading water quality in the lower Cape Fear River. Petitioners would have the State simply quit trying to protect this resource for use by aquatic life that requires “normal” pH levels above 6.8 and/or DO levels of above 5.0 mg/L. Petitioners essentially claim that because their best efforts will not achieve universal year-round attainment of desired pH and DO levels and eliminate all naturally caused occasional exceedances of current standards, those standards should be replaced with standards designed to allow persistent low DO and pH levels to protect use of different aquatic environments. The EMC should not accept Petitioner’s invitation to view the perfect as the

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<sup>84</sup> See Mary L. Moser & Steve W. Ross, *Habitat Use and Movements of Shortnose and Atlantic Sturgeon in the Lower Cape Fear River, North Carolina*, 124 Transactions of the American Fisheries Society 225 (1995).

<sup>85</sup> 15A N.C. Admin. Code 2B .0110.

<sup>86</sup> Atlantic Marine Fisheries Commission, *Habitat Addendum IV to Amendment I to the Fishery Management Plan for Atlantic Sturgeon* 2 (Sept. 2012), available at [http://www.asmfc.org/uploads/file/sturgeonHabitatAddendumIV\\_Sept2012.pdf](http://www.asmfc.org/uploads/file/sturgeonHabitatAddendumIV_Sept2012.pdf)

<sup>87</sup> *Id.* at 3.

<sup>88</sup> Mark R. Collins et al, *Primary Factors Affecting Sturgeon Populations in the Southeastern United States: Fishing Mortality and Degradation of Essential Habitats*, 66 Bulletin of Marine Science 917, 917 (2000), available at

Elizabeth Kountis, DENR-DWR Planning Section  
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enemy of the good. Instead, we urge the EMC to continue to manage the lower Cape Fear River so as to provide for the best usage of the water body.

## VII. Management Plan

The management plan suggested by Petitioners is not designed to achieve best usage of the river and should also therefore be rejected by the EMC. Water quality management plans are supposed to be developed “to attain, maintain or enhance water quality.”<sup>89</sup> Yet, the proposed management plan is only being put forth in recognition of the fact that classifying the lower Cape Fear River as swamp waters would lower water quality standards. As explained above, the best way for the EMC to attain, maintain or enhance water quality is to leave in place existing water quality standards and strive to attain them. Instead, the EMC is considering a management plan that starts from the premise that target goals for pH and DO in the river should be lowered.

There are a number of problems with the management plan beyond the fact that it represents a refusal to manage the river to achieve its currently defined “best usage.” To begin, the plan would only apply to “new individual NPDES wastewater discharges and expansions of existing NPDES wastewater dischargers.” As such, no currently permitted operations would be impacted (i.e., the effluent limits expressed in Petitioner’s current NPDES permits would not be amended). In other words, just as Petitioners seek to minimize their responsibility for existing impairment of aquatic life use in the river, they also seek to minimize their responsibility for improving conditions in the river. Moreover, while Petitioners point to studies claiming that point sources contribute less than 10% of the waste load in the River, they propose a management plan that would do little to actually limit point source loading. First, due to its limitation to “individual” NPDES permittees, the management plan would not even apply to point sources operating under a general NPDES permit. The plan further limits its applicability to point sources with a provision noting that the State can impose “seasonal effluent limits for oxygen-consuming waste” on a “case-by-case basis in accordance with 15A NCAC 2B .0404.” And even after substantial limitation, the management plan would not apply to point source loading in the tributaries that Petitioners claim are feeding low pH and DO waters into the segment they seek to protect through this management plan. In sum, the proposal would have the EMC adopt a management plan that applied only to a subset of point sources, only in the event of new or expanded operations, only if the permittee was not granted an exemption, and only in the area of the river where Petitioners insist point source waste loading is not resulting in impairment.<sup>90</sup>

Still, the greatest flaw of this management plan is that it makes no attempt to address the contribution of nonpoint sources to water pollution in the river, which are largely to blame for conditions in these tributaries. Most of the Concentrated Animal Feeding Operations (CAFOs) in the Cape Fear River basin, which produces 50% of North Carolina’s swine and large numbers

<sup>89</sup> See 15A NCAC 02B .0227.

<sup>90</sup> See Letter from Chris May, Chair, Lower Cape Fear River Program Advisory Board, to Tom Reeder, Director, DENR-Division of Water Resources D-18 (March 5, 2014) (claiming that the lower Cape Fear River estuary lacks “sensitivity to changes in point source loads”).

Elizabeth Kountis, DENR-DWR Planning Section  
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of poultry, are in watersheds drained by blackwater streams.<sup>91</sup> Petitioners ignore scientific analysis showing that poorly regulated waste management practices of CAFOs mean that “large amounts of nitrogen and phosphorus enter the environment through runoff, percolation into groundwater, and volatilization of ammonia,”<sup>92</sup> all of which can exacerbate DO and pH levels. Indeed, Petitioners ignore data published on their own website showing a statistically significant increase in ammonium in the Northeast Cape Fear River (one of the tributaries Petitioners blame for impairment of the Cape Fear River) suggesting water quality degradation by animal farming operations.<sup>93</sup> “Hypoxia is regulated primarily by controlling nutrients (largely nitrogen) and other oxygen-demanding wastes.”<sup>94</sup> Yet, the proposed management plan would neither attempt to limit nonpoint source loading of nutrients and oxygen-demanding waste in the segment Petitioners seek to reclassify nor address considerable loading in upstream tributaries that Petitioner’s blame for currently impaired use of the river.

Lastly, the management plan does little to ensure its own effectiveness. The proposed language states that any new or expanded discharge “shall not cause the dissolved oxygen of the receiving water to drop more than 0.1 mg/L below the modeled in-stream dissolved oxygen at total permitted capacity.” Again, the plan fails to require monitoring or reduction of the effects of pollutant loading by *existing* point sources or nonpoint sources. And, despite current impairment caused by low pH in the river, the plan would not monitor the effect on pH of additional pollutant loading. The plan also fails to explain how the State will identify the cause of potential future decreases of DO concentration; this is particularly problematic given that Petitioner’s reclassification request highlights the difficulty of pinpointing the cause of decreases in DO concentration. Nor is there any explanation of how frequently waters will be monitored under the plan or how the prohibition against causing DO decreases will be enforced, if at all. Finally the plan makes no mention of biological monitoring to ensure that use of the river for aquatic life survival and propagation is actually improving.

Indeed, by disregarding its effect on aquatic life, the management plan bears strong resemblance to the associated reclassification proposal. The EMC should not grant Petitioner’s request for permission to further impair use of the Cape Fear River by aquatic life, but should instead continue efforts to develop an appropriate Total Maximum Daily Load (TMDL) and strive to achieve currently applicable water quality standards.

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<sup>91</sup> Michael A. Mallin & Lawrence B. Cahoon, *Industrialized Animal Production—A Major Source of Nutrient and Microbial Pollution to Aquatic Ecosystems*, 24 *Population and Environment* 369, 369 (2003).

<sup>92</sup> *Id.* at 379.

<sup>93</sup> *Id.* at 376 (citing data “published by the Lower Cape Fear River Program (available at the website <http://www.uncwil.edu/cmsr/aquaticceology/labrotory/lcfrp>)

<sup>94</sup> US EPA, *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras*, at v (Nov. 2000), available at [http://water.epa.gov/scitech/swguidance/standards/upload/2007\\_03\\_01\\_criteria\\_dissolved\\_docrriteria.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2007_03_01_criteria_dissolved_docrriteria.pdf).

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VIII. Conclusion

For more than 30 years, the EMC has concluded that the best usage of the lower Cape Fear by aquatic life is protected by the water quality standards for pH and DO associated with Class SC waters and that swamp waters classification was not appropriate for that segment. More recently, the EMC has recognized that usage of the lower Cape Fear River by aquatic life is impaired by low pH and DO concentrations. The State should not abandon efforts to return these waters to the conditions that support their best usage. Rather than grant its imprimatur to increasing water pollution, the EMC should continue to strive to "maintain, protect, and enhance water quality within North Carolina."<sup>95</sup> Accordingly, we urge the EMC to reject the proposal to adopt the proposed classification and management plan.

Thank you for the opportunity to comment on this important matter.

Sincerely,



Will Hendrick

cc (by email):

Lauren Pedder, USEPA- Region 4  
Peter Raabe, American Rivers  
Grady McCallie, North Carolina Conservation Network  
Kemp Burdette, Cape Fear RIVERKEEPER®  
Julie Youngman, Southern Environmental Law Center

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<sup>95</sup> N.C. Gen. Stat. § 143-215.2(b).

**Kountis, Elizabeth**

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**From:** Meri Battles <janedoe693@aol.com>  
**Sent:** Tuesday, February 24, 2015 10:04 AM  
**To:** Kountis, Elizabeth  
**Subject:** Clean Water - Lower Cape Fear River

Dear Ms. Elizabeth Kountis,

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp.

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

Meri Battles

124 McDougald Drive  
Castle Hayne, NC 28429

**Kountis, Elizabeth**

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**From:** Bill White <bwhite17@earthlink.net>  
**Sent:** Tuesday, February 24, 2015 10:39 AM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

Are you going to let "Big Money" ruin our river?

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp.

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Bill White  
4380 NC Hwy 133  
Rocky Pont, NC 28457

Sincerely,

Bill White  
4380 NC Hwy 133  
Rocky Point, NC 28457

**Kountis, Elizabeth**

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**From:** Owen O'Neill <owen\_24431@msn.com>  
**Sent:** Tuesday, February 24, 2015 6:59 PM  
**To:** Kountis, Elizabeth  
**Subject:** Protect our water

Dear Ms. Elizabeth Kountis,

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp.

Please reject the proposed reclassification of the Lower Cape Fear.  
Try to remember that you are tasked with protecting our environment.  
Thank you.

Sincerely,

Owen O'Neill

313 Pettigrew Dr  
Wilmington, NC 28412

9105382293

**Kountis, Elizabeth**

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**From:** nancy sharp <nancysharp53@gmail.com>  
**Sent:** Wednesday, February 25, 2015 7:53 AM  
**To:** Kountis, Elizabeth  
**Subject:** Protect the water in the lower Cape Fear

Dear Ms. Elizabeth Kountis,

DENR, redeem yourselves! After the mess you made with the Duke coal ash leaks, your reputation as an agency that might give a damn about clean water has been seriously damaged. Now you want to solve another grave water pollution problem by redefining the description of the water rather than requiring that the pollution be cleaned up. If you do the right thing now, you may regain some public trust.

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp.

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

nancy sharp

609 Holbrook Ave  
Wilmington, NC 28412

**Kountis, Elizabeth**

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**From:** Joseph Reardon <jrear6640@aol.com>  
**Sent:** Thursday, February 26, 2015 4:33 PM  
**To:** Kountis, Elizabeth  
**Subject:** Guarding our Resources

Dear Ms. Elizabeth Kountis,

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp. Having kayaked this river with my sons and grandsons I can speak first hand on this subject!

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

Joseph Reardon

6640 Brookshire Street  
Fayetteville, 28314

**Kountis, Elizabeth**

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**From:** kat wies <kwies@fmrealty.com>  
**Sent:** Thursday, February 26, 2015 8:40 PM  
**To:** Kountis, Elizabeth  
**Subject:** nc matters

Dear Ms. Elizabeth Kountis,

The state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem.

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

kat wies

506 adil ct  
graham, nc, 27253  
graham, NC 27253

**Kountis, Elizabeth**

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**From:** Andy McGlinn <andymcglinn@gmail.com>  
**Sent:** Thursday, February 26, 2015 9:29 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp. I, like many other enjoy kayaking the river. It is an obvious river based on using the current to plan your trip. We see many types of birds and wildlife. We also see many others who use the river for many types of recreation. This is a river, not a swamp. It is your responsibility to clean it and enforce laws. Please do so for us and for future generations.

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

Andy McGlinn

4147 ABBINGTON TGR  
WILMINGTON, NC 28403

9208839908

**Kountis, Elizabeth**

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**From:** Anita Moloney <neesathrives@gmail.com>  
**Sent:** Sunday, March 01, 2015 12:10 PM  
**To:** Kountis, Elizabeth  
**Subject:** Clean up water safety now.

Dear Ms. Elizabeth Kountis,

Water is essential and needs to be protected and preserved, not reclassified.

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp.

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

Anita Moloney

304 Eden Drive  
Hillsborough, NC 27278

9192969164

**Kountis, Elizabeth**

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**From:** Renee Arbia <renee\_arbia@yahoo.com>  
**Sent:** Sunday, March 01, 2015 12:27 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

Dear Ms. Elizabeth Kountis,

I was sad to hear that yet again, we are trying to sweep away the acts of a big corporation at the cost of ruining the state that you and I love most.

Under the federal Clean Water Act, the state should write a cleanup plan to reduce upstream pollution enough for the river to heal. Redefining the water quality standards in the Lower Cape Fear by calling it a 'swamp water' is not the solution to the problem. While it is true that some swamp water can have low dissolved oxygen, the Lower Cape Fear is a flowing river, not a static swamp.

The Cape Fear River is not just a body of water. As a resident of Leland and Wilmington for many years, The Cape Fear River is seen as a boating, fishing, tourist attraction. It is one of the main attractions to our beautiful area of our state.

You are not cleaning it up due to funds and laziness. Do you care about our state or not? Just because factory farming puts money in pockets does not make it right. It does not make factory farming something that people want. Did you ever stop to think what the people want? That is who you ultimately are supposed to represent. We do not want factory farms, even if they are Smithfield, the Southern Ham. We would rather our Cape Fear River where we have fished with our grandparents and boated and have pictures for generations and will hope to bring more tourism for generations. Not some toxic, smelling, bad for our health factory farm, (which by the way is going to be shut down in a matter of time anyway if you open your eyes and look around it's not what your citizens want). Your citizens want natural food from farms, with no hormones, no factory farms, no phosphorous, no nitrogen, no pollution. Did you know that the majority of pollution is caused by factory farming.

Think of being a hero instead of the usual political schmuck that just buries everything under the rug. Stop taking easy ways out. Did you not get into politics to make a difference? Didn't you want to do something for your state? For your people? Here is your chance. Stand up and say NO I will not throw this under the rug, The Cape Fear River is a huge part of North Carolina and the history of it and we are not just going to let it be a swamp to save money and save a factory farm's butt. We are going to make them clean it up, by fining them and show the citizens of North Carolina that we value them and where they live as much as they do! Thank you for doing the right thing which although is never easy is always worth it in the end!

With Gratitude

Sincerely,

Renee Arbia

8400 Heirloom Drive NE  
Leland, NC 28451

Please reject the proposed reclassification of the Lower Cape Fear.

Thank you.

Sincerely,

Renee Arbia

8400 Heirloom Drive NE  
Leland, NC 28451

9103528148

**Kountis, Elizabeth**

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**From:** Dell Godwin <dellgodwin@earthlink.net>  
**Sent:** Tuesday, February 24, 2015 10:05 AM  
**To:** Kountis, Elizabeth  
**Subject:** Clean up the Cape Fear

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Dell Godwin

625 Brisbane Court  
Fayetteville, NC 28314

9104890703

**Kountis, Elizabeth**

---

**From:** John Wallace <wallacejohn@charter.net>  
**Sent:** Tuesday, February 24, 2015 10:21 AM  
**To:** Kountis, Elizabeth  
**Subject:** Lower Cape Fear River Pollution

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

As concerned as I am with the Lower Cape Fear, I am concerned you'll rewrite the rules to affect the Neuse and the Trent as well.

BTW, are you a Republican appointee?

Thank you.

Sincerely,

John Wallace

412 Pond View Circle  
Hampstead, NC 28443

**Kountis, Elizabeth**

---

**From:** Nancy McCullough <nancymccullough@thomas-hicks.com>  
**Sent:** Tuesday, February 24, 2015 10:24 AM  
**To:** Kountis, Elizabeth  
**Subject:** Pollution in The Cape Fear River

Dear Ms. Elizabeth Kountis,

I am alarmed about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

PLEASE reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Nancy McCullough

1705 Princess St  
Wilmington, NC 28405

**Kountis, Elizabeth**

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**From:** Dr. Austin Bowden-Kerby <abowdenkerby@gmail.com>  
**Sent:** Tuesday, February 24, 2015 3:47 PM  
**To:** Kountis, Elizabeth  
**Subject:** Please Act Now to Clean up the Lower Cape Fear River

Dear Ms. Elizabeth Kountis,

As a PhD marine scientist, I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Our nation's leaders and political system are being bought by industry, please stand strong and do what is right by rejecting the proposed reclassification, and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Dr. Austin Bowden-Kerby

Masonborough Sound  
Wilmington, NC 28403

**Kountis, Elizabeth**

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**From:** Bruce Gartner <brucegartner@aol.com>  
**Sent:** Tuesday, February 24, 2015 2:07 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

As an avid boater I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Bruce Gartner

6609 Becket Notch SW  
Ocean Isle Beach, NC 28469

**Kountis, Elizabeth**

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**From:** George welborn <gewelb@aol.com>  
**Sent:** Tuesday, February 24, 2015 10:38 PM  
**To:** Kountis, Elizabeth  
**Subject:** lower cape fear river

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

The animal farms, particularly pig farms have been a concern ever since I attended FTI in the 70's and ECU to get my environmental science degrees, the fact that this problem is still being discussed expresses a failure on the part of DENR. Don't cover this failure with a reclassification.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

George welborn

5132 Bogue sound drive  
emerald Isle, NC 28594

**Kountis, Elizabeth**

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**From:** Daleen Fisher <lilmslady101@aol.com>  
**Sent:** Wednesday, February 25, 2015 11:06 AM  
**To:** Kountis, Elizabeth  
**Subject:** Protection for the Cape Fear River

Dear Ms. Elizabeth Kountis,

My family and I often go to the Cape Fear river and beaches in Beaufort and the surrounding area. It is obvious there are problems with pollution in the area that still require attention and actions to reduce that pollution. It is concerning to see large fish kills, crabs dying, and seafood/ shellfish warnings in such a beautiful and unique ecosystem. This last summer my husband and I organized a group camping trip with 4 of our 5 kids, their spouses and our grandbabies, our teenaged daughter with several teenaged friends of hers (some were boys who had never been camping). While we all marvel at the beauty of the area, it was quite distressing to all of us when we went down to the shore of the river late at night and witnessed the hundreds of little fish, big fish and crabs coming to the shore, gasping and dying. We tried to guide fish back out onto the water but they would just turn back to shore and beach themselves. Every morning the beach was littered with dead fish and crabs.

This was a distressing thing to witness for all of us but also made us aware, and prodded us to search out information on the cause. My husband and I frequent the area of Beaufort and surrounding area all up and down the coastline. It is very concerning to see shellfish warnings, large numbers of dead fish and crabs of all kinds in so many of the inlets and areas where the river and tributaries reach the sea. I've looked at the data maps and restriction maps and it is obvious there is much work to do toward cleaning up and protecting the Cape Fear River. We want to protect this beautiful place and be able to take our grandchildren there to net shrimp, gather clams and fish for their dinner. The actions of all activities up river become glaringly obvious in the Lower Cape River areas. I, my husband and our family are very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Daleen Fisher

209 Cedar St  
Louisburg, NC 27549

**Kountis, Elizabeth**

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**From:** Marissa Roman <mdroman831@gmail.com>  
**Sent:** Thursday, February 26, 2015 12:05 PM  
**To:** Kountis, Elizabeth  
**Subject:** Do Not Reclassify the Lower Cape Fear River

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Citizens like myself use the Lower Cape Fear River for recreation and food, from fishing. We need to protect the river, not ignore the problems it is facing.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Marissa Roman

308 Hibiscus Way  
Wilmington, NC 28412

4105047535

**Kountis, Elizabeth**

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**From:** Kathy Haigh <khaigh04@gmail.com>  
**Sent:** Wednesday, February 25, 2015 8:04 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River Pollution

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Ignoring or masking the causes of pollution is never wise and invariably costs more longer-term. Please step up and assure the correct measures are taken.

Thank you.

Sincerely,

Kathy Haigh

713 N 4th St  
Wilmington, NC 28401

**Kountis, Elizabeth**

---

**From:** sam clark <sclark@trilan.net>  
**Sent:** Wednesday, February 25, 2015 2:38 PM  
**To:** Kountis, Elizabeth  
**Subject:** My children drink and bathe in our water

Dear Ms. Elizabeth Kountis,

Why would a smart answer to be to adjust the standards to allow more pollution rather than take measures to prevent and reduce said pollution?

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

sam clark

5006 Pine Needles Dr  
Wilmington, NC 28403

9102561888

**Kountis, Elizabeth**

---

**From:** Tish Yarborough <tish.yarborough@gmail.com>  
**Sent:** Thursday, February 26, 2015 7:29 PM  
**To:** Kountis, Elizabeth  
**Subject:** Dirty Cape Fear River

Dear Ms. Elizabeth Kountis,

anyone who lives around here knows that the river is terribly polluted and has been for years. we don't take our children to Carolina Beach because of this. You can see the brown colored water spreading into the Sound and ocean. Why do you continue to ignore this awful mess?

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Tish Yarborough

7517 Mason Landing Rd  
Wilmington, NC 28411

**Kountis, Elizabeth**

---

**From:** fred walker <walkerhfred@gmail.com>  
**Sent:** Friday, February 27, 2015 6:10 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River Pollution

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear. I live on the Northeast Cape Fear River and am very concerned regarding the continuing degradation of the river by farming and logging operations. Now is the time to tighten regulations before we lose this vital resource.

Thank you.

Fred Walker  
449 old river acres dr  
Burgaw nc  
[walkerhfred@gmail.com](mailto:walkerhfred@gmail.com)

Sincerely,

fred walker

449 old river acres dr  
burgaw, NC 28425

9102316008

**Kountis, Elizabeth**

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**From:** Catherine Laramee <laramee@bellsouth.net>  
**Sent:** Sunday, March 01, 2015 4:48 PM  
**To:** Kountis, Elizabeth  
**Subject:** Reclassifying Lower Cape Fear River

Dear Ms. Elizabeth Kountis,

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

As a concerned citizen who lives close to the Lower Cape Fear, I would like for upstream polluters to be held responsible for cleaning up their act. The river and the immense natural world it supports belongs to all of us, not just the pork producers.

Thank you.

Sincerely,

Catherine Laramee

101 Laffitte St  
Wilmington, NC 28411

**Kountis, Elizabeth**

---

**From:** Suzanna Dees <cgscconely@yahoo.com>  
**Sent:** Monday, March 02, 2015 12:31 PM  
**To:** Kountis, Elizabeth  
**Subject:** Care for our water quality

Dear Ms. Elizabeth Kountis,

Water quality is hugely important to our state. Please take every step possible to protect it.

I am very concerned about the proposed reclassification and management plan for the Lower Cape Fear River. When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Suzanna Dees

15232 Torrence Branch Road  
Charlotte, NC 28278

**Kountis, Elizabeth**

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**From:** Aron Lanie <Aronleigh@hotmail.com>  
**Sent:** Tuesday, February 24, 2015 10:06 AM  
**To:** Kountis, Elizabeth  
**Subject:** Fix the problem, don't hide it

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Aron Lanie

149 Northern Blvd  
Wilmington, NC 28401

**Kountis, Elizabeth**

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**From:** Edith Kurie <ekurie@gmail.com>  
**Sent:** Tuesday, February 24, 2015 10:05 AM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Alternatively we can simply wait for the next hurricane to flush the water supply as often happens in the Florida Everglades.

Thank you.

Sincerely,

Edith Kurie

1424 Stonehaven Ct  
Wilmington, NC 28411

**Kountis, Elizabeth**

---

**From:** Michelle Mavroudis <michellebmav@gmail.com>  
**Sent:** Tuesday, February 24, 2015 10:08 AM  
**To:** Kountis, Elizabeth  
**Subject:** Clean Up the Animal Farm Waste

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream. Don't prostitute North Carolina's beauty and nature for corporate agendas. My children have to live here and their children.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Michelle Mavroudis

3703 Willow Lake Dr  
Southport, NC 28461

**Kountis, Elizabeth**

---

**From:** Lloyd Smith <LSmith@cortechsolutions.com>  
**Sent:** Tuesday, February 24, 2015 11:13 AM  
**To:** Kountis, Elizabeth  
**Subject:** Don't

Dear Ms. Elizabeth Kountis,

You probably already know that our local economy **DEPENDS** on the quality of the water in our river, and the river runs directly into our marine fisheries. Water quality is an economic issue of importance to the entire state of NC!

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Lloyd Smith

1409 Audubon Blvd, Ste B1  
Cortech Solutions, Inc  
Wilmington, NC 28403

9104312811

**Kountis, Elizabeth**

---

**From:** Kathleen Gale <kegale@bellsouth.net>  
**Sent:** Tuesday, February 24, 2015 11:39 AM  
**To:** Kountis, Elizabeth  
**Subject:** citizen protection

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

Fishing in these waters is a pleasurable pastime for the local residents and we need to be protected by our government. Individually there is little we can do - which is why we rely on agencies such as yours. The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Kathleen Gale

413 W. Windward Landing Place  
Hampstead, NC 28443

**Kountis, Elizabeth**

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**From:** Palma Smith <dsmith905@gmail.com>  
**Sent:** Tuesday, February 24, 2015 11:48 AM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

Don't make it easy on polluters!!

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Palma Smith

905 Cedarcroft Ct  
Winnabow, NC 28479

9103713690

**Kountis, Elizabeth**

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**From:** David Paynter <dpaynter@yahoo.com>  
**Sent:** Tuesday, February 24, 2015 12:39 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

This is the height of absurdity. Government officials should be embarrassed by the proposed reclassification. This proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

David Paynter

6242 Head Rd  
Wilmington, NC 28409

9103929232

**Kountis, Elizabeth**

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**From:** John Coyle <Jbcoyle42@yahoo.com>  
**Sent:** Tuesday, February 24, 2015 12:50 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River classification

Dear Ms. Elizabeth Kountis,

I have lived my entire life on rivers--the Maumee,the Ohio, the Hidson and now the Cape Fear.The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

John Coyle

1428 Ebrington Lane  
Leland, NC 28451

**Kountis, Elizabeth**

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**From:** David James <djames56@gmail.com>  
**Sent:** Tuesday, February 24, 2015 3:05 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river, it has a very strong current. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

David James

124 Edgewater Lane  
Wilmington, NC 28403

**Kountis, Elizabeth**

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**From:** Michele Zapple <michelezapple@yahoo.com>  
**Sent:** Tuesday, February 24, 2015 2:59 PM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear River

Dear Ms. Elizabeth Kountis,

I live in Wilmington, and see the river every day. Besides it's natural beauty, the river as a clean water source for New Hanover County is essential to our citizens. The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Michele Zapple

321 R.L. Honeycutt Drive  
Wilmington, NC 28412

**Kountis, Elizabeth**

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**From:** Cheryl McGraw <chrrlgrrl@gmail.com>  
**Sent:** Friday, February 27, 2015 8:57 PM  
**To:** Kountis, Elizabeth  
**Subject:** CLEAN UP THIS RIVER, IT IS NOT A SWAMP

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

I own a house in a community on this river I was astounded to hear that people are afraid to let their dogs swim in it. This is a travesty and a public health risk to humans as well as dogs. You must do something to clean up the river. IT IS NOT A SWAMP!

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Cheryl McGraw

121 East Pointe Road  
Rocky Point, NC 28457

910-470-0217

**Kountis, Elizabeth**

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**From:** Carolyn Fortner-Burton <fortnerburton@gmail.com>  
**Sent:** Monday, March 02, 2015 7:50 PM  
**To:** Kountis, Elizabeth  
**Subject:** Pollution on the lower Cape Fear River

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. I can personally attest to this fact because I've canoed on the river and work at PPD where I've had the opportunity to watch the Cape Fear River, up close and personal.

It is really cool to watch when the tide is coming in and the downstream flow meets it and they form what looks like a small rapid. I've watched huge tree trunks moving rapidly down the river and get caught under docks.

The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

If the lower Cape Fear was a swamp then I wouldn't have to work so hard going upstream and be so grateful when going downstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please help find ways to control these unnecessary nutrients and reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Carolyn Fortner-Burton

109 Foxwood Lane  
Wilmington, NC 28409

910-558-4990

**Kountis, Elizabeth**

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**From:** Bill Bush <billbush44@hotmail.com>  
**Sent:** Friday, February 27, 2015 9:24 AM  
**To:** Kountis, Elizabeth  
**Subject:** NO to reclassifying LCF River.

Dear Ms. Elizabeth Kountis,

NC water quality is under attack, and evidently up for sale. Unless we gain control over runoff and dumping and drainage, we will be ruining the most vital of all our resources at a continuation of the current rate, and damaging the oyster beds, too.

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

The Lower Cape Fear has too much nutrient pollution, and it needs to be controlled, not swept under the rug. Please reject this unacceptable proposal and work towards real solutions that reduce the nitrogen and phosphorus pollution from animal farms upstream.

Thank you.

Sincerely,

Bill Bush

8040 Park Springs Road  
Ruffin, NC 27326

336-388-2805

**Kountis, Elizabeth**

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**From:** steve roberts <poetsroberts@yahoo.com>  
**Sent:** Tuesday, February 24, 2015 10:09 AM  
**To:** Kountis, Elizabeth  
**Subject:** clean Water

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

steve roberts

202 s 3rd st  
apt 10  
Wilmington, NC 28401

**Kountis, Elizabeth**

---

**From:** Dale Jarvis <djarvis1@gmail.com>  
**Sent:** Tuesday, February 24, 2015 10:30 AM  
**To:** Kountis, Elizabeth  
**Subject:** Pollution of Cape Fear River

Dear Ms. Elizabeth Kountis,

Whoever is polluting the River is changing the make up of the food chain in Nature. It will take sometime but the problems from the pollution will compound beyond what can be imagined now. There is no way to fore tell the total ramifications.

It all starts small and ends when the last Dr says to a patient I really don't know what has caused this terminal illnesses.

We must take control of our responsibility and it is obvious to everyone the sooner the better.

The only thing that stops you from doing the right thing and stopping the pollution is the influence of money and unfortunately the marine life in the river halve zero dollars and the polluters have the money.

It can not be right to destroy this Ecosystem but it can be justified by the dollar. Please do the right thing and save our river you may never know the life you save may be related to you.

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Dale Jarvis

3806 Sarasota Dr  
Fayetteville, NC 28311

**Kountis, Elizabeth**

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**From:** Curtis Schacher <curtis.schacher@gmail.com>  
**Sent:** Tuesday, February 24, 2015 10:51 AM  
**To:** Kountis, Elizabeth  
**Subject:** Cape Fear Water Quality

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. I fish regularly in the river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Thank you.

Sincerely,

Curtis Schacher

515john barry drive  
wilmington, NC 28412

**Kountis, Elizabeth**

---

**From:** Judith Sellers <jsellers@frontiernet.net>  
**Sent:** Sunday, March 01, 2015 7:31 PM  
**To:** Kountis, Elizabeth  
**Subject:** Environment

Dear Ms. Elizabeth Kountis,

The Lower Cape Fear is surrounded by swamps, but it is not swamp water; it is a flowing river. The proposal to reclassify the river as swamp water is a transparent attempt to avoid acknowledging the serious man-made pollution problems the river has, caused by heavy loads of nitrogen and phosphorus from animal agriculture upstream.

When a river is polluted, the Clean Water Act requires the state to develop a cleanup plan involving all sources of pollution upstream. That's both legally and practically necessary here.

Please reject the proposed reclassification and instead pursue meaningful reductions in the upstream pollution that is causing the very low dissolved oxygen conditions in the Lower Cape Fear.

Please also encourage the planting of riparian tree lines and other natural pollution barriers to reduce run-off and encourage native wildlife.

Thank you.

Sincerely,

Judith Sellers

2297 Co. Hwy. 18  
South New Berlin, NY 13843