UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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JUL 31 2014

Mr. Tom Reeder
Director
Division of Water Quality
North Carolina Department of Environment
and Natural Resources
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

Subject: The EPA's Partial Approval of the State of North Carolina's 2014 303(d) List Submittal

Dear Mr. Reeder:

The U.S. Environmental Protection Agency, Region 4 has completed its review of the North Carolina Department of Environment and Natural Resources' final 2014 Clean Water Act section 303(d) list of water quality limited segments. The EPA has determined that the list substantially meets the intent of section 303(d) of the Clean Water Act and associated regulations and is partially approving that submission.

The EPA approves North Carolina's decision to include additional waters and associated pollutants on the section 303(d) list. However, the EPA is not satisfied that the State's methodology for toxics properly implements the currently applicable water quality standards and therefore conducted an independent assessment of water quality data to determine if additional impairments should be added to the 303(d) list. Our review found fifty-two waterbody-pollutant combinations that should be included on the 2014 list. For more information, see Section III.A.4.e *Impairments Indicated by Toxic and Non-Conventional Pollutants* (pages 15-19) and Appendix D of the decision document. The EPA will open a public comment period to receive comments concerning its decision to add these impairments to the list.

The decision document for this approval action is enclosed. The EPA would like to continue to work closely with your Division to successfully implement the Clean Water Act and achieve improvements in water quality. If you have questions, please contact Mr. Jim Giattina at (404) 562-9345 or Ms. Joanne Benante at (404) 562-9125.

Sincerely,

Heather McTeer Toney
Regional Administrator

Enclosure

DECISION DOCUMENT

for the

Partial Approval of the

North Carolina Department of Environment and Natural Resources'

2014 Section 303(d) List submitted on March 31, 2014

Prepared by

U.S. Environmental Protection Agency, Region 4

Water Protection Division

July 2014

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I. Executive Summary

On March 31, 2014, North Carolina Department of Environment and Natural Resources, Division of Water Resources, submitted its final 2014 section 303(d) list of impaired waters to the U.S. Environmental Protection Agency for review. After a thorough review of North Carolina's submittal, the EPA is partially approving the State's section 303(d) list. This Decision Document summarizes the EPA's review and the basis for the Agency's decision.

Section 303(d)(1) of the Clean Water Act (CWA or Act) directs states to identify those waters within their jurisdictions for which effluent limitations required by section 301(b)(1)(A) and (B) are not stringent enough to implement any applicable water quality standard (referred to as water quality limited segments, defined in Title 40 of the *Code of Federal Regulations* (CFR) section 130.7) and to establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters. The section 303(d) listing requirement applies to water quality limited segments impaired by pollutant loadings from both point and/or nonpoint sources. After a State submits its section 303(d) list to the EPA, the Agency is required to approve or disapprove that list.

This report updates the State's most recently approved section 303(d) list, approved by the EPA on November 27, 2012 (the 2012 list). North Carolina's initial Public Review Draft of the 2014 section 303(d) list was issued on January 14, 2014. The State submitted the final section 303(d) list to the EPA on March 31, 2014.

The EPA has not determined that the State's methodology is a reasonable method to assess toxic or non-conventional pollutants consistent with the State's currently applicable, EPA-approved water quality standards. Based on the EPA's independent review, fifty-two waterbody-pollutant combinations will be included on the EPA's approved section 303(d) list for North Carolina. The EPA is deferring action on Waterville Reservoir, pending completion of a plan of study to better determine water column dioxin concentrations.

II. Statutory and Regulatory Background

A. Identification of Water Quality Limited Segments for Inclusion on the Section 303(d) List

Section 303(d)(1) of the CWA directs states to identify those waters within its jurisdictions for which effluent limitations required by sections 301(b)(1)(A) and (B) are not stringent enough to implement any applicable water quality standard and to establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters. The section 303(d) listing requirement applies to waters impaired by point and/or nonpoint sources, pursuant to the EPA's long-standing interpretation of section 303(d).

The EPA regulations at 40 CFR 130.7(b)(1) state, "Each State shall identify those water quality-limited segments still requiring TMDLs within its boundaries for which: (i) Technology-based effluent limitations required by sections 301(b), 306, 307, or other sections of the Act; (ii) More stringent effluent limitations (including prohibitions) required by either State or local authority preserved by section 510 of the Act, or Federal authority (law, regulation, or treaty); and (iii) Other pollution control requirements (e.g., best management practices) required by local, State, or Federal authority are not stringent enough to implement any water quality standards (WQS) applicable to such waters." The EPA regulations define water quality limited segment as "[a]ny segment where it is known that water quality does not meet applicable water quality standards and/or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations required by section 301(b) and section 306 of the Act." See 40 CFR 130.2(j). Note: The term "water quality limited segment" as defined by federal regulations may also be referred to as "impaired waterbodies" or "impairments" throughout this decision document. TMDL is the acronym for Total Maximum Daily Load. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that load among the various sources of that pollutant.

The EPA's *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act* (http://www.epa.gov/owow/tmdl/2006IRG) (July 29, 2005), hereafter referred to as the 2006 IR guidance, recommends the use of five categories, described below, to classify the water quality standard attainment status for each waterbody segment, or assessment unit. The guidance includes three sub-categories for Category 4. North Carolina currently uses the five categories recommended by the EPA plus additional sub-categories within those categories. A description of the State's sub-categories is provided in Appendix A.

Category 1: All designated uses are supported, no use is threatened;

Category 2: Available data and/or information indicate that some, but not all of the designated uses are supported;

Category 3: There is insufficient available data and/or information to make a use support determination;

Category 4: Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed because:

4a - A TMDL to address a specific segment/pollutant combination has been approved or established by the EPA.
4b - A use impairment caused by a pollutant is being addressed by the state through other pollution control requirements.
4c - A use is impaired, but the impairment is not caused by a pollutant.

Category 5: Available data and/or information indicate that at least one designated use is not being supported or is threatened and a TMDL is needed.

B. Consideration of Existing and Readily Available Water Quality Related Data and Information (40 CFR Part 130.7(b)(5)(i-iv))

In developing section 303(d) lists, states are required to assemble and evaluate all existing and readily available water quality-related data and information, including, at a minimum, consideration of existing and readily available data and information about the following categories of waters: (1) waters identified as partially meeting or not meeting designated uses, or as threatened, in the State's most recent section 305(b) report; (2) waters for which dilution calculations or predictive modeling indicate non-attainment of applicable standards; (3) waters for which water quality problems have been reported by governmental agencies, members of the public, or academic institutions; and (4) waters identified as impaired or threatened in any section 319 nonpoint assessment submitted to the EPA. See 40 CFR 130.7(b)(5).

In addition to these minimum categories, states are required to consider any other water quality-related data and information that is existing and readily available. The EPA's 1991 Guidance for Water Quality-Based Decisions describes categories of water quality-related data and information that may be existing and readily available. See Appendix C of Guidance for Water Quality-Based Decisions: The TMDL Process, EPA Office of Water, 1991 (EPA/440/4-91-001, http://www.epa.gov/OWOW/tmdl/decisions/). While states are required to evaluate all existing and readily available water quality-related data and information, states may decide to rely or not rely on particular data or information in determining whether to list particular waters.

In addition to requiring states to assemble and evaluate all existing and readily available water quality-related data and information, the EPA regulations at 40 CFR 130.7(b)(6) require states to include, as part of its submissions to the EPA, documentation to support decisions to list or not list waters. Such documentation needs to include, at a minimum, the following information: (1) a description of the methodology used to develop the list, (2) a description of the data and information used to identify waters, (3) a rationale for any decision to not use any existing and readily available data and information and (4) any other reasonable information requested by the Region.

C. Priority Ranking

The EPA regulations also codify and interpret the requirement in section 303(d)(1)(A) of the Act that states establish a priority ranking for listed waters. The regulations at 40 CFR 130.7(b)(4) require states to prioritize waters on their section 303(d) lists for TMDL development and also to identify those impaired waterbodies targeted for TMDL development in the next two years. In prioritizing and targeting waters, states must, at a minimum, take into account the severity of the pollution and the uses to be made of such waters. See CWA section 303(d)(1)(A). As long as these factors are taken into account, the Act provides that states establish priorities. States may consider other factors relevant to prioritizing waters for TMDL development, including immediate programmatic needs; vulnerability of particular waters as aquatic habitats; recreational, economic and aesthetic importance of particular waters; degree of public interest and support; and state or national policies and priorities.

III. Analysis of the North Carolina Submittal

A. Review of North Carolina's Identification of Waters (40 CFR 130.7(b)(6)(i - iv))

In reviewing North Carolina's submittal, the EPA first reviewed the methodology used by the State to develop the list update in light of the State's approved water quality standards and then reviewed the actual list of waters. This section describes the State's listing methodology and outlines the EPA's evaluation of both that methodology and the actual list of impaired waterbodies included in the submittal. In cases where the EPA could not determine if the State's listing methodology identified all impaired waterbodies for a given designated use or water quality criteria, the EPA conducted a review of water quality data to determine whether any waterbodies should be added to the section 303(d) list.

Each of the assessment and listing methodologies was compared against the North Carolina water quality standards as found in the North Carolina Division of Water Resources (DWR) "Redbook" (*Surface Waters and Wetlands Standards, North Carolina Administrative Code* 15A NCAC 02B .0100,

.0200 & .0300; amended effective May 1, 2007, hereafter "North Carolina Water Quality Standards.") Information on monitoring procedures and water quality assessment was obtained from the DWR Monitoring Program Strategy (Version 2.4, October 10, 2012), as well as DWR's Basinwide Assessment Reports (http://portal.ncdenr.org/web/wq/ess/reports) and Basinwide Water Quality Plans (http://portal.ncdenr.org/web/wq/ps/bpu/basin).

1. North Carolina's Water Quality Standards and Section 303(d) List Development

The CWA requires each State to identify and prioritize those waters where technology-based controls are inadequate to implement water quality standards:

> *Each State shall identify those waters within its boundaries for which the effluent limitations required by section 1311(b)(1)(A) and section 1311(b)(1)(B) of this title are not stringent enough to implement any water quality standards applicable to such waters.* 33 U.S.C. 1313(d)(1)(A); see also 40 CFR 130.7(b) (EPA section 303(d) listing regulations)

The EPA regulations expressly provide that "[f]or purposes of listing waters under 130.7(b), the term 'water quality standard applicable to such waters' and 'applicable water quality standards' refer to those water quality standards established under section 303 of the Act, including numeric criteria, narrative criteria, water body uses and antidegradation requirements." See 40 CFR 130.7(b)(3). The EPA's review of the North Carolina section 303(d) list ensures that the list identifies water quality limited segments consistent with existing State standards.

Water quality criteria can be expressed either as narrative or numeric criteria. Numeric criteria typically establish either a maximum level or a range of levels of a pollutant which can be present in the waterbody while still attaining water quality standards. Narrative criteria typically describe a condition (e.g., waters shall be suitable for aquatic life propagation and maintenance of biological integrity) which must be met for the waterbody to meet water quality standards. Determining whether a waterbody is meeting water quality standards for narrative criteria requires the identification of reference points against which the waterbody can be evaluated. The EPA defers to a State's interpretation of its water quality standards, including how narrative criteria should be interpreted, when that interpretation is consistent with the underlying narrative criteria and is a reasonable translation of those criteria.

Narrative Water Quality Criteria

The following is a list of the primary narrative criteria considered in North Carolina's water quality assessment. The sections below summarize the EPA's review of the State's methodology against these narrative criteria.

- North Carolina Administrative Code (NCAC) 15A 02B .0208 (Narrative for toxics and temperature).
- NCAC 15A 02B .0211 (Several narratives related to making all fresh waters suitable for aquatic life propagation and maintenance of biological integrity, wildlife, secondary recreation and agriculture).
- NCAC 15A 02B .0220 (Several narratives related to making all salt waters suitable for aquatic life propagation and maintenance of biological integrity, wildlife, and secondary recreation).
- NCAC 02B 15A .0231 (Narratives related to wetlands).

Numeric Water Quality Criteria

The primary numeric criteria related to water quality assessment in North Carolina are detailed in 15A NCAC 02B .0100, .0200 & .0300 (amended effective date May 1, 2007). The State expresses its numeric water quality criteria in a variety of ways, which are delineated for each parameter in the following sections. In general, numeric criteria are written as "maximum permissible levels" or values which "shall not be exceeded."

2. Consideration of Existing and Readily Available Water Quality-Related Data and Information

Federal regulations provide that each state "shall assemble and evaluate all existing and readily available water quality-related data and information to develop the list required by sections 130.7(b)(1) and 130.7(b)(2)." See 40 CFR 130.7(b)(5). The North Carolina DWR collects a variety of biological, chemical and physical data from six primary programs, including benthic macroinvertebrates, fish community, fish tissue, lake assessment, ambient monitoring and aquatic toxicity monitoring.

Sources of data and information include the following: previous section 303(d) lists; waterbodies where specific fishing or shellfish bans and/or advisories are currently in effect; and data, information and water quality problems reported from local, State, or Federal agencies, Tribal governments, members of the public and academic institutions. DWR maintains a standing solicitation for data on their website http://portal.ncdenr.org/web/wq/ps/mtu/assessment. For data to be used for impairment determinations, data must meet specific submission criteria, including quality assurance and quality control of the collection and analysis of the data.

Use support is assessed for all basins statewide. The 2014 list is based on all data collected in calendar years 2008 through 2012. In some cases, older biological data is used for waters that have not been re-sampled during this data window or where the current impairment is based on that sample.

According to DWR's Use Assessment Methodology, greater than nine samples are needed to be considered for use support assessments (other than biological data). DWR's monitoring program routinely collects more than nine samples at each monitoring site for most parameters.

EPA Conclusion

North Carolina's assessment methodology contains provisions, as described above, for limiting the use of data based on the age of data (five year window) and sample size (greater than nine samples). North Carolina does include older data in their assessment when no current data is available. However, the EPA recommends that older data not be automatically excluded, particularly when its inclusion could be used to augment small sets of more current data. The assessment methodology could include a list of circumstances that would explain why the data is no longer reliable or representative. We acknowledge that DWR has not excluded data older than 5 years for metals. The State suspended the collection of routine total recoverable metals in 2007 in anticipation of the development of new metals water quality standards and there have been very limited metals data collected since then. In previous 303(d) assessments, DWR indicated that metals-impaired waters would not be delisted solely on the basis that the metals data "aged out" of the prescribed data window.

As to minimum sample size provisions in the State assessment methodology, the EPA has two significant concerns. First, the methodology should allow listing where data demonstrates sufficient exceedances of a criterion, even though the minimum sample size (>9 samples) has not yet been collected. For example, North Carolina's methodology specifies 3 exceedances out of 10 samples are necessary to determine that a waterbody is impaired. Where a waterbody has 3 exceedances, regardless of the total number of samples, there is no need to collect the full 10 samples to pass the assessment methodology's exceedance threshold. Such waterbodies should be identified as impaired. Second, many states make the decision of whether a small number of data points can adequately support a conclusion of impairment or non-impairment based on whether the evidence for the small number of samples is "overwhelming." An overwhelming evidence test could consider such factors as the magnitude of exceedance over water quality standards, or the frequency at which standards were exceeded, or other lines of evidence (e.g., biological, physical, tissue, or sediment data) could be consulted in making an impairment decision on small data sets. Section 4.3 of the EPA's July 2002 Consolidated Assessment and Listing Methodologies, or 2002 CALM guidance, discusses this issue in detail (http://water.epa.gov/type/watersheds/monitoring/calm.cfm).

DWR's data sets for metals and most other parameters of concern are of high quality (refer to the Ambient Monitoring System Quality Assurance Project Plan on the DWR website: http://portal.ncdenr.org/web/wq/ess/eco/ams/qapp) and because only high quality data is accepted for use support decisions (see criteria for submitting data for regulatory use on the DWR website: http://portal.ncdenr.org/web/wq/ps/mtu/assessment#5), the number of samples used in listing decisions is typically small.

Because the EPA identified the State's provisions as being overly restrictive, a data review was conducted to determine if waters, which should be considered impaired, may have been omitted from the list due to these provisions. The EPA conducted the review by reviewing all data received from DWR for the applicable data window. For most parameters, only 2% of the data sets contained fewer than ten data points and within those small sets there were fewer than three exceedances.

The data sets for metals are very small because monitoring for metals was suspended in 2007. See Section *4.e. Aquatic Life Use Support / Impairments Indicated by Toxic and Non-Conventional Pollutants*, below, for a discussion of the EPA's independent review of metals data. Even though the State's provisions are restrictive regarding small data sets and lack of consideration of older data, the EPA did not identify any waters that should be added to the section 303(d) list due to these restrictions.

In order for the EPA to conclude that the State's process is consistent with federal requirements for consideration of data and information, the State should revise its methodology to allow consideration of older data and data contained within smaller data sets for future section 303(d) lists.

3. Assessment Unit Delineation Approach / Geo-referencing

North Carolina maintains a water quality assessment database, which for each assessment unit provides a description, use support ratings, parameters of interest, as well as the capability to track changes through time. This database is linked with other North Carolina water quality databases including ambient, benthic and fish community data as well as 1:24,000 hydrography. Assessment units are delineated to the 1:24,000 statewide hydrography and can be easily located using a Geographic Information System (GIS). The State has completed georeferencing statewide including indexing assessment units to the high resolution National Hydrography Dataset (NHD).

EPA Conclusion

The State provided a GIS dataset of the State's assessment units at NHD 1:24,000 scale. For the 2014 303(d) list, DWR posted draft GIS data on its website and will finalize the data after the EPA approval (http://portal.ncdenr.org/web/wq/ps/mtu/assessment).

4. Aquatic Life Use Support

The State considers biological and ambient monitoring data in assessing the aquatic life use support category. The EPA separated its review of North Carolina's assessment of aquatic life use support into five categories: waterbodies not listed due to natural conditions; assessment based on physical (naturally variable) parameters, nutrient enrichment, biological indicators; and toxic/non-conventional pollutants.

a. Waterbodies not listed due to natural conditions

North Carolina does not list waterbodies where it is determined that measured concentrations of pH (potential of Hydrogen ions, a measure of acidity or alkalinity) or dissolved oxygen (DO) do not meet the numeric criteria due to natural conditions. North Carolina's water quality standards address natural conditions, providing that "natural waters may on occasion, or temporarily, have characteristics outside of the normal range established by the standards. The adopted water quality standards relate to the condition of waters as affected by the discharge of sewage, industrial wastes or other wastes including those from nonpoint sources and other sources of water pollution. Water quality standards will not be considered violated when values outside the normal range are caused by natural conditions. Where wastes are discharged to such waters, the discharger will not be considered a contributor to substandard conditions provided maximum treatment in compliance with permit requirements is maintained and therefore, meeting the established limits is beyond the discharger's control." (15A NCAC 02B .0205) North Carolina has assigned a supplemental classification category for Swamp Waters (Sw) which is intended to recognize those waters that generally have naturally occurring very low velocities, low pH and low DO. State water quality standards acknowledge that DO and pH may be natural conditions that are outside the required standard range. For DO, 15A NCAC 02B .0211(3) (b) states, "swamp water, lake coves or backwaters, and the lake bottom waters may have lower values if caused by natural conditions." For pH, 15A NCAC 02B .0211(3) (g) states, "...swamp waters may have a pH as low as 4.3 if it is the result of natural conditions."

If DWR identifies natural condition waters with point source discharges, DWR conducts an analysis of the likely impact of the discharges. The waters will be listed if the discharges may be contributing to the low DO or pH.

EPA Conclusion

DWR has identified waterbodies containing low pH and DO which are believed due to natural conditions. These are generally slow-moving blackwater streams, low-lying swamps and productive estuarine waters in the Coastal Plain. Based on the available data and information, North Carolina's decision that these waterbodies should be included in Category 3 rather than on the State's section 303(d) list is reasonable. However, these segments should be considered high priority for follow-up monitoring in order to confirm that the low pH and DO found in these waterbodies is due solely to natural conditions.

In addition, the State should continue to include in its Integrated Report submission a rationale for either removing or not including these water/pollutant combinations on the State's Section 303(d) list. The EPA's *Information Concerning 2014 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions* http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/2014-memo.cfm provides this guidance:

> *The rationale should identify the geologic or other conditions that cause the natural loading of the pollutant to exceed otherwise applicable water quality standards. In addition, the rationale should document why anthropogenic sources of pollutant loading, such as municipal, industrial, agricultural, contaminated groundwater, or anthropogenic airborne deposition, were determined not to be sources of pollutant loading. The rationale should also cite the approved, applicable natural conditions provision upon which the State is relying.*

b. *Impairments Indicated by Physical Parameters*

Naturally variable physical parameters are those that fluctuate in a waterbody due to non-anthropogenic influences such as rainfall/flow, depth, time of day, salinity, etc. Naturally variable parameters assessed by DWR during this listing cycle include DO, pH, temperature and turbidity. Comparison against the North Carolina water quality standards is as follows.

Water Quality Standard (note: mg/l is milligrams per liter)	**State Assessment Methodology**
Freshwater Dissolved Oxygen **NCAC 15A 02B .0211(3)(b)** DO not less than 6.0 mg/l for trout water, not less than a daily average of 5.0 mg/l with a minimum instantaneous value of not less than 4.0 mg/l; swamp waters, lake coves or backwaters and lake bottom waters may have lower values if caused by natural conditions (see section 4a, above). **Saltwater Dissolved Oxygen** **NCAC 15A 02B .0220(3)(b)** DO 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.	**Exceeding Criteria-Category 5** - Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine - AU is not a class Sw or swamp-like
Freshwater pH **NCAC 15A 02B .0211 (3)(g)** pH shall be normal for the waters in the area, which generally shall range between 6.0 and 9.0 except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions	**Exceeding Criteria-Category 5** - Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine

Saltwater pH **NCAC 15A 02B .0220(3)(g)** pH shall be normal for the waters in the area, which generally shall range between 6.8 and 8.5.	- AU is not a class Sw or swamp-like
Freshwater Temperature **NCAC 15A 02B .0211 (3)(j)** Temperature not to exceed 2.8° C above the natural water temperatures, and in no case to exceed 29° C for mountain and upper piedmont waters and 32° C for lower piedmont and coastal plain waters. The temperature for trout waters shall not be increased by more than 0.5° C due to the discharge of heated liquids but in no case to exceed 20° C. **Saltwater Temperature** **NCAC 15A 02B .0220(3)(k)** Temperature shall not be increased above the natural water temperature by more than 0.8° C during June, July and August nor more than 2.2° C during other months and in no cases to exceed 32° C due to the discharge of heated liquids.	**Exceeding Criteria-Category 5** - Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine
Turbidity NCAC 15A 02B .0211 (3)(k) and 15A NCAC 02B .0220 Turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural conditions the existing turbidity level cannot be increased. 25 NTU – salt waters	**Exceeding Criteria-Category 5** - Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine

The State currently does not list trout waters for temperature excursions where thermal discharges are present because they have not determined background conditions. The EPA recommends that the State focus their monitoring program to determine background conditions and to assess such waters.

The State's water quality standards for DO, pH and turbidity do not specify an allowable percent of samples outside of the criteria. However, North Carolina's use of a ten percent threshold for determining use support for naturally variable parameters is consistent with the EPA's 2006 IR guidance.

The EPA's 2002 CALM guidance recommends that the "state's assessment and listing methodology should describe how chemical data are collected and how they are used to determine the attainment of water quality standards." The web page for DWR's Ambient Monitoring System references a draft standard operating procedure (*Intensive Survey Unit Standard Operating Procedures*, November 2011; http://portal.ncdenr.org/web/wq/ess/isu that provides additional information on the collection of samples which satisfies that provision.

EPA conclusion

DWR's methodology for assessment of DO, pH, temperature and turbidity is consistent with North Carolina's existing, the EPA-approved water quality standards and with the EPA regulations.

The EPA does not agree that provisions in the State's methodology related to age of data and minimum sample size are consistent with federal requirements. However, based on the EPA's independent review of the existing and readily available data, the provisions of the State's methodology related to age of data and minimum sample size did not result in DWR failing to identify any waters not attaining DO, pH, temperature and turbidity standards. The EPA is, therefore, approving DWR's listing decisions for DO, pH, temperature and turbidity. For trout waters, the EPA recommends that the State's monitoring program target waters with thermal discharges to determine background conditions.

c. *Impairments Indicated by Nutrient Enrichment*

North Carolina's water quality standards include a numeric criterion for chlorophyll *a*, which is used as an indicator of nutrient enrichment in waters of the State.

Water Quality Standard	**State Assessment Methodology**
NCAC 15A 2B .0211 (3) (a) "Chlorophyll *a*: not greater than 40 ug/l for lakes, reservoirs, and other waters subject to growths of macroscopic or microscopic vegetation not designated as trout waters and not greater than 15 ug/l for lakes, reservoirs, and other waters subject to growths of macroscopic or microscopic vegetation designated as trout waters (n/a to lakes and reservoirs less than 10 acres in surface area)."	**Exceeding Criteria-Category 5** - Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine

EPA conclusion

The EPA has determined that North Carolina's use of a ten percent threshold for determining use support for chlorophyll *a* is consistent with North Carolina's existing, EPA-approved water quality standards.

The EPA does not agree that provisions in the State's methodology related to age of data and minimum sample size are consistent with federal requirements. However, based on the EPA's independent review of the existing and readily available data, the provisions of the State's methodology related to age of data and minimum sample size did not result in DWR failing to identify any waters not attaining chlorophyll *a* standards. The EPA is, therefore, approving DWR's listing decisions for chlorophyll *a*.

d. Impairments Indicated by Biological Information

The EPA reviewed North Carolina's listing methodology for assessment of Aquatic Life designated use support indicated by biological monitoring. North Carolina's water quality standards include a narrative for biological integrity applicable to all Class C waters, as follows.

Water Quality Standard	State Assessment Methodology
NCAC 15A 2B .0211 (2) "The waters shall be suitable for aquatic life propagation and maintenance of biological integrity, wildlife, secondary recreation and agriculture; sources 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." **NCAC 15 A 2B .0202 (11)** Biological integrity is defined as "...the ability of an aquatic ecosystem to support and maintain a balanced and indigenous community of organisms having species composition, diversity, population densities and functional organization similar to that of reference conditions."	**Exceeding Criteria-Category 5** - Poor, Fair, and Severe biological ratings

Benthic macroinvertebrate and fish community assessments are completed by the DWR Biological Assessment Unit. The most recent Standard Operating Procedures for macroinvertebrate and fish community assessment, data and scores and ratings are available on the DWR website (http://portal.ncdenr.org/web/wq/ess/bau). If both macroinvertebrate and fish community data are available, both are used to evaluate use support. The State's use of multiple assemblages is in conformance with the EPA's recommendation in the 2002 CALM guidance that the use of more than one biological index enhances "confidence in the assessment finding."

<u>EPA Conclusion</u>

The DWR assessment listing methodology for biological data is consistent with North Carolina's existing, EPA-approved water quality standards and EPA regulations. The EPA is approving DWR's listing decisions based on biological data.

e. Impairments Indicated by Toxic and Non-Conventional Pollutants

Many pollutants which exert a toxic effect in water react and behave differently in the environment than the naturally variable pollutants discussed above. Unlike the naturally variable pollutants described above, toxic and non-conventional pollutants do not generally have wide variability in concentration under natural conditions that would still be protective of the designated use. Therefore, the EPA carefully considered waterbodies with data related to toxic and non-conventional pollutants when reviewing North Carolina's section 303(d) list. In considering this data, the EPA paid particular attention to the magnitude and duration of any exceedances and also considered any compensating periods of time when no exceedances were observed. See the Technical Support Document for Water Quality-based Toxics Control, Appendix D - Duration and Frequency, U.S. Environmental Protection Agency, March 1991, EPA/505/2-90-001 (http://www.epa.gov/npdespub/pubs/owm0264.pdf).

Parameter	Water Quality Standard NCAC 15A 02B .0211(3)(l) 15A NCAC 02B .0211(4) 15A NCAC 02B .0220 (µg/l is micrograms per liter.)	State Assessment Methodology
Arsenic	50 µg/l (fresh and salt waters)	**Exceeding Criteria-Category 5** - Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine
Chromium	50 µg/l fresh water 20 µg/l salt water	
Lead	25 µg/l (fresh and salt waters)	
Cadmium	0.4 µg/l for trout waters, 2.0 µg/l for non-trout waters and 5.0 µg/l for salt waters	
Nickel	88 µg/l fresh water 8.3 µg/l salt water	
Cyanide	5 µg/l fresh water	
Flouride	1.8 milligram/l	
Copper	7 µg/l fresh water 3 µg/l salt water	
Zinc	50 µg/l fresh water 86 µg/l salt water	
Iron	1 milligram/l	Iron was not assessed in this cycle. Previous iron data that was assessed showed elevated levels to be a natural condition statewide.

North Carolina's WQSs for toxics, as currently documented in the State's *Redbook* (Amended Effective May 1, 2007; available on the DWR Classification and Standards Unit webpage: http://portal.ncdenr.org/web/wq/ps/csu), are specified as "maximum permissible levels." Because the State's WQSs do not define the conditions of toxicity (acceptable duration and frequency), one interpretation of the WQSs could be that no exceedances are permissible in the waters of the state; i.e., one sample value over the applicable criterion is cause for listing the water as impaired. The DWR has assessed its waters for toxics by assigning impairment to waters with a greater than ten percent exceedance frequency of the criteria, with at least 90% statistical confidence level and the sample size exceeds nine.

Use of the ten percent "rule of thumb" for interpreting water quality data is usually considered appropriate for conventional or naturally variable pollutants. However, it is not consistent with toxics criteria expressed as "maximum permissible levels." The EPA's 2006 IR guidance, Part IV *(Issues Concerning the Development and Use of an Assessment Methodology)*, Section G, states:

> **How should statistical approaches be used in attainment determinations?**
>
> Past EPA guidance (1997 305(b) and 2002 CALM) recommended making non-attainment decisions, for "conventional pollutants" — TSS, pH, BOD, fecal coliform bacteria grease [There are a variety of definitions for the term "conventional pollutants." Wherever this term is referred to in this guidance, it means "a pollutant other than a toxic pollutant."] — when more than "10% of measurements exceed the water quality criterion." (However, EPA guidance has not encouraged use of the "10% rule" with other pollutants, including toxics.) Use of this rule when addressing conventional pollutants, is appropriate if its application is consistent with the manner in which applicable WQC (Water Quality Criteria) are expressed. ...
>
> On the other hand, use of the ten percent rule for interpreting water quality data is usually not consistent with WQC expressed either as: 1) instantaneous maxima not to be surpassed at any time, or 2) average concentrations over specified times. In the case of "instantaneous maxima (or minima) never to occur" criteria use of the ten percent rule typically leads to the belief that segment conditions are equal or better than specified by the WQC, when they in fact are considerably worse. (That is, pollutant concentrations are above the criterion-concentration a far greater proportion of the time than specified by the WQC.) Conversely, use of this decision rule in concert with WQC expressed as average concentrations over specific times can lead to concluding that segment conditions are worse than WQC, when in fact they are not. If the state applies different decision rules for different types of pollutants (e.g., toxic, conventional and non-conventional pollutants) and types of standards (e.g., acute vs. chronic criteria for aquatic life or human health), the state should provide a reasonable rationale supporting the choice of a particular statistical approach to each of its different sets of pollutants and types of standards.

The State may use an alternative scientifically defensible methodology if it can show that the methodology is no less stringent than the WQS (40 CFR 131.11(b)) and can demonstrate that the alternative frequency component fully protects aquatic life. In the State's section 303(d) list submittal of March 31, 2014, DWR provided a "*Justification for Changes to the 10% Listing Method*" which states:

> In 2013 the Environmental Management Commission approved changes to the assessment methods. These methods were used to develop the 2014 303(d) list. The new method uses the 10% exceedance approach and adds a 90% statistical confidence component. This approach is a nonparametric procedure [similar to Lin *et al.* 2000: Lin, Pi-Erh, Duane Meeter and Xu-Feng Niu. 2000. *A Nonparametric Procedure for Listing and Delisting Impaired Waters Based on Criterion Exceedances.* Technical Report. Department of Statistics, Florida State University, Tallahassee, FL. (http://www.dep.state.fl.us/water/tmdl/docs/Supdocument.PDF)].
>
> The EMC adopted the statistical confidence approach to provide more statistical confidence that standards were exceeded in at least 10 percent of samples by taking sample size into account. This reduces the chance of listing a parameter as exceeding criteria when it may be meeting criteria.

Florida Department of Environmental Protection used the Technical Report referenced above to support "Florida's Methodology for Identifying Surface Water Impairment Due to Metals" as part of the State's Impaired Waters Rule (IWR). Florida applies this methodology, in part, to water quality parameters such as metals to account for uncertainty in data quality. A large proportion of FDEP's sizable data set is from third party sources, including volunteer groups, and its validity is uncertain. These factors weighed heavily in the EPA's evaluation of the use of the nonparametric statistical test for use support determinations for that State. Appendix B of this Decision Document includes the EPA's detailed evaluation of FDEP's methodology. This "Detailed Review of the IWR Binomial Statistical Test" is an appendix to the EPA's *Determination Upon Review of Amended Florida Administrative Code Chapter 62-303 Identification of Impaired Surface Waters*, dated February 19, 2008.

In North Carolina, data validity is ensured through consistent use of standard operating procedures and rigorous quality assurance and quality control processes (refer to the DWR monitoring *Standard Operating Procedures*: http://portal.ncdenr.org/web/wq/ess/isu and *Ambient Monitoring System Quality Assurance Project Plan*: http://portal.ncdenr.org/web/wq/ess/eco/ams/qapp. In addition, only high quality data is accepted for use support decisions (see criteria for submitting data for regulatory use on the DWR website: http://portal.ncdenr.org/web/wq/ps/mtu/assessment#5 . The majority of third party data in NC, in contrast to Florida, comes from the State's monitoring coalitions which operate under mutually agreed upon Memoranda of Agreement that ensure that the data collected by the coalitions are of comparable quality to the data collected by DWR http://portal.ncdenr.org/web/wq/ess/eco/coalition.

Thus, in North Carolina, statistical confidence is not necessary to account for uncertainty in data quality. The EPA's evaluation of and qualified agreement with, the nonparametric procedure in the case of FDEP 303(d) listing decisions for metals was based on the large size and uncertain quality of the data set. Given the different circumstances in North Carolina, the EPA does not agree with the use of a ten percent exceedance approach with ninety percent confidence for metals use support assessment.

The State's justification does not address how a ten percent exceedance rate with a confidence level supports the currently approved WQS. Nor does it demonstrate protection of aquatic life.

For toxics criteria, the EPA CWA section 304(a) guidance recommends an average frequency for criteria excursions not to exceed once in three years. The EPA selected this frequency of criteria exceedance based on derivation of the nationally-recommended criteria. Section 3.1.2 of the EPA Water Quality Standards Handbook: Second Edition (EPA-823-B-12-002; http://water.epa.gov/scitech/swguidance/standards/handbook/ states:

> Frequency for Aquatic Life Criteria
>
> To predict or ascertain the attainment of criteria, it is necessary to specify the allowable frequency for exceeding the criteria. This is because it is statistically impossible to project that criteria will never be exceeded. As ecological communities are naturally subjected to a series of stresses, the allowable frequency of pollutant stress may be set at a value that does not significantly increase the frequency or severity of all stresses combined.
>
> The EPA recommends an average frequency for excursions of both acute and chronic criteria not to exceed once in 3 years. In all cases, the recommended frequency applies to actual ambient concentrations and excludes the influence of measurement imprecision. The EPA established its recommended frequency as part of its guidelines for deriving criteria (Appendix H). The EPA

selected the 3-year average frequency of criteria exceedance with the intent of providing for ecological recovery from a variety of severe stresses.

DWR is not required to use the EPA-recommended one-in-three method. However, North Carolina has not provided a scientifically defensible rationale to support their methodology for toxics.

Whenever the EPA cannot conclude that an assessment methodology is appropriate, an independent review of data is done to determine whether all waterbody impairments are properly identified. Prior to the 2008 303d list cycle, North Carolina was not consistently assessing for impairments of metals, particularly "action level" metals, i.e., copper and zinc. The EPA's independent assessment of metals data identified numerous impaired waterbodies. The State subsequently added 82 copper and/or zinc impairments to waterbodies to the 2008 and 2010 section 303(d) lists.

Given the amount of data then available for metals in the assessment data windows (2002-2006 and 2004-2008, respectively), the ten percent exceedance methodology resulted in the same (or more) listings as the EPA recommended one-in-three exceedance frequency. Within the five-year data window for each listing cycle, DWR conducted metals monitoring quarterly for most sampling stations, resulting in twenty samples, sometimes fewer. In most cases, just two exceedances triggered an impaired designation.

In 2007, DWR suspended most ambient monitoring for all metals as they began a process to update metals water quality standards. Limited metals monitoring was resumed in 2010. Therefore, for the 2012 and 2014 cycles, there was very little new metals data within the assessment data windows (2006-2010 and 2008-2012, respectively).

In the 2012 cycle, DWR proposed to delist the copper impairment from part of the North Toe River based on a 9.5 percent exceedance frequency. The EPA's independent assessment determined that the State had failed to adequately demonstrate good cause for delisting. See Appendix C, "*Responsiveness Summary to Comments Regarding the EPA's August 16, 2012 Action to Add a Water to North Carolina's 2012 Section 303(d) List.*"

In the State's submittal of the 2014 303(d) list, over fifty waterbody-pollutant combinations (metals) were proposed for delisting based solely on the change in assessment methodology (the addition of a confidence level).

EPA Conclusion

The EPA is not satisfied that the State's methodology for toxics properly implements the currently applicable water quality standards and has conducted an independent assessment of water quality data to determine if additional metals impairments should be added to the 303(d) list. Our review found forty-nine waterbody-pollutant combinations (metals) that should be included on the 2014 list as impairments to aquatic life, based on greater than one exceedance in three years. Three waterbody-pollutant combinations (arsenic) also found in this review are discussed in the section on Human Health protection, below (section III.A.8). Appendix D contains an entire list of waterbody-pollutant combinations to be included on the 2014 list.

A thorough review of the State's data also revealed an additional 153 waterbody-pollutant combinations with potential metals impairments. See Appendix E for a list of these waterbodies. Data for these waters shows more than one exceedance in three years. However, much of the data is qualified. The two most common data qualifiers associated with metals data were "U": *Analyzed for but not detected above the Practical Quantitation Limit (PQL), which is defined as the lowest level achievable among laboratories within specified limits during routine laboratory operation (The PQL is about three to five times the method detection limit and represents a practical and routinely achievable detection level with a relatively good certainty that any reported value is reliable.)*; and "P": *Elevated PQL due to matrix interference and/or sample dilution.* Data flags are defined in the DWR's Ambient Monitoring Systems Data Explanations (http://portal.ncdenr.org/web/wq/ess/eco/ams).

The EPA recommends that these waterbodies remain or be placed in Category 3 and be given high priority for follow-up monitoring. Monitoring and assessment of those and all waterbodies must be based on North Carolina's EPA-approved water quality standards and would include any revised metals standards that have been approved by the EPA.

The EPA's independent assessment of metals data for the 2008 and 2010 lists, described above, resulted in a list of 23 waterbody-pollutant combinations requiring further investigation for potential impairments of copper and/or zinc. These waters were placed in Integrated Reporting Category "3a." The EPA's 2006 IR guidance defines Category 3: "No data, or insufficient information to determine if any designated use is attained. Supplementary data and information, or future monitoring, will be required to assess the attainment status." In an internal memo dated April 9, 2010, the State indicated its intention to conduct metals sampling at "assessment units identified for 303(d) additional metals sampling." EPA anticipated that these waterbodies would be treated as high priority for additional assessment monitoring during future listing cycles. DWR has monitored several of these waterbodies, some as part of a special study to assist in the new water quality standards development.

Appendix F contains the list of waterbodies that require further investigation for potential impairments of copper and/or zinc and an update on the status of these waterbodies. The EPA has added six waterbody-pollutant combinations to this list in Appendix F based on the review of data and need for additional information.

EPA Conclusion – IRON

DWR provided USGS data to support the determination that high iron in many North Carolina surface waters is a natural condition. The EPA analyzed the information and concurs that the levels of iron found do appear to be naturally occurring, related to the sediment in streams and the geochemistry of the ecoregions within the state. The EPA concurs that the levels of iron found appear to be naturally occurring. The EPA recommends and the State has agreed, that DWR will continue to assess iron data to identify any waters with high levels not attributable to natural conditions.

5. Fish Consumption Use Support

Class C waters are freshwaters protected for several uses, including fishing. Class SC represents saltwater protected for several uses, including fishing. All waters in the state are protected at a minimum at the Class C or SC level. The fish consumption use support category is based on protecting human health, so these waters are assessed to determine whether humans can safely consume fish from a particular waterbody.

Water Quality Standard	State Assessment Methodology

15A NCAC 02B.0211(l)(ix) (l) Toxic substances: numerical water quality standards (maximum permissible levels) for the protection of human health applicable to all fresh surface waters are in Rule .0208 of this Section. Numerical water quality standards (maximum permissible levels) to protect aquatic life applicable to all fresh surface waters: (ix) Mercury (water column criteria): 0.012 µg/l	Fish consumption was assessed based on site-specific fish consumption advisories developed using fish tissue data. Advisories and advice are developed by the NC Department of Health and Human Services using fish tissue data collected by DWR and others. See http://epi.publichealth.nc.gov/fish/current.html for all advice and advisories. **Exceeding Criteria-Category 5** o Fish consumption advisory in place for AU o AU has site specific fish tissue data
NCAC 15A 02B .0208(a)(2) Standards for Toxic Substances and Temperature Human Health Standards: The concentration of toxic substances will not exceed the level necessary to protect human health through exposure routes of fish (or shellfish) tissue consumption, water consumption, or other route identified as appropriate for the water body. (A) For non-carcinogens, WQS or criteria used to calculate water quality based effluent limitations to protect human health for fish consumption. (See regulation for details on calculation.) (B) For carcinogens: WQS applicable to protect human health from carcinogens through the consumption of fish are: (i) Aldrin: 0.05 ng/l; (ii) Arsenic: 10 ug/l; (iii) Benzene: 51 ug/l; (iv) Carbon tetrachloride: 1.6 ug/l; (v) Chlordane: 0.8 ng/l; (vi) DDT: 0.2 ng/l; (vii) Dieldrin: 0.05 ng/l; (viii) Dioxin: 0.000005 ng/l; (ix) Heptachlor: 0.08 ng/l; (x) Hexachlorobutadiene: 18 ug/l; (xi) Polychlorinated biphenyls (total of all identified PCBs and congeners): 0.064 ng/l; (xii) Polynuclear aromatic hydrocarbons (total of all PAHs): 31.1 ng/l; (xiii) Tetrachloroethane (1,1,2,2): 4 ug/l; (xiv) Tetrachloroethylene: 3.3 ug/L; (xv) Trichloroethylene: 30 ug/l; (xvi) Vinyl chloride: 2.4 ug/l.	<u>Additional Mercury Assessment Criteria</u> An assessment unit was assessed as Impaired for fish consumption when greater than 10% (with greater than or equal to 90% confidence) of samples (sample size greater than 9) were greater than 0.012 µg/l.

The Monitoring Program Strategy states that DWR conducts fish tissue testing for mercury, selenium, cadmium, PCBs and pesticides (including dioxins). Data are provided to the North Carolina Department of Health and Human Services (DHHS) for that agency to make fish consumption advisories.

Dioxins in Waterville Reservoir

The EPA's independent analysis of fish tissue data from Waterville Reservoir indicates a probable standard exceedance of dioxin in the water column. DWR's assessment methodology for dioxin is based on fish consumption advisories issued by the DHHS, not an evaluation of compliance with the water quality standard. DWR has listed the Pigeon River and Waterville Reservoir in the past based on fish advisories. However, levels in fish tissue (monitored annually) have been declining and, when the fish advisories were dropped, these waterbodies were removed from the State's section 303(d) list. The presence of an advisory indicates impairment, however, lack of an advisory does not necessarily indicate lack of impairment.

The North Carolina water quality standard for dioxin is given as a water column number (0.005 parts per quadrillion, or ppq). Levels in the water column are below detection limits with normal sampling methods. Because dioxin bioaccumulates in aquatic organisms, fish tissue data is used to determine use support. However, the level of dioxin in fish tissue which triggers a fish consumption advisory in the state (3.0 parts per trillion, or ppt) is less stringent than the level (0.025 ppt) that would indicate the water is not attaining the standard for dioxin.

Since the time that Blue Ridge Paper Products, a facility upstream of the Reservoir, stopped releasing detectable levels of dioxin in the early 1990s, levels in fish tissue have been declining. The EPA's review of the Blue Ridge Paper Products NPDES permit renewal in 2009 led to review of recent fish tissue data in Pigeon River and Waterville Reservoir (no probable exceedances were found in the Pigeon River). Though the current fish tissue data for Waterville Reservoir does not trigger a fish advisory, the EPA conducted back calculations of this fish tissue data to determine the level of dioxin in the water column, and these calculations indicate that the water column levels are elevated.

Based on the data analysis, the EPA has determined that it is likely the Waterville Reservoir continues to be impaired for dioxin. In order to further confirm the dioxin levels that currently exist in the water column of Waterville Reservoir, and make a determination about whether water quality standards are currently being met, the EPA has discussed with DWR the use of high volume sampling, a technique developed by the EPA Region 4's Science and Ecosystems Support Division. High volume sampling can achieve a much lower detection limit, allowing direct comparison of the water column monitoring data with the state water column standard.

Statewide Fish Consumption Advisory for Mercury

In North Carolina, a statewide fish consumption advisory exists for mercury in Largemouth Bass. Due to this advisory, the designated uses of all water bodies statewide are impaired by mercury. Therefore, all named water bodies in North Carolina were included in the 2014 Integrated Report for mercury impairment. DWR developed a TMDL which the EPA approved on October 12, 2012.

EPA Conclusion

The EPA has determined that, in general, North Carolina's use of fish tissue data and fish consumption advisories is consistent with North Carolina's existing, EPA-approved water quality standards. However, the methodology should allow flexibility to address site specific data as in the case of Waterville Reservoir. The EPA's 2002 CALM guidance advises "...for fish and shellfish advisories for 'dioxin and dioxin-like compounds,' the EPA recommends that because of the unique risk characterization issues, listing decisions should be made on a case-by-case basis."

The EPA is deferring action on Waterville Reservoir, pending completion of a plan of study to better determine water column dioxin concentrations. The *Pigeon River Dioxin High Volume Sampling Quality Assurance Project and Study Plan* is provided in Appendix G. The EPA Region 4's Science and Ecosystems Support Division completed this sampling effort in May, 2014, and will work expeditiously on analysis of the data so the State can make a final determination regarding impairment status of this water.

The EPA does not agree that provisions in the State's methodology related to age of data and minimum sample size are consistent with federal requirements. Also, for the reasons set out in the section addressing assessment of section III.A.4.e above, the EPA has not determined that use of the greater than ten percent exceedence with greater than or equal to 90% confidence test is a reasonable method for DWR to assess toxic or non-conventional pollutants such as mercury. However, based on the EPA's independent review, the provisions of the State's methodology related to age of data, minimum sample size and toxic or non-conventional pollutants did not result in DWR failing to identify any waters based on fish consumption use. Therefore, the EPA is approving DWR's listing decisions for fish consumption use support.

6. Shellfish Consumption Use Support

The methodology for Shellfish Harvesting Use Support is applicable only to Class SA waters: tidal salt water bodies used for shellfish harvesting for market purposes.

Water Quality Standard	State Assessment Methodology
15A NCAC 02B .0221 Waters shall meet the current sanitary and bacteriological standards as adopted by the Commission for Health Services and shall be suitable for shellfish cultures...Quality standards applicable: (a) Floating solids; settleable solids; sludge deposits: none attributable to sewage, industrial or other wastes. (b) Sewage: None (c) Industrial Wastes or other wastes: none which are not effectively treated...in accordance with the requirements of the Division of Health Services.	An assessment unit was assessed as Impaired when the geometric mean was greater than 14 colonies/100ml or greater than 10% of the samples were higher than 43 colonies/100ml. **Exceeding Criteria-Category 5** o Class SA water o Growing area classification is Not Approved

(d) Organisms of the coliform group: fecal coliform group not to exceed a median MF of 14/100 ml and not more than 10 percent of the samples shall exceed an MF count of 43/100 ml in those areas most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions. (Note: MF is an abbreviation for the membrane filter procedure for bacteriological analysis)	

The North Carolina Division of Environmental Health (DEH) operates its monitoring program under guidelines outlined in the National Shellfish Sanitation Program's Guide for the Control of Molluscan Shellfish. When a condition or event occurs that impacts the open status of waters, DEH closes those waters to protect public health.

According to the DEH website (http://portal.ncdenr.org/web/mf/shellfish-sanitation), conditionally approved "areas are generally open to shellfishing, but can be closed after a significant rainfall event due to the resultant runoff. The area will then remain closed until water sampling indicates a return to acceptable bacteria levels." By definition, conditionally approved areas do not meet the water quality criteria based on a sanitary survey involving detailed water quality assessments conducted under the national protocols. Consequently, EPA's guidance advises and DWR's listing methodology appears to agree, that all conditionally approved areas be listed on the section 303(d) list.

In the 2014 303(d) assessment methodology, an assessment unit was assessed as Impaired when the North Carolina DEH growing area classification was Prohibited or Conditionally Approved. It appears that these classifications are considered "Not approved" in the State's assessment methodology.

EPA Conclusion

The EPA agrees that North Carolina's listing methodology provides for DWR to make listing decisions based on bacteriological data and shellfish harvesting classification information and in a manner consistent with the State's currently applicable water quality standards and EPA regulations.

The EPA does not agree that provisions in the State's methodology related to age of data and minimum sample size are consistent with federal requirements. However, based on the EPA's independent review of the existing and readily available data, the provisions of the State's methodology related to age of data and minimum sample size did not result in DWR failing to identify any waters not attaining shellfish use. Therefore, the EPA is approving DWR's listing decisions for shellfish use support based on that methodology.

7. Recreational Use Support

In addition to all Class C requirements, Primary Recreation Use Support (e.g., swimming, water-skiing, skin diving) is assessed for all Class B, SA and SB waters. Secondary Recreation Use Support (e.g., wading, boating) is assessed for all Class C and SC waters. Water quality standards applicable to Class C waters also apply to all waters classified as water supply.

North Carolina bases its determination of use support on (1) the fecal coliform bacteria water quality standard for fresh water (applicable to all Class C, B and SA waters), (2) the enterococcus water quality standard for coastal waters (applicable to all Class SA, SB and SC waters) and (3) the duration of swimming advisories issued by state and local health departments.

Water Quality Standard	State Assessment Methodology
15A NCAC 2B .0211 (3)(e) (Class C) **15A NCAC 2B .0219 (3)(b) (Class B)** **15A NCAC .0220 (3)(e) Class SC** **15A NCAC .0222 (3)(c) Class SB**	
Fresh Waters Organisms of the coliform group: fecal coliforms shall not exceed (1) a geometric mean of 200/100 ml (MF count) based upon at least five consecutive samples examined during any 30 day period, nor exceed (2) 400/100 ml in more than 20 percent of the samples examined during such period. (Note: MF is an abbreviation for the membrane filter procedure for bacteriological analysis)	**Recreation Use Support** Fresh Waters Exceeding Criteria-Category 5 o There are at least five samples collected within a 30-day period and o Geometric mean is greater than 200 colonies/100ml of water or o Greater than 20% of the samples exceed 400 colonies/100ml
Coastal Waters Enterococcus, including *Enterococcus faecalis, Enterococcus faecium, Enterococcus avium* and *Enterococcus gallinarium*: not to exceed a geometric mean of 35 enterococci per 100 ml based upon a minimum of five samples within any consecutive 30 days.	Coastal Waters Exceeding Criteria-Category 5 o There are at least five samples collected within a 30-day period and o Geometric mean of 35 enterococci per 100 ml
	Advisory Posting Assessment An AU was assessed as Impaired when a swimming advisory was posted for greater than 61 days in any 5 year period (includes permanent postings).

DWR conducts monthly fecal coliform bacteria testing as part of its ambient monitoring program for fresh waters. The North Carolina Division of Environmental Health (DEH) tests coastal recreation waters for Enterococcus levels. According to recent discussions with DWR staff and as stated in North Carolina's 2006 Integrated Report, "Locations with annual geometric means greater than 200 colonies per 100 ml, or when more than 20 percent of the samples are greater than 400 colonies per 100 ml, are identified for potential follow-up monitoring conducted five times within 30 days as specified by the state fecal coliform bacteria standard. If bacteria concentrations exceed either portion of the state standard, the data are sent to DEH and the local county health director to determine the need for posting swimming advisories."

EPA Conclusion

Based on the EPA's review of DWR's assessment submittals, DWR's assessment methodology for recreational use is consistent with North Carolina's existing, EPA-approved water quality standards.

The EPA does not agree that provisions in the State's methodology related to age of data and minimum sample size are consistent with federal requirements. However, based on the EPA's independent review of the existing and readily available data, the provisions of the State's methodology related to age of data and minimum sample size did not result in DWR failing to identify any waters not attaining recreational use. Therefore, the EPA is approving DWR's listing decisions for bacteria related to recreational use based on that methodology.

8. Drinking Water Use Support and Protection of Human Health

Water supply watersheds are classified as WS-I through WS-V waters. Water quality standards applicable to Class C waters also apply to Class WS-I through WS-V waters. The following water quality standards apply to surface waters within water supply watersheds.

Water Quality Standard	State Assessment Methodology
NCAC 15A 02B .0212, .0214, .0215, .0216, .0218 Waters of this class are protected by numerous management strategies including significantly limiting the point and non-point sources and imposing development management practices. Arsenic: 10 ug/l Chloride: 250 mg/l Manganese: 200 ug/l Nickel: 25 ug/l Nitrate nitrogen: 10 mg/l MBAS (Methylene-Blue Active Substances): not greater than 0.5 mg/l to protect the aesthetic qualities of water supplies and to prevent foaming;	**Exceeding Criteria-Category 5** -Greater than 10% exceedance with greater than or equal to 90% confidence - Sample size is greater than nine.
Aldrin: 0.05 ng/L Coliforms: total coliforms not to exceed 50/100ml (MF count) as a monthly geometric mean value in watersheds serving as unfiltered water supplies in Class WS-I only) Barium: 1.0 mg/l Benzene: 1.19 ug/l Carbon Tetrachloride: 0.254 ug/l Chlordane: 0.8 ng/L Chlorinated benzenes: 488 ug/l 2,4-D: 100 ug/l DDT: 0.2 ng/L Dieldrin: 0.05 ng/L	The Use Support Methodology does not discuss an assessment methodology for these parameters. A number of indicators with associated standards are not monitored or infrequently monitored by the DWR Ambient Monitoring Program, primarily due to expense of analysis or current analytical methods have reporting limits above the applicable standard. Since 2007, DWR has conducted a Random Ambient Monitoring System (RAMS) on freshwater streams statewide which collects many of these parameters. [See Probabilistic Monitoring of North Carolina Freshwater Streams - 2007-2010 (DWR, 2012;

Dioxin: 0.000005 ng/L Total hardness: not greater than 100 mg/l as calcium carbonate Heptachlor: 0.08 ng/l Hexachlorobutadiene: 0.44 ug/l Phenolic compounds: not greater than 1.0 ug/l Polynuclear aromatic hydrocarbons: 2.8 ng/l 2,4,5-TP (Silvex): 10 ug/l Sulfates: 250 mg/l TDS: not greater than 500 mg/l Tetrachloroethane: 0.17 ug/l Tetrachloroethylene: 0.7 ug/l Trichloroethylene: 2.5 ug/l Vinyl Chloride: 0.025 ug/l	page 6) and North Carolina Monitoring Program Strategy (DWR, 2012)]

All Toxics are Maximum Permissible Concentrations to protect human health through water consumption and fish tissue consumption for carcinogens and non-carcinogens.

EPA Conclusion

DWR's methodology to assess attainment of drinking water and human health uses for conventional pollutants is consistent with North Carolina's existing, the EPA-approved water quality standards and with the EPA regulations. The EPA does not agree that provisions in the State's methodology related to age of data and minimum sample size are consistent with federal requirements. Based on the EPA's independent review of the existing and readily available data, the provisions of the State's methodology related to age of data and minimum sample size, did not result in DWR failing to identify any waters not attaining drinking water and human health uses.

The EPA has not determined that use of the 10% exceedence frequency test is a reasonable method for DWR to assess toxic or non-conventional pollutants. Our review found three waterbody-pollutant combinations (arsenic) that should be included on the 2014 list as impairments to human health, based on greater than one exceedance in three years. Therefore, the EPA is approving all but three of DWR's listing decisions for drinking water and human health uses. See Appendix D for the list of all waterbody-pollutant combinations included on the North Carolina 2014 303(d) list.

9. Other Pollution Control Requirements (40 CFR 130.7(b)(1))

The EPA's regulations provide that Total Maximum Daily Loads (TMDLs) are not required for waterbodies where "[o]ther pollution control requirements (e.g., best management practices) required by local, State, or Federal authority are stringent enough to implement any water quality standards [WQS] applicable to such waters." 40 C.F.R. section 130.7(b)(1)(iii). The EPA's 2006 IR Guidance acknowledges that the most effective method for achieving water quality standards for some water quality impaired segments may be through controls developed and implemented without TMDLs (referred to as a "4b alternative"). The EPA expects that these controls must be specifically applicable to the particular water quality problem and be expected to result in standards attainment in the near future. The EPA evaluates on a case-by-case basis a State's decision to exclude certain segment/pollutant combinations from Category 5 (the section 303(d) list) based on the 4b alternative.

There are no new Category 4b listings in North Carolina's 2014 section 303(d) list. For all waterbodies identified in Category 4b, the State expects that other required regulatory controls (e.g., NPDES permit limits, Stormwater Program Rules, Nutrient Management Rules, etc.) will result in compliance with standards within a reasonable period of time. North Carolina has also confirmed that future monitoring will be used to verify standards achievement.

B. North Carolina's 2014 Section 303(d) List of Impaired Waters (40 CFR 130.7(b)(4))

1. North Carolina's Addition of Water Quality Limited Segments

North Carolina identified additional water quality limited segments (WQLS) in its 2014 section 303(d) list submittal, consistent with section 303(d) and EPA's implementing regulations. The EPA is approving the addition of those WQLSs to North Carolina's section 303(d) list. (See Appendix H.)

2. Delistings from North Carolina's 2012 Section 303(d) list (40 CFR 130.7(b)(6)(iv))

North Carolina proposed to remove specific WQLSs from its 2012 section 303(d) final list, consistent with section 303(d) and EPA's implementing regulations. The EPA has reviewed the good cause justification for those delisting requests and is approving the delisting of all but forty-eight of those WQLSs from North Carolina's section 303(d) list. All delisted waterbodies are identified in Appendix I. The delistings not approved by the EPA are discussed in sections III.A.4.e and III.A.8. A list of all WQLSs the EPA proposes to add to the section 303(d) list is provided in Appendix D.

3. Water Quality Limited Segments added by the EPA to the North Carolina 2014 Section 303(d) list

The EPA is not satisfied that the State's methodology for toxics properly implements the currently applicable water quality standards and has conducted an independent assessment of water quality data to determine if additional metals impairments should be added to the 303(d) list. Our review found forty-nine WQLSs that should be included on the 2014 list as metals impairments to aquatic life, based on greater than one exceedance in three years (see section III.A.4.e). An additional three WQLSs found in this review involved exceedances of the human health criteria for arsenic (see section III.A.8).

Of the fifty-two WQLSs to be included on the 2014 list, forty-eight are those for which the State failed to adequately demonstrate good cause for delisting. The remaining four WQLSs identified in the EPA independent assessment are those that the State failed to list as impaired for metals. Appendix D contains an entire list of WQLSs added by the EPA to the North Carolina 2014 section 303(d) list.

C. Priority Ranking and Targeting (40 CFR 130.7(b)(4))

Priority Ranking and Targeting for Total maximum daily loads (TMDL) and individual water quality-based effluent limitations is described in 40 C.F.R. section 130.7(b)(4): "The list required under [sections] 130.7(b)(1) and 130.7(b)(2) of this section shall include a priority ranking for all listed water quality-limited segments still requiring TMDLs, taking into account the severity of the pollution and the uses to be made of such waters and shall identify the pollutants causing or expected to cause violations of the applicable water quality standards. The priority ranking shall specifically include the identification of waters targeted for TMDL development in the next two years."

DWR provided a description of how water quality limited segments are prioritized for TMDL development. Prioritization is determined according to the severity of the impairment and the designated uses of the segment. The prioritization is based these factors:

1. Surface waters with classifications of water supply and class B waters would receive a higher priority than class C waters.
2. Biological or ambient water quality data that indicate severely impaired conditions would receive a higher priority than waters that exhibit moderate impairment.
3. Waters with multiple impairments would receive higher priority than waters with a single impairment.
4. Impairments located in smaller drainage areas would receive higher priority that waters in larger drainage area, because any action taken would be more likely to result in measurable improvement.

NC will identify waters targeted for TMDL development in the next two years using this process. The EPA has determined that the State's priority ranking adequately considers the severity of pollution and the designated uses of waterbodies.

D. Schedule for Development of TMDLs for Listed Waters and Pollutants

Pursuant to 40 CFR Section 130.7(b)(4), the State's submittal "shall specifically include the identification of waters targeted for TMDL development in the next two years." The submittal provides a description of the method used for prioritization but does not provide a Development Schedule. The EPA recommends inclusion of both the method for prioritization of TMDL development and a schedule in future lists.

E. Government to Government Consultation

The EPA recognizes its unique legal relationship with Tribal Governments as set forth in the United States Constitution, treaties, statutes, executive orders and court decisions. Government wide and the EPA specific policies call for regular and meaningful consultation with Indian Tribal Governments when developing policies and regulatory decisions on matters affecting their communities and resources. The *EPA Policy on Consultation and Coordination with Indian Tribes* (Policy) was finalized on May 4, 2011, in accordance with the Presidential Memorandum issued November 5, 2009, directing agencies to develop a plan to implement fully Executive Order 13175. This Policy reflects the principles expressed in the *1984 EPA Policy for the Administration of Environmental Programs on Indian Reservations* (1984 Policy).The 1984 Policy remains the cornerstone for the EPA's Indian program and "assure[s] that tribal concerns and interests are considered whenever the EPA's actions and/or decisions may affect" tribes (1984 Policy, p.3, principle no.5).

On March 31, 2014, the State of North Carolina submitted its final section 2014 303(d) list to the EPA for review. This submittal triggered the EPA's mandatory duty under section 303(d) of the CWA to review the State's section 303(d) list for consistency with the requirements of the CWA and to take action to approve or disapprove the 303(d) list.

The State of North Carolina's section 303(d) list and the EPA's decision on this list will apply to waters in the State of North Carolina and will not apply to waters in Indian Country. Nonetheless, because some of the State waters are adjacent to or upstream of Tribal waters, Tribal resources could be impacted by this action. As such, the EPA identified and offered government to government consultation to two federally recognized tribal governments to ensure that tribal input was considered prior to a final Agency action on the North Carolina 2014 section 303(d) list.

By letter of April 2, 2014, the EPA formally offered consultation to the Eastern Band of Cherokee Indians and the Catawba Indian Nation. The consultation process was conducted in accordance with the EPA Policy www.epa.gov/tribal/consultation/consult-policy.htm. The process ended on May 6, 2014.

The Eastern Band of Cherokee Indians did not choose to consult on the 2014 Section 303(d) list. Verbal comments were received from the Catawba Indian Nation (CIN) on April 26, 2014, and a phone consultation between CIN and EPA Region 4 staff occurred on April 29, 2014. The CIN comments covered a number of topics related to impaired waters that flow from North Carolina downstream to Tribal lands, mostly related to pollution control implementation and surface water quality monitoring that fall outside the scope of the EPA's review of the North Carolina 2014 303(d) list. However, the EPA acknowledges the validity the CIN comments and will initiate discussions with the DWR as well as the South Carolina Department of Health and Environmental Control in order to more fully address the comments.

As discussed in Section III.A.4.e of this document, the EPA conducted an independent assessment of water quality data and determined that fifty-two waterbody-pollutant combinations (metals) should be included on the 2014 list as impairments. The EPA will open a comment period to solicit comments on the proposed addition of these impairment to the North Carolina 2014 section 303(d) list. The EPA's proposed additions to the list will not trigger an offer of tribal consultation and coordination.

IV. Final Recommendation on North Carolina's 2014 Section 303(d) List Submittal

After careful review of the final section 303(d) list submittal package, the EPA Region 4 Water Protection Division recommends that the EPA partially approve the State of North Carolina's 2014 section 303(d) list. The Water Protection Division's review concluded that DWR's approach was acceptable for most waterbody impairments.

The EPA has not determined that DWR's methodology is a reasonable method for DWR to assess toxic or non-conventional pollutants consistent with the State's currently applicable, the EPA-approved water quality standards. Based on the EPA's independent review, fifty-two waterbody-pollutant combinations will be included on the EPA's approved section 303(d) list for North Carolina. (See Appendix D.)

The EPA will open a comment period to solicit comments on the proposed addition of these waterbody-pollutant combinations to the North Carolina 2014 section 303(d) list. The EPA's proposed additions to the list will not trigger an offer of tribal consultation and coordination.

The EPA is deferring action on Waterville Reservoir, pending completion of a plan of study to better determine water column dioxin concentrations. The EPA completed the field work in May, 2014, and will work quickly on data analysis so the State can make a final determination on the impairment status of this water.

The EPA's approval of North Carolina's section 303(d) list extends to all other waterbodies on the list with the exception of those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. The EPA is taking no action to approve or disapprove the State's list with respect to those waters at this time. The EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under section 303(d) for those waters.

APPENDIX A
North Carolina 2014 Integrated Report Categories

EPA category	NC Integrated Report Category	NC Integrated Report Category Description
1	1	Parameter assessed was meeting criteria
1	1b	Parameter assessed was meeting criteria and there is a management strategy in place for the assessed parameter
1	1f	Fish tissue collected in Assessment Unit with no advisories other than
1	1nc	Parameter assessed was exceeding some criteria but it was determined that the exceedances were due to natural conditions (documentation required)
1	1r	Parameter assessed was meeting criteria and there and there are ongoing
1	1t	Parameter assessed was meeting criteria and there is an approved TMDL in
1	3a1	Greater than 10% criterion exceeded, 90% statistical confidence criterion not
3	3a2	Greater than 10% criterion exceeded, 90% confidence criterion met, N <10
3	3a3	Benthos or fish community data are inconclusive
3	3a4	Fecal coliform GM>200 and/or 20% of samples >400, 5 samples in 30 days
3	3a5	Low DO- Greater than 10% criterion exceeded, natural conditions assessment
3	3a6	Low pH- Greater than 10% criterion exceeded, natural conditions assessment
3	3a7	Fish consumption advisory in place with no site specific fish tissue data for the
3	3a8	Enterro for the Asmnt Period is Meeting Criteria
3	3a9	Temperature criteria exceeded in Class Trout water with no assessment of
3	3b1	Greater than 10% criterion exceeded, 90% statistical confidence criterion not met, management strategy in place for parameter
3	3b2	Greater than 10% criterion exceeded, 90% confidence criterion met, N <10, management strategy in place for parameter
3	3b3	No data or information to make assessment, management strategy in place
3	3c1	Greater than 10% criterion exceeded, 90% statistical confidence criterion not met, non-pollutant is reason for exceedance
3	3c2	Greater than 10% criterion exceeded, 90% confidence criterion met, N <10, non-pollutant is reason for exceedance
3	3cr	DMF RecMon Advisory Days is 61
3	3e	Metals exceeding standard greater than one time in lastest three year. Criterion not used for category 5 assessments in NC
3	3r1	Greater than 10% criterion exceeded, 90% statistical confidence criterion not met, ongoing restoration activities in place to address parameter
3	3r2	Greater than 10% criterion exceeded, 90% confidence criterion met, N <10, ongoing restoration activities in place to address parameter
3	3r3	No data or information to make assessment, ongoing restoration activities in
3	3t1	Greater than 10% criterion exceeded, 90% statistical confidence criterion not met, approved TMDL in place for parameter
3	3t2	Greater than 10% criterion exceeded, 90% confidence criterion met, N <10, approved TMDL in place for parameter
3	3t3	No data or information to make assessment, approved TMDL in place for
3	3v1	Greater than 10% criterion exceeded, 90% statistical confidence criterion not met, exceedance due to permitted facility with a variance
3	3v2	Greater than 10% criterion exceeded, 90% confidence criterion met, N <10, exceedance due to permitted facility with a variance

APPENDIX A

North Carolina 2014 Integrated Report Categories

3	3v3	No data or information to make assessment, exceedance due to permitted
3	3z1	Data not assessed against a NC water quality standard
3	3z2	No data or information to make assessment
4b	4b	Exceeding Criteria, with 4b demonstration for the parameter
4c	4c	Exceeding Criteria, non-pollutant is reason for exceedance
4c	4cr	DMF Recmon Swimming Advisory Posted
4c	4s	Biological data exceeding criteria, another aquatic life parameter is assessed in
4a	4t	Exceeding Criteria, approved TMDL for assessed parameter
4c	4v	Exceeding Criteria, exceedance due to permitted facility with a variance
5	5	Exceeding Criteria, no approved TMDL in place for assessed parameter
5	5r	Exceeding Criteria, no approved TMDL in place for assessed parameter, ongoing restoration activities in place to address parameter

Appendix A "Detailed Review of the IWR Binomial Statistical Test" is part of the United States Environmental Protection Agency's Determination Upon Review of Amended Florida Administrative Code Chapter 62-303 Identification of Impaired Surface Waters, February 19, 2008

APPENDIX A: Detailed Review of the IWR Binomial Statistical Test

APPLICATION OF THE STATISTICAL TEST

A primary feature of the Florida Impaired Waters Rule (IWR) is the use of a statistical test based on the binomial distribution to evaluate data sets of water quality parameter measurements prior to relying on such data sets in listing a waterbody as "impaired." Statistical tests are useful when making decisions based on limited information (samples) about a general condition (population). While samples generally represent a population, they may have limited power to accurately and precisely represent specific characteristics of that population with great confidence. For example, it can be difficult to determine whether a particular data set of water quality sample measurements accurately represents actual conditions in ambient waters.

The binomial distribution is a nonparametric test based on a yes/no or pass/fail outcome. Such tests can be used, for example, to determine how many defective parts are allowed to come off an assembly line run without rejecting the entire lot (the example given in Microsoft Excel software). Nonparametric tests are useful, in general, when data are sampled from a population that is not normally distributed (i.e., a "bell" shaped curve) or where some data are "off the scale" (i.e., too high or too low to measure because of limitations of measuring devices or detection limits). The latter condition is typical of many water quality data sets. Going back to the assembly line example, the binomial test as applied to water quality is used to determine how many "defective" water quality measurements can occur before the waterbody as a whole is determined to be impaired (rejection of the entire lot).

The binomial statistical test has two key components, a probability value and a confidence value (or alpha). The probability value represents the proportion of samples that do not meet applicable water quality criteria (or the proportion of "defective" samples) associated with determining impairment in the waterbody as a whole. In the IWR, the probability value is 10%. In other words, "I believe that a rate of 10% or more of samples not meeting water quality criteria is enough to determine that the waterbody as a whole is impaired". The confidence value represents the desired certainty that small sample sizes are truly representative of the entire population. The confidence value is also expressed as a percentage value. In the IWR, the confidence value is 90% (80% for the planning list). In other words, "I want to be 90% certain that I have the right answer." For small sample sets, application of the confidence value results in the proportion of samples not meeting criteria to be greater than 10% before determining impairment, because of the relatively low certainty that small sample sets adequately represent the waterbody as a whole. As the size of the sample set increases, the proportion of samples not meeting criteria that are necessary to determine impairment approaches 10% because of the increased certainty, afforded by more data, that the sample set adequately represents the waterbody as a whole. The choice of probability value is not affected by sample size: the same acceptable proportion of "defective" measurements is applied to large and small data sets. Likewise, the choice of confidence value is not related to the acceptable proportion of "defective" measurements: it is a separate expression of desired certainty when considering the reliability of limited information. The probability value and the confidence value work together in the statistical test: "I want to be 90% sure that 10% or more of the samples do not meet water quality criteria in order to determine that the waterbody as a whole is impaired."

INTERPRETATION OF THE PROBABILITY VALUE OF 10%

In 2005, EPA determined that changes to criteria were those that affected magnitude (i.e., "how much"; usually expressed as a concentration such as "milligrams per liter"), duration (i.e., "how long"; usually expressed as an averaging period in hours or days), and frequency (i.e., "how often"; usually expressed as a return interval such as "no more than once every three years" or as a percent of time), as these features establish the level of protection or underlying expectation for ambient water quality. EPA further determined that provisions related to data reliability or sufficiency were not changes to water quality standards. In 2005, and now, EPA has determined the confidence value is not a change to standards because it relates to data reliability rather than to magnitude, duration, or frequency. In 2005, however, EPA determined the probability value was a new or revised water quality standard as a change to the frequency component of criteria. As explained more fully below, EPA is changing that determination because, based on additional information submitted by FDEP, we believe the probability value is a data reliability component of the IWR rather than a modification to the frequency component of the criteria.

In evaluating the IWR, both the 2001 version examined in EPA's 2005 Determination and the amended 2007 version which is the subject of this review, EPA's question with respect to the binomial test is "what is meant by the probability value?", or in other words, "what does it mean to be a 'defective' water quality measurement?" Is it defective in the sense that it is in error, inaccurate, biased, or an unreliable measure, or is it defective in the sense that it represents a pollutant or water quality parameter that exceeds its criterion? Based on the analytical framework laid out in EPA's 2005 Determination, if it is the latter then the probability value represents a new or revised water quality standard as a frequency component of water quality criteria. Florida's currently applicable water quality standards say that, "unless otherwise stated, all criteria express the maximum not be exceeded at any time." However, if the probability value represents the former (data reliability), then it does not represent a new or revised water quality standard. Under this interpretation, the underlying expectations for the ambient water are unchanged: the criteria are not to be exceeded. The probability value establishes the strength of the signal from data that may include a proportion of unreliable measures that is necessary to conclude that the criteria have in fact been exceeded. In the absence of documented clarification, EPA acted expansively with respect to what is a new or revised standard and concluded that the probability value constituted a new or revised water quality standard in its review of the of the 2001 IWR (2005 Determination).

EPA now understands that the probability value operates differently than we determined it did in 2005. In 2005, EPA reasoned that application of the 10% probability value would result in a 10% exceedance of a criterion magnitude value <u>in ambient water</u>.

Under this earlier understanding, a "defective" measurement actually would represent a pollutant or water quality parameter that, in fact, would exceed the criterion in the ambient water. Requiring a 10% exceedance rate in the ambient water would be different than what is expressed in Florida's water quality standards in terms of frequency. Based on consideration of additional information submitted by the State, however, EPA now understands that the purpose of the 10% probability value is to exclude data that are likely to be unrepresentative of actual ambient water conditions. Unless the number of samples ostensibly showing exceedance of the relevant water quality criterion is 10% or more, then FDEP will not list the receiving waters as having exceeded the criterion. The 10% probability value reflects the fact that the universe of samples assessed by FDEP are likely to include many unreliable and thus unrepresentative measurements, which do not accurately reflect the condition of the ambient water. Therefore, the State's binomial statistical test requires 10% or more of such samples to exceed criterion magnitude values before it will determine the waterbody itself does not meet water quality standards.

MODIFICATIONS TO THE 2007 AMENDED IWR

The 2007 amended IWR differs from the 2001 IWR with respect to the binomial statistical test in both the wording of the rule language and the supporting rationale that the State submitted in 2007.

In the 2001 IWR, it was unclear whether the probability value component of the binomial statistical test revised the expectations for ambient water set out in Florida's existing water quality standards. The binomial test provisions appeared in Florida Administrative Code (F.A.C.) rule 62-303.320(1), for the planning list, and rule 62-303.420(2), for the verified list, and the test was cross referenced in a number of other sections of the IWR.[1] The 2001 IWR described the probability value as "the number of exceedances of an applicable water quality criterion" necessary to determine impairment. EPA understood this language to revise the frequency component set out Florida's existing water quality standards and, in its 2005 Determination, identified the provisions implementing the binomial as new or revised water quality standards.

The 2007 amended IWR addresses the binomial test in the same provisions of the Rule as did the 2001 IWR However, the description of the probability value in the 2007 IWR refers to "the number of samples that do not meet an applicable water quality criterion" necessary to determine impairment for the waterbody as a whole. The consistent use of the term "samples" throughout these provisions describes the objective of the provisions as data reliability rather than ambient expectation. This interpretation is further clarified in the written materials submitted by FDEP in 2007.

The binomial statistical test first appears in the 2007 IWR in rule 62-303.320, related to the planning list. This provision has been renamed "Aquatic Life-Based Water Quality Assessment" in the 2007 IWR. The provision had been titled "Exceedances of

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[1] Unless otherwise stated, all Rule and subsection citations are to provisions in the Florida Administrative Code.

Aquatic Life-Based Water Quality Criteria" in the 2001 Rule. The changes to the text in paragraph (1) are as follows:

> Water segments shall be placed on the planning list if, using objective and credible data, as defined by the requirements specified in this section, the number of samples that do not meet ~~exceedances of~~ an applicable water quality criterion due to pollutant discharges is greater than or equal to the number listed in Table 1 for the given sample size. For sample sizes up to 500, waters are placed on the planning list when ~~This table provides the number of exceedances that indicate a minimum of a~~ 10% or more of the samples do not meet the applicable criteria ~~exceedance frequency~~ with a minimum of an 80% confidence level using a binomial distribution. For sample sizes greater than 500, the Department shall calculate the number of samples not meeting the criterion that are needed to list the waterbody with an 80% confidence level for the given sample size using the binomial distribution.

References to "number of exceedances" and "exceedance frequency" have been replaced with "number of samples". Likewise, the changes in the text heading of Table 1 are as follows:

> **Minimum number of samples not meeting an applicable water quality criterion ~~measured exceedances~~ needed to put a water on the ~~P~~planning list with at least 80% confidence ~~that the actual exceedance rate is greater than or equal to ten percent.~~**

The term "measured exceedances" and the phrase "that the actual exceedance rate is greater than or equal to ten percent" have been removed and replaced with "samples not meeting an applicable water quality criterion".

The binomial statistical test appears in the 2007 IWR provisions related to the verified list at rule 62-303.420(2). This provision includes a 90% confidence limit, rather than the 80% confidence limit applied to the planning list. However, the probability value remains the same in this provision. Language changes similar to those made in rule 62-303.320(1) and Table 1 are also made for this provision and Table 3:

> …Once these additional data are collected, the Department shall re-evaluate the data using the approach outlined in rule 62-303.320(1), F.A.C., but using Table 3~~2~~, and place waters on the verified list when ~~which provides the number of exceedances that indicate a minimum of a~~ 10% or more of the samples do not meet the applicable criteria, ~~exceedance frequency~~ with a minimum of a 90% confidence level using a binomial distribution.

As with the changes to rule 62-303.320, the changes to rule 62-303.420 represent a clear change in meaning from the 2001 IWR. These changes in language clarify that the probability value of 10% is intended to be a data reliability provision related to the number of samples necessary to conclude that criteria have been exceeded in a waterbody rather than a new allowable frequency of exceedance. EPA acknowledges that the assessment result is the same as in 2001. However, the amended language clarifies that the probability value of 10% serves as a data reliability provision related to the number of samples necessary to conclude that criteria have been exceeded in the waterbody as a whole rather than a new frequency component allowing ambient waters to exceed criteria 10% of the time. This clarification is fully explained in the FDEP supporting materials accompanying the submission of the IWR for review.

RELATED PROVISIONS IN THE 2007 AMENDED IWR

There are two important provisions within 62-303.320 that merit further discussion to understand the context of the application of the binomial statistical test. The first is paragraph (4)(a) which establishes a procedure for grouping data collected within a 4 day period and using the median as the representative value for the entire period. This provision clearly represents a new or revised water quality standard as it adds a duration component to the criteria. EPA reached the same conclusion in its 2005 Determination of the 2001 IWR, when the duration period was 7 days. The same duration period is established specifically for the marine dissolved oxygen daily average criterion in paragraph (5). The second note-worthy provision is paragraph (6)(b), which calls off the duration period in paragraph (4)(a) and the binomial statistical test for acute toxicity-based water criteria (as did the 2001 IWR) and for synthetic organic compounds and synthetic pesticides (which is new for the 2007 IWR), opting for a no more than once in three year period frequency of exceedance for any measurement above the criteria for any of these parameters. For practical purposes, these provisions limit the applicability of the binomial statistical test to metals, dissolved oxygen, and bacteria measurements.

Although they appear in planning list provisions, the duration and frequency criteria components described in 62-303.320(4)(a), (5), and (6)(b) constitute new or revised water quality standards based upon their cross reference in 62-303.420(1) and (6) and 62-303.720(m), which execute attainment decisions for purposes of meeting the requirements of Clean Water Act section 303(d).

The binomial statistical test described in 62-303.320, excluding the 4 day duration period, is cross referenced in 62-303.360(1)(a) and 62-303.370(1) for evaluating samples with respect to bacteria criteria and 62-303.380(1)(a) and (3)(a) with respect to drinking water and human health criteria (excluding synthetic organics and synthetic pesticides via 62-303.320(6)(b)). The binomial statistical test described in 62-303.420, excluding the 4 day duration period, is also cross referenced in 62-303.460(3)(a), 62-303.470(3)(a), and 62-303.480(3)(a) for evaluating samples with respect to bacteria criteria.

An important feature of the amended 2007 IWR is the so-called "overwhelming evidence clause" at 62-303.420(7):

> ...water segments shall also be included on the verified list if, based on representative data...scientifically credible and compelling information regarding

> the magnitude, frequency, or duration of samples that do not meet an applicable water quality criterion provides overwhelming evidence of impairment.

This provision allows FDEP to consider data of known high quality and reliability, as well as data having other characteristics that make a credible and compelling case for non-attainment, and execute an attainment decision with respect the 303(d) list. While this provision does not constitute a new or revised water quality standard, because the standards for evaluating the credible and compelling information are not changed, it does help provide needed flexibility for considering all relevant information pursuant to the regulatory requirements of 40 C.F.R. Part 130 for preparing an appropriate and complete list of impaired waters. There are also other provisions of the 2007 IWR that provide FDEP the legal authority to exercise discretion in identifying waters as impaired.

EVALUATION OF SUPPORTING RATIONALE

FDEP submitted a 40 page document entitled "Florida's Methodology for Identifying Surface Water Impairment Due to Metals" (metals methodology) among the package of supporting material accompanying the submittal of the 2007 IWR for EPA review. In the Introduction section of this document, FDEP summarizes:

> The IWR, which was adopted in 2001, establishes procedures for evaluating data sufficiency and data quality to ensure that a number of sample exceedances of a water quality criterion do, in fact, represent impairment of a waterbody. The statistical approach and thresholds selected are intended to provide greater confidence that the outcome of the water quality assessment is correct.
>
> While the IWR uses EPA's long-standing 10% exceedance rate as the threshold for impairment when evaluating aquatic life-based numeric water quality criteria, it differs from EPA's Integrated Report guidance in two principal ways. First, it applies the threshold to both conventional pollutants and metals, while EPA recommends it only for conventionals. <u>Florida applies this methodology to water quality parameters such as metals to account for uncertainty in data quality.</u> Second, it establishes a minimum confidence level for the assessment (an 80% confidence level for the Planning List of potentially impaired waters and a 90% confidence level for the Verified List of impaired waters) that is calculated using a non-parametric statistical approach called the binomial method. (emphasis added)

Chapter 3 of FDEP's metals methodology describes in detail the factors supporting the need to address uncertainty in data quality based on accounting for sampling and analytical error, with a particular concern for "false positive" (bias at the high end of measurement). The document states "erroneously high metal concentrations have routinely been reported in natural waters because of contamination artifacts introduced during sampling and analysis" (scientific literature citations provided). The document also states that "[i]t is the Department's experience that much of the data reported for metals in natural waters are biased erroneously high and need to be verified if reported to exceed water quality standards," adding that "[s]ampling errors can sometimes be detected through metadata (for instance, if field blanks are contaminated)." Specific experiences related to working with Florida's data set are recounted, as in:

> The Department's Bureau of Laboratories has referred a number of cases in which exceedances of water quality standards were alleged for metals; however further investigation (split sample studies, etc.) using analytical techniques designed to remove interfering substances (e.g., chelation extraction techniques for metals) nearly always demonstrated that measurement artifacts were the likely culprit, as few chronically reported water quality exceedances for metals could be substantiated in the laboratory or in properly designed field studies.

A detailed evaluation of phosphorus data from the Everglades provides some quantification of error rates from reports from lab analysis of field data, and the implications are summarized as:

> While the previous example clearly illustrates the importance of metadata, the vast majority (>80%) of the state's data providers still did not meet the metadata requirements of the original IWR due to data management constraints. FDEP has nonetheless accepted the data and has, in fact, revised the IWR to allow use of data without metadata because we do not want to overly limit the amount of data available for impaired water assessments[2]. However, it should be noted that most of the water quality data collected for ambient waters come from laboratories with less incentive and less oversight than in the Everglades Program. Analysis of exceedances suggests that many are the result of data that were improperly qualified and that should not have been submitted without proper qualifiers identifying them as below the MDL or PQL. As a result, FDEP remains convinced that data lacking supporting QA/QC metadata (e.g., Legacy STORET data) should be used very cautiously in deciding whether a waterbody should be listed as impaired, and that the assessment methodology needs to acknowledge some level of false positives in the dataset. EPA's TSD Response Summary states that "**the allowable frequency for criteria excursions should refer to true excursions of the criteria, not to spurious excursions caused by analytical variability or error.**"
>
> When deciding on an appropriate assessment methodology, FDEP recognized that there would be some unknown number of false positives (given the potential for error combined with the limited ability to identify and exclude bad data). Because of the large water quality dataset (some 45 million records in the IWR database) it is not possible to do a QA analysis of each data point. As such, the only alternatives are to either exclude all data of unknown quality (the majority of currently available data), or to acknowledge this error in designing an assessment methodology. Florida's methodology attempts to use as many data as possible to

[2] In cases where metadata show the data to be unreliable (i.e., do not meet the minimum QA/QC standards), the data are of course not used.

> include as many waterbodies as possible in assessing waters for the TMDL Program. (emphasis theirs)

FDEP has assembled a large amount of data, a large proportion of which is from third party sources. This large database factors heavily in EPA's evaluation of the use of the binomial statistical test and FDEP's supporting material. Going back to the statistical background provided at the beginning of this analysis, the need for a method to determine the "greatest number of defective parts allowed to come off an assembly line run without rejecting the entire lot," or in this case "how many 'defective' water quality measurements need to occur to gain confidence that the water is impaired," is evident. FDEP's metals methodology provides an extensive list of outside data providers, along with the number of records provided by each. FDEP summarizes the challenges of working with large volumes of data from multiple sources:

> Given the vast amount of ambient data available in Florida and the uncertainties associated with this data as far as its quality, accuracy and representativeness, FDEP needed to either limit the data that could be used to only that which could be rigorously evaluated for data quality and representativeness, or develop an assessment methodology that allowed for computerized, statistical evaluation of the data. Rather than limit the data that could be used, FDEP opted to use the vast combined monitoring capacity of multiple entities within Florida that collect data and promote documentation of collection, handling, and analysis, and reporting procedures.
>
> However, from a practical management point, FDEP recognized that, even with improved sampling procedures, a significant fraction of the data will continue to represent erroneously high values because of errors introduced in sampling and analysis and bias from non-representative sampling. When examining data, it is not possible to identify (or program a computer to identify) which particular data points are valid or invalid because of the large range of possible results. However, certainty is increased greatly when multiple values are found to be exceeding a threshold. The extreme tail end of a distribution may be most likely to contain the most erroneous data, but as a greater proportion of the data lie above a threshold of interest, certainty increases greatly that the value has in fact been exceeded. The use of a 10% exceedance frequency in the IWR represents a threshold where the frequency of poor quality data suggests it is not likely that all the data above this point would be erroneously high, as a general rule. Thus, this serves as a practical adjustment for uncertainty from known data quality impacts, while ensuring confidence that waters that are impaired will be captured.

FDEP's methodology also documents and supports the selection of 10% as the probability value:

> FDEP selected EPA's recommended 10% exceedance frequency as the listing threshold for the assessment of aquatic life use support in acknowledgement that some percentage of the available data are unreliable and/or represent natural

variation. The FDEP included the binomial method as a mechanism to establish the confidence associated with the assessment and applied the method to both conventional pollutants and toxics. FDEP has subsequently revised the IWR so that the binomial method does not apply to synthetic organics or pesticides because data for these pollutants are typically negatively biased. However, FDEP has concluded that the binomial method is appropriate for metals… The following points summarize FDEP's alternative approach for metals:

- The confidence limit aspect of the alternative approach using the binomial reflects FDEP's management of statistical uncertainty of sampling (grab sample monitoring) from an overall population (ambient water conditions)
- The 10% exceedance rate is a **sample** exceedance rate for the assessment data, not an inherent allowable rate of criteria exceedance in the ambient water. Florida must process over 45 million data records to conduct its assessment program, and nearly 75% of Florida's data are from other agencies. These non-FDEP data have greater uncertainty with respect to accuracy and representativeness, and it is not possible to thoroughly review the QA/QC associated with all these data. However, these data also provide a wealth of information about the status of Florida's waters. To most fully utilize these data resources, FDEP developed a statistical approach that is amenable to computerized data processing and that allows FDEP to achieve the objectives of using data most likely to be reliable, while ensuring that waters not expected to meet applicable water quality standards are indeed placed on the state's 303(d) list
- The 10% exceedance rate quantitatively represents an accounting for sampling and analytical error associated with factors such as collection and handling errors, reporting errors, blank contamination, reversals, and matrix interference. The extent and effect of these types of data quality factors have been quantified for specific data sets in Florida to provide further support for the selection of 10% as a reasonable and appropriate target value. For example, the USGS audit identified that 10% of the samples in Florida's data were unreliable. [*Note: this USGS audit was conducted using all of Florida's data, not just USGS collected data.*] The best quantification of potential error rates comes from Everglades data records, which indicate a range of between 2-60% for various water quality parameters. Excluding the extremes (a low overall error rate for calcium and a very high rate of blank contamination from one lab for orthophosphate), this range narrows to 7-33% with all but one remaining value above 10%. Recognizing that the majority of error is reflected on the high end of reported data, a selection of 10% is reasonable and appropriate for this accounting.

EPA finds this rationale reasonable and concludes that the 10% probability value does not constitute a new or revised water quality standard. EPA acknowledges that this conclusion differs from the 2005 Determination associated with the 2001 IWR with respect to the comparable provisions. However, EPA rigorously applied the identical analytical approach for evaluating what constitutes new or revised water quality standards as it employed in the 2005 Determination. With the benefit of FDEP's supporting rationale and the changes in the regulatory language itself, the documentation of the 10% probability value functioning as a data reliability provision is clear and convincing. EPA believes that the characteristics of Florida's assessment data base in terms of volume of records and proportion generated from sources outside the state regulatory agency's control may be unique in the nation. While Florida has successfully made a State-specific case that use a 10% probability value in a statistical binomial test is appropriate and acceptable for use in Florida at this time, the documentation does not support this use as a general matter in other places or with an assessment data base that differs from Florida's current one in terms of documentation, quality, volume and underlying sources.

In its metals methodology, FDEP also makes an assertion concerning a minimal number of valid samples that exceed criteria, outside the context of data reliability:

> The 10% exceedance rate also reflects that a minimal number of valid samples may exceed the criteria, but would not result in impairment of designated uses. No significant damage to the biological community is expected to occur from intermittent, low-level exceedances of chronic criteria because the exceedances are typically very short in duration (shorter than 96-hours) and, for metals, typically include non-bioavailable particulate forms. The results from FDEP stream bioassessments include many cases of waters that have had intermittent exceedances of chronic criteria for toxics and still have excellent bioassessment scores. Florida's well-developed bioassessment tools are an integral part of the assessment process, and FDEP believes that these tools are useful at identifying impairment of aquatic life use support.

This assertion no doubt expresses the belief of the authors of the report, but nonetheless does not have a relationship to the intended function of the 10% probability value, which is clearly identified as a "sample exceedance rate for the assessment data, not an inherent allowable rate of criteria exceedance in the ambient water" a few sentences above this assertion in the same Methodology document, nor did this assertion have any bearing on EPA's evaluation. However, as a factual matter EPA does not disagree with the general point, as evidenced by EPA's own criteria recommendation published pursuant to Clean Water Act section 304(a), which are the basis for the magnitude value in Florida's underlying water quality criteria for metals, and for which EPA has recommended associated duration and frequency components whereby the magnitude may be exceeded for short periods of time at infrequent intervals and still be fully protective of aquatic life uses. Florida could have elected to produce a methodology with an alternative allowable frequency component for their criteria, but they did not choose to do so.

CONTINUED EPA OVERSIGHT

While not identified as a new or revised water quality standard, EPA continues to have a responsibility for regulatory oversight of use of the 10% probability value in conjunction with its review of lists of impaired waters submitted to EPA pursuant to

Clean Water Act section 303(d). EPA recognizes that the 10% probability value represents a reasonable choice based on data quality as documented at this time. However, EPA also recognizes the improvement in data quality that Florida seeks in their underlying data moving forward, and that several provisions of the IWR encourage and mandate documentation of monitoring data used for water quality assessment purposes. EPA will continue to monitor and evaluate waters in all assessment categories with respect to the underlying data and the relevant aspects of the binomial statistical test as part of the Agency's oversight responsibilities under the Clean Water Act. EPA retains the discretionary authority to add waters to Florida's list of impaired waters if circumstances warrant. Furthermore, EPA will advise Florida accordingly if at some time in the future, continued use of the 10% probability value as a data reliability provision becomes inappropriate and counter-productive to Florida's program goals and responsibilities.

NATURALLY VARIABLE POLLUTANTS

As mentioned previously, the binomial statistical test applies to parameters other than metals, most notably to dissolved oxygen and bacteria criteria. EPA has addressed Florida's assessment methodology with respect to "naturally variable" pollutants or pollutant parameters in previous determinations and actions associated with Florida's 303(d) list. As explained above, EPA has determined that the bionomial probability value is a "sample exceedance rate for the assessment data, not an inherent allowable rate of criteria exceedance in the ambient water." As to naturally variable parameters, like dissolved oxygen and bacteria, however, even if EPA determined the probability value were an allowable rate of criteria exceedance in a waterbody, that allowable exceedance rate would not constitute a new or revised water quality standard. As explained more fully below, applying a 10% exceedance rate to naturally variable parameters would be consistent with Florida's currently approved water quality standards and would not represent a change in magnitude, frequency, or duration.

Natural variability relates to the degree that conditions in nature vary as a function of time and space based on physical, chemical, biological, hydrological, and geomorphological factors. Pollutants and pollutant parameters can be placed into three distinct groups for considering the effects of natural variability. Some pollutants, such as chlorine and pesticides, are introduced solely as a function of anthropogenic activity and, although natural factors can mitigate or augment their effects, their presence cannot be attributed to natural conditions. The second group of pollutants usually occurs naturally in the environment at low levels, such as copper and cadmium, but protective water quality criteria for these pollutants usually lie well above the typical range of solely natural occurrence. For this group, the natural contribution is likely negligible at measured levels above or near the water quality criterion. Natural variability is generally not a factor for consideration in evaluating ambient measurement samples that exceed water quality criterion magnitude values for these first two groups of pollutants. By contrast, a third group of pollutants or pollutant parameters has protective water quality criteria that lie within or near the range of naturally occurring conditions. This "naturally variable" group includes pollutants or pollutant parameters such as dissolved oxygen, turbidity, bacteria, conductivity, and alkalinity. Natural variability is an appropriate and reasonable factor to consider in evaluating ambient data for this group of pollutants or pollutant parameters.

Dissolved oxygen (DO) is perhaps the best example of a naturally variable pollutant parameter. DO refers to the volume of oxygen that is contained in water, and is measured and expressed as a concentration (typically in mg/L). Oxygen may occur in surface water as a by-product of photosynthesis by aquatic plants and/or through physical transfer from the surrounding air. DO solubility and, as a result, the expected ambient measured levels, are affected by temperature (colder water holds more oxygen), salinity (fresher water holds more oxygen), and altitude (lower pressure reduces oxygen's solubility). DO levels are also affected by flow and stream channel or lake morphology (more turbulent or well-mixed water transfers more oxygen from the air at the water surface), degree of biological activity (plant and animal respiration deplete oxygen, especially at night), and the amount of naturally occurring organic matter (aerobic decomposition depletes oxygen). As a result, DO can change and vary in a single water body according to time of day, season, weather, temperature, depth and location of sampling, and flow. The variability across different waters is augmented by many of the factors described above. DO can range from 0-18 mg/L in natural water systems, with long-term levels set generally within 5-6 mg/L to support a diverse aquatic community in most warmwater systems, as reflected by Florida's water quality standards.

An allowable exceedance rate of 10% for naturally variable pollutants would be consistent with EPA's general recommendations for such pollutants and would represent a reasonable choice for attainment decisions. In 2003, EPA approved, as consistent with Florida's existing water quality standards, FDEP's use of a 10% exceedance rate for naturally variable pollutants when compiling the State's Group 1 update to its section 303(d) list.[3] The Eleventh Circuit Court of Appeals recently ruled in a challenge to that approval in Sierra Club et al. v. Leavitt, 488 F.3d 904 (11th Cir. 2007). One issue addressed by the Court was EPA's recognition that while some of Florida's water quality criteria are "not to be exceeded at any time," it was reasonable for Florida to interpret that regulatory phrase in concert with legislation authorizing the creation of Florida's water quality standards. That legislation provided that FDEP was to take into account the variability occurring in nature when applying the State's water quality standards. Id. at 919. The Eleventh Circuit held:

> The EPA noted that because Florida does not have a monitoring program that continuously measures all points in its waterbodies (and thus the FDEP could never determine that a waterbody had not exceeded water quality criteria "at any time"), Florida must use statistical sampling to estimate a waterbody's compliance

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[3] See Decision Document Regarding Department of Environmental Protection's § 303(d) List Amendment Submitted on October 1, 2002 and Subsequently Amended on May 12, 2003. (June 11, 2003), page 25 and Appendix N on naturally variable pollutants.

<www.epa.gov/region4/water/tmdl/florida/documents/EPA303d_decdoc.pdf>

with water quality standards. Florida's Legislature recognized that sampling introduces variability into the testing process, some due to natural variability and some associated with sample collection and analysis. Thus, the EPA concluded, a single sample does not determine whether a waterbody fails to meet water quality standards. Instead, the EPA "considered a number of factors" in reviewing whether a waterbody was impaired. Decision Document at 21. "These factors included whether more recent data show attainment that renders earlier data suspect (trends); the magnitude of exceedance; the frequency of exceedance; pollutant levels during critical conditions; and any other site-specific data and information such as biological monitoring, whether new controls have been implemented on the water, etc." Id. Like the district court, we find the EPA's "totality" approach reasonable. Id. at 920.Recently, Florida has revised its underlying water quality standards to more clearly incorporate the legislative requirement that FDEP consider natural variability when applying its water quality standards:

In applying the water quality standards, the Department shall take into account the variability occurring in nature and shall recognize the statistical variability inherent in sampling and testing procedures. The Department's assessment methodology, set forth in Chapter 62-303, F.A.C., accounts for such natural and statistical variability when used to assess ambient waters pursuant to sections 305(b) and 303(d) of the Federal Clean Water Act. [Rule 62-302.530, F.A.C]

EPA believes that Florida has correctly interpreted its own statute and regulations to recognize natural and statistical variability when making determinations of impairment. Therefore, even if EPA were to determine that the 10% probability value in the binomial statistical test was a new allowable exceedance rate rather than a data reliability provision, EPA would also determine such an exceedance rate does not constitute a new or revised water quality standard as to naturally variable pollutants.

Bacteria represents a special case in applying the binomial statistical test because the criteria itself includes allowable exceedance rate of 10% in ambient water. In this case, application of the 10% probability value is redundant with the criteria already in place as a practical matter. It is clear there is no intended change in criteria. EPA considers the application of the 10% probability value to provide no additional consideration for data reliability as a listing metholodogy for this component of the bacteria criteria. The binomial statistical test does function to add a confidence value to the assessment procedure. Regardless, however, EPA is neither approving nor disapproving the confidence value because it is not a not a new or revised water quality standard.

USE OF THE CONFIDENCE VALUE

As described in the beginning of this appendix, the confidence value represents the desired certainty that small sample sizes are truly representative of the entire population. In a few places in its 2005 Determination, EPA mistakenly suggested that the application of the confidence value constituted a new or revised water quality standard. For example, on page 14 of Appendix C of the 2005 Determination, EPA stated:

> EPA has determined that as applied to Shellfish Use Consumption Support, this provision changes or further defines the frequency of Florida's currently approved Fecal and Total Coliform criteria found at 62-302.530(6) and (7) from a strict "not more than 10% of the samples exceeding . . ." and replaces it with an evaluation of samples targeting higher than 10% of the samples to gain confidence of an actual exceedance rate of 10%.

On pages 55-56 of that same document, EPA stated:

> EPA does not find the minimum sample size aspect of this provision to be a water quality standard. This provision relates to the exclusion of data for CWA 303(d) listing purposes pursuant to implementing regulations at 40 CFR Part 130.7(b)(5) and 40 CFR Part 130.7(b)(6)(ii) and (iii). This aspect of the provision is not a water quality standard because it does not describe the ambient condition of a water body. This provision contains policy choices about what data is reliable, but it does not describe the condition of the water body that is assessed. Additionally, <u>applying a confidence test to assessing exceedance frequency does not itself change the targeted magnitude, duration, and frequency of criteria that describes the ambient condition of the waterbody as long as the targeted exceedance frequency is equivalent to the underlying frequency of the existing water quality standard. The statistical confidence test relates to the reliability or sufficiency of data rather than to the ambient condition of the waterbody</u>. The statistical confidence takes into account the variability of data that derives from sampling error that occurs in any field sampling/water monitoring, and thus whether the data accurately represent the condition of the waterbody, but it does not incorporate a different ambient condition in the waterbody - in other words, a different level of pollutant(s) or pollutant indicators that are acceptable in the waterbody. The frequency of exceedence, however, does relate to the ambient condition and therefore is a part of a water quality criterion. The statistical confidence test may be used to gain assurances of an exceedance of a defined frequency for purposes of identifying water quality limited segments. [emphasis added]

The underlined portion of the second quote above reflects the correct understanding of the confidence value and EPA's current determination with respect to whether the confidence value constitutes a new or revised water quality standard. However, the rationale offered in the next sentence of the 2005 Determination, "statistical confidence takes into account the variability of data that derives from sampling error that occurs in any field sampling/water monitoring, and thus whether the data accurately represent the condition of the waterbody," does not correctly describe how the confidence value works in the IWR. A statistical confidence test does not account for the underlying accuracy of data, rather it accounts for the representativeness of the sample data -- how well a sample set represents a population. The effect of sampling error is accounted for by the probability value in the IWR.

As explained above, FDEP demonstrated that 10% is a reasonable representation of erroneously high values in their overall population of water quality data, without respect to sample size. If one could expect 10% of the data to be in error regardless of sample size (i.e., a 10% error rate for the population of recorded ambient measurements), then a confidence value associated with sample size simply represents the degree to which a small sample set could disproportionately represent erroneously high values (i.e., the sample set may have more than 10% erroneously high values while the population maintains an overall rate of 10% erroneously high values). Thus, the confidence value component of the binomial statistical test does not constitute a new or revised water quality standard in any context that it appears in the IWR.

Appendix A "Detailed Review of the IWR Binomial Statistical Test" is part of the United States Environmental Protection Agency's Determination Upon Review of Amended Florida Administrative Code Chapter 62-303 Identification of Impaired Surface Waters, February 19, 2008

Responsiveness Summary to Comments
Regarding the EPA's August 16, 2012 Action to Add
a Water to North Carolina's 2012 Section 303(d) List

On August 10, 2012, the EPA partially approved the North Carolina (NC) section 303(d) list submittal for the 2012 listing cycle, approving NC's listing of waters, associated pollutants, and associated priority rankings for the State. The EPA also independently determined that one additional waterbody-pollutant combination should be added to the State's List: the section of the North Toe River from a point 0.2 mile upstream of Pyatt Creek to a point 0.5 mile upstream of U.S. Hwy. 19E (NC Division of Water Quality (DWQ) Assessment Unit Number 7-2-(21.5)), listed in the 2008 303(d) listing cycle for copper. On August 16, 2012, the EPA issued a public notice of the decision to add this waterbody to NC's 303(d) List. During the comment period, we received two separate letters. Copies of the letters are provided in Attachments 1 and 2.

The EPA, after consideration of all comments received, is not changing its partial approval of the NC 303(d) list submittal for the 2012 listing cycle and intends to list the copper impairment on a portion of the North Toe River. Comments are summarized and responses are provided below. Comments fell into two broad issue categories –assessment methodology and the data. Responses are grouped in these categories.

COMMENTS

NC Water Quality Association

- Objects to the listing because no impairment has been demonstrated
- EPA decision to list based on non-binding guidance, not regulation and conflicts with State's Use Support Assessment Methodology
- Data used in decision were 'outliers,' likely the result of sampling, recording or laboratory error
- The waterbody should be classified as Category 3a and targeted for further monitoring

American Rivers, NC Conservation Network, Sierra Club, Southern Environmental Law Center, Waterkeepers Carolina, Western NC Alliance

- Supports the listing based on assessment using the EPA guidance
- State's Use Support Assessment Methodology does not 'measure up' to the EPA methodology in this case
- Argument for delisting is a lack of recent data, as the State stopped collecting metals data pending updates to State water quality standards
- Certain nonpoint source pollution (e.g., land clearing and pesticide applications) may be sources of 'rare but concentrated slugs of pollution'

RESPONSES

Methodology

Section 303(d)(1) of the Clean Water Act (CWA) directs states to identify those waters within its jurisdictions for which effluent limitations are not stringent enough to implement any applicable water quality standard (WQS). This requirement applies to waters impaired by point and/or nonpoint sources. Section 303(d)(2) of the CWA directs states to submit the section 303(d) list to the EPA, and the EPA is required to approve or disapprove that list. The "... State must demonstrate good cause for not including a water or waters on the list" (40 CFR 130.7(b)(6)(iv)).

Applicable WQSs are those established under section 303 of the CWA. Nonattainment of the WQSs is determined by examining all existing and readily available water quality-related data and information.

NC's WQS for copper in fresh water, as currently specified in DWQ's *Redbook* (Amended Effective May 1, 2007; at 15A NCAC 02B .0211), is a "maximum permissible level" of 7 micrograms per liter (ug/L). Because the NC WQSs do not define the conditions of toxicity (acceptable duration and frequency), one interpretation of the copper criteria could be that no digressions are permissible in the waters of the state; i.e., one sample value over the applicable criterion is cause for listing the water as impaired. The NC DWQ assesses its waters for toxics, including metals, by using a greater than ten percent exceedance frequency. Use of this ten percent "rule of thumb" for interpreting water quality data is usually not consistent with criteria expressed as "maximum permissible levels," as North Carolina's toxics criteria are.

Using a greater than ten percent exceedance frequency may lead to the conclusion that waterbody conditions are meeting or above the WQS, when in fact the pollutant concentrations exceed the criterion-concentration a greater proportion of the time than specified by the criteria. When the number of samples is small, as is the case in the North Toe River assessment, this approach can leave a truly impaired water off of the list. (*Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act,* July 29, 2005; http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2006irg-report.pdf)

For toxics, the EPA CWA section 304(a) guidance recommends an average frequency for criteria excursions not to exceed once in three years. The EPA selected this frequency of criteria exceedence with the intent of providing time for ecological recovery (Water Quality Standards Handbook: Second Edition EPA-823-B-12-002; http://water.epa.gov/scitech/swguidance/standards/handbook/). In carrying out its 303(d) responsibilities, the EPA reviews the State's assessment methodology to determine if it properly implements applicable WQSs and federal 303(d) regulations for each category of impairment. The State may use an alternative scientifically defensible methodology if it can show that the methodology is no less stringent than the WQS (40 CFR 131.11(b)). Where the State's assessment methodology can be shown to properly implement the State's EPA-approved WQS, that methodology will be used as the basis for approval of the section 303(d) list.

When the EPA cannot conclude that the State's methodology properly implements the WQS, the EPA conducts an independent assessment and reviews water quality data for each relevant category to determine if additional impairments should be added to the 303(d) list. Since the EPA could not conclude that DWQ's ten percent exceedance frequency methodology was appropriate, the EPA conducted an independent assessment for the 2008 and 2010 303(d) list cycles. Given the amount of data then available for metals, the ten percent exceedance methodology resulted in the same listings as the EPA recommended exceedance frequency. For the 2012 cycle, using the EPA recommended guidance, the EPA's independent assessment and review of data showed that the North Toe River (Assessment Unit Number 7-2-(21.5)) should remain on the 303(d) list for copper.

The EPA has determined that the State's ten percent exceedance methodology for toxics does not properly implement the WQS, as currently specified. DWQ is not required to use the EPA-recommended one-in-three method. However, DWQ has not provided a scientifically defensible rationale to support the ten percent methodology. Thus the State has not shown good cause for delisting the copper impairment on the North Toe River.

Data

Because DWQ suspended most monitoring for all metals in 2007, there was no new copper data for the North Toe River in the 2012 assessment window. It should be noted that DWQ did not delist waters impaired for metals due to a lack of data; the North Toe River delisting was based on "(f)laws in the original analysis of data and information [which] led to the segment being incorrectly listed in Category 5" (NC 2012 303(d) list, *Waters Removed from Category 5*).

Regarding the assertion that the two exceedances in question are outlier data points, the EPA finds no convincing evidence to suggest the quality of the data is questionable. DWQ has quality assurance procedures in place that help ensure all data and subsequent decisions are scientifically and legally defensible. All sampling, preservation and handling, and analytical methods are expected to be performed in accordance with the Ambient Monitoring System Quality Assurance Project Plan, Intensive Survey Unit Standard Operating Procedures and the Laboratory Section's Quality Assurance Manual. These documents can be found on DWQ's Environmental Science Section's webpage at http://portal.ncdenr.org/web/wq/ess/eco/ams. In addition, there are no data flags assigned to the copper data for the applicable North Toe River monitoring station in the EPA Storage and Retrieval (STORET) data repository (http://epa.gov/storet/).

In general, data points, or outliers, that vary greatly from most others in a water quality monitoring dataset highlight a need for additional investigation. While outliers can result from sampling, recording, or laboratory error, extreme values should not be rejected simply on the basis of statistical testing or because they appear unusual. Outliers can represent naturally occurring or rare conditions that may be very informative.

In the North Toe River basin, there are activities that could potentially contribute pollutant loads to the river on a rare or infrequent basis. The DWQ's French Broad Basin Water Quality Planning Report (WQPR), April 2011 (http://portal.ncdenr.org/web/wq/ps/bpu/basin/frenchbroad/2011) indicates that mining and ornamental tree farming are common activities in the basin. Restoration activities on the North Toe headwaters and the turbidity impairment indicate nonpoint source impacts. The WQPR states that it is not known whether the copper source is anthropogenic, natural or both.

The EPA review of the North Toe River delisting included an examination of all available data. An examination of several parameters (see Table, below) supports DWQ's findings that the data is sound. It is clear that several parameters exceeded normal levels during heavy rains on 11/29/2005. Flow was indicated by the daily mean discharge rate at a nearby (roughly 15 miles away) United States Geological Survey (USGS) stream gage. Although exceedances of other parameters are not as clear at the 8/30/2006 sampling event, it should be noted that while the daily mean discharge at the USGS gage was relatively low at the South Toe gaging station that day, there was rainfall in the area prior to the time of the sampling event, reported as 4:50 pm in STORET. (See weather report from Boone, NC: http://classic.wunderground.com/history/airport/KTNB/2006/8/30/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA) The other parameters not measuring proportionately higher on that date is inconsistent with predicted levels and underscores the need for further study of this waterbody.

Table. Selected parameters of interest at North Toe River Station E7000000

Date	Copper ug/L	Iron ug/L	Turbidity NTU	Alum-inum ug/L	Solids, Total Suspended (TSS) mg/L
2/19/2002	*Non-detect	120	1.8	67	*Non-detect
5/30/2002	2	430	7	310	8
8/27/2002	2.4	470	8	400	7
11/13/2002	*Non-detect	250	5.2	150	3.9
2/5/2003	2	210	3.9	140	2.4
5/29/2003	*Non-detect	360	8.4	280	6.6
8/25/2003	2.3	650	11	470	9.5
11/21/2003	*Non-detect	580	7.4	410	9.7
2/18/2004	*Non-detect	120	1.5	56	*Non-detect
5/18/2004	*Non-detect	400	2.9	290	6.8
8/25/2004	*Non-detect	500	7.2	320	8
11/23/2004	*Non-detect	520	7	290	10
2/24/2005	*Non-detect	240	3.4	160	3
5/12/2005	*Non-detect	490	5.2	370	8
8/10/2005	2.3	1300	19	1000	20
11/29/2005	25	22000	240	16000	480
2/22/2006	*Non-detect	180	2.6	120	*Non-detect
6/1/2006	*Non-detect	800	10	760	13
8/30/2006	15	280	2.6	180	3
11/30/2006	*Non-detect	240	2.4	140	3.5

Sources: STORET http://epa.gov/storet/

USGS Flow Data Monitoring

USGS Mean Discharge on S.Toe near Celo, NC ft^3/s
75
59
49
200
92
183
102
345
95
72
53
122
154
80
254
1,370
116
59
63
261

USGS http://waterdata.usgs.gov/nc/nwis/

While Integrated Reporting Category 3 is meant for those waters where there are insufficient available data and information to make a use attainment determination, the "EPA also expects that waters identified as impaired in the previous reporting cycle will not be placed in Category 3 in the subsequent listing cycle unless the State can demonstrate good cause for doing so"(*Information Concerning 2010 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions*, May 5, 2009; http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/final52009.cfm#enclosure2).

CONCLUSION

The EPA, after consideration of all comments received, is not changing its decision regarding the listing of the North Toe River.

The EPA has determined that the State's ten percent exceedance methodology for toxics does not properly implement the WQS, as currently specified. DWQ is not required to use the EPA-recommended one-in-three method. The State may use a scientifically defensible alternative methodology if they can show that it is no less stringent than the WQS (40 CFR 131.11(b)). However, DWQ has not provided a scientifically defensible rationale to support the ten percent methodology. Thus the State has not shown good cause for delisting the copper impairment on the North Toe River.

The EPA finds no convincing evidence to suggest the quality of the data is questionable. Rather, the character and limitations of the data underscore the need for further study of this waterbody. The EPA anticipates that the North Toe River will be treated as high-priority for additional assessment monitoring as soon as possible and certainly once new metals standards are adopted.

Appendix D - water quality limited segments added to the 2014 Section 303(d) List by the EPA

2014 Assessment Unit#	Assessment Unit Name	Assessment Unit Description	NC Basin	Parameter of Interest	EPA Region 4 comments
16-(1)c1	HAW RIVER	From SR 2426 to Troublesome Creek at US29	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
16-11-(9)b	Reedy Fork (Hardys Mill Pond)	From Buffalo Creek to Haw River	Cape Fear	Zinc	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
16-11-14-2c	South Buffalo Creek	From US 70 to Buffalo Creek	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
16-41-1-12-(1)	Third Fork Creek	From source to a point 2.0 miles ups	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
16-41-1-12-(2)	Third Fork Creek	From a point 2.0 miles upstream of NC HWY. 54 to New Hope Creek	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
16-41-1-17-(0.7)b2	Northeast Creek	From Kit Creek to a point 0.5 mile downstream of Panther Creek	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
17-(10.5)d2	DEEP RIVER	From Gabriels Creek to Brush Creek	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
18-(16.7)	CAPE FEAR RIVER	From Lillington water supply intake to Upper Little River	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
18-(71)b	CAPE FEAR RIVER	From a line across the river between Lilliput Creek and Snows Cut to a line across the river from Walden Creek to the Basin	Cape Fear	Arsenic Nickel	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
18-(87.5)a	CAPE FEAR RIVER	Prohibited area north of Southport Restricted Area and west of ICWW in Cape Fear R	Cape Fear	Arsenic	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.

Appendix D - water quality limited segments added to the 2014 Section 303(d) List by the EPA

18-74-(61)	Northeast Cape Fear River	From mouth of Ness Creek to Cape Fear River	Cape Fear	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
18-28ut3	Ut to Locks Creek	From source to Locks Creek	Cape Fear	Arsenic Zinc	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
11-129-5-(9.5)	Clark Creek	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba R.	Catawba	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
11-137-1	Irwin Creek	From source to Sugar Creek	Catawba	Lead Zinc	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
11-138	Twelvemile Creek	From source to North Carolina-South Carolina State Line	Catawba	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
25a2a	CHOWAN RIVER	From near Riddicksville to Deep Creek	Chowan	Cadmium	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
7	NOLICHUCKY RIVER	From source to North Carolina-Tennessee State Line	French Broad	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
7-2-(21.5)	North Toe River	From a point 0.2 mile upstream of Pyatt Creek to a point 0.5 mile upstream of U.S. Hwy. 19E	French Broad	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
27-(22.5)c	NEUSE RIVER	From Crabtree Creek to Auburn Knightdale Road	Neuse	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
27-(36)	NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	Neuse	Zinc Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.

Appendix D - water quality limited segments added to the 2014 Section 303(d) List by the EPA

27-(38.5)	NEUSE RIVER	From a point 0.2 mile downstream of Johnston County SR 1700 to point 1.4 mile downstream of Johnston County SR 1908	Neuse	Copper	Independent Review shows greater than 1 exceedance in 3 years.
27-(49.75)	NEUSE RIVER	From a point 0.5 miles upstream of Richardson Bridge Road/SR 1201 to Johnston County's intake at Richardson Bridge Road/SR 1201	Neuse	Copper	Independent Review shows greater than 1 exceedance in 3 years.
27-(96)b2	NEUSE RIVER Estuary	From Trent River to a line across Neuse River from Johnson Point to McCotter Point (part of upper model segment)	Neuse	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
27-34-(4)b	Walnut Creek	From UT 0.6 miles west of I-440 to Neuse River	Neuse	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
22-40-(1)	Smith River	From North Carolina-Virginia State Line to a point 0.8 mile downstream of Rockingham County SR 1714 (Aiken Road)	Roanoke	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
22-58-12-6b	Marlowe Creek	From Mithcell Creek to Storys Creek	Roanoke	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
29-(27)	PAMLICO RIVER	From a line across Pamlico River from Cousin Point to Hickory Point to a line across Pamlico River from Roos Point to Persimmon Tree Point	Tar Pamlico	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
29-6-(5)	Chocowinity Bay	From a line across the Bay from the upstream mouth of Cedar Creek to the upstream mouth of Silas Creek to Pamlico River	Tar Pamlico	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.

Appendix D - water quality limited segments added to the 2014 Section 303(d) List by the EPA

19-14	Wilson Bay	Entire Bay	White Oak	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
21-32b	Calico Creek	From Ut on south side of creek 0.35 miles west of SR1176 bridge to Newport River	White Oak	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
21-35-7-10-4	Broad Creek (Nelson Bay)	From source to Nelson Bay	White Oak	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
12-(108.5)b1	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	From mouth of Grants Creek to Buck Steam Station	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
12-(38)b	YADKIN RIVER	From Reddies River to Mulberry Creek	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
12-(47.5)	YADKIN RIVER	From a point 0.2 mile upstream of Big Bugaboo Creek to a point 0.9 mile upstream of mouth of Elkin Creek (River)	Yadkin PeeDee	Zinc	Independent Review shows greater than 1 exceedance in 3 years.
12-108-18-(3)	Bear Creek	From a point 0.2 mile downstream of U.S. Hwy. 64 to South Yadkin River	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
12-94-(0.5)b2b	Muddy Creek	From Silas Creek to SR 2995	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
12-94-12-(4)b	Salem Creek (Middle Fork Muddy Creek)	From Burke Creek to SR1120	Yadkin PeeDee	Zinc Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.

12-94-12-(4)c	Salem Creek (Middle Fork Muddy Creek)	From SR1120 to Muddy Creek	Yadkin PeeDee	Copper	method. Independent Review shows greater than 1 exceedance in 3 years.
13-17-36-(5)a2	Richardson Creek	From Watson Creek to Salem Creek	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
13-17-40-11	Beaverdam Creek	From source to Lanes Creek	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
13-17-5a	Mallard Creek	From source to mouth of 0.2 miles downstream of Stoney Creek	Yadkin PeeDee	Copper	Independent Review shows greater than 1 exceedance in 3 years.
13-17-9-(2)	Irish Buffalo Creek	From Kannapolis Water Supply Dam to Rocky River	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
13-17c2	Rocky River	From Hamby Branch to Anderson Creek	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
13-17c3	Rocky River	From Anderson Creek to Lanes Creek	Yadkin PeeDee	Zinc	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.
				Copper	
13-17d	Rocky River	From the Lanes Creek to the Pee Dee River	Yadkin PeeDee	Copper	Proposed for delisting due to change in assessment method. Independent Review shows greater than 1 exceedance in 3 years.

Appendix E. Assessment Units where metals data shows >1 exceedance in 3 years but data is flagged.

Assessment Unit #	Waterbody Name	NC Basin	Potential Impairment
9-50-(1)	First Broad River	Broad	Cadmium
18-(71)a	CAPE FEAR RIVER	Cape Fear	Cadmium, Chromium, Nickel
18-(71)b	CAPE FEAR RIVER	Cape Fear	Chromium, Nickel
18-(87.5)a	CAPE FEAR RIVER	Cape Fear	Chromium
18-74-(61)	Northeast Cape Fear River	Cape Fear	Chromium, Nickel
18-88-3.5	Southport Restricted Area	Cape Fear	Chromium
11-38-34	Wilson Creek	Catawba	Cadmium
5-41	Cataloochee Creek	French Broad	Cadmium
5-(6.5)	PIGEON RIVER	French Broad	Cadmium
5-26-(7)	Jonathans Creek	French Broad	Cadmium
6-(1)	FRENCH BROAD RIVER	French Broad	Cadmium
6-34-(15.5)	Davidson River	French Broad	Cadmium
6-38-(1)	Little River (Cascade Lake)	French Broad	Cadmium
6-54-(1)b	Mills River	French Broad	Cadmium
7-2-(21.5)	North Toe River	French Broad	Cadmium
7-2-(27.7)b	North Toe River	French Broad	Cadmium
7-2-52-(1)	South Toe River	French Broad	Cadmium
7-3-(13.7)b	Cane River	French Broad	Cadmium
1-52c	Valley River	Hiwasee	Cadmium
2-190-(3.5)	Cheoah River	Little Tennessee	Cadmium
2-57-(0.5)	Nantahala River	Little Tennessee	Cadmium
15-25-1-(11)	Lockwoods Folly River	Lumber	Chromium, Nickel
15-25-1-(16)a	Lockwoods Folly River	Lumber	Arsenic, Cadmium, Chromium, Nickel, Lead
15-25-1-(16)c	Lockwoods Folly River	Lumber	Arsenic, Cadmium, Chromium, Nickel, Lead
15-25-13	Calabash River	Lumber	Cadmium, Chromium, Nickel
15-25-2-(10)d1	Shallotte River	Lumber	Arsenic, Cadmium, Chromium, Nickel, Lead
15-25-2-(7.5)	Shallotte River	Lumber	Chromium, Nickel
15-25d	Intracoastal Waterway	Lumber	Arsenic, Cadmium, Chromium, Nickel
15-25v	Montgomery Slough	Lumber	Arsenic, Cadmium, Chromium, Nickel
27-(104)a	NEUSE RIVER Estuary	Neuse	Chromium, Nickel
27-(118)a1	NEUSE RIVER Estuary	Neuse	Chromium, Nickel
27-(118)a2	NEUSE RIVER Estuary	Neuse	Cadmium, Chromium, Nickel
27-(96)a	NEUSE RIVER Estuary	Neuse	Chromium, Nickel
27-(96)b1	NEUSE RIVER Estuary	Neuse	Chromium, Nickel
27-(96)b2	NEUSE RIVER Estuary	Neuse	Chromium, Nickel
27-101-(31)b	Trent River	Neuse	Chromium, Nickel
27-128-3a	Back Creek (Black Creek)	Neuse	Chromium, Nickel
27-150-(9.5)a2	Bay River	Neuse	Chromium, Nickel
27-97-(6)	Swift Creek	Neuse	Chromium, Nickel
30-16-(7)	Alligator River	Pasquotank	Chromium, Nickel
30-3-(12)	Pasquotank River	Pasquotank	Chromium, Nickel
30-6-(3)	Perquimans River	Pasquotank	Chromium, Nickel
30-9-(2)	Kendrick Creek (Mackeys Cree	Pasquotank	Chromium
30a	ALBEMARLE SOUND	Pasquotank	Chromium, Nickel

Appendix E. Assessment Units where metals data shows >1 exceedance in 3 years but data is flagged.

Assessment Unit #	Waterbody Name	NC Basin	Potential Impairment
30b	ALBEMARLE SOUND	Pasquotank	Chromium, Nickel
30c	ALBEMARLE SOUND	Pasquotank	Chromium, Nickel
22-(1)b	DAN RIVER (North Carolina po	Roanoke	Cadmium
4-13-(0.5)b	Horsepasture River	Savannah	Cadmium
29-(1)	PAMLICO RIVER (Upper Pamlic	Tar Pamlico	Chromium, Nickel
29-(27)	PAMLICO RIVER	Tar Pamlico	Cadmium, Chromium, Nickel
29-(5)a	PAMLICO RIVER (Upper Pamlic	Tar Pamlico	Chromium, Nickel
29-(5)b1	PAMLICO RIVER (Pamlico Blou	Tar Pamlico	Chromium, Nickel
29-(5)b2	PAMLICO RIVER (Pamlico Bath	Tar Pamlico	Chromium, Nickel
29-(5)b3	PAMLICO RIVER(Pamlico Midd	Tar Pamlico	Cadmium, Chromium, Nickel
29-(5)b4	PAMLICO RIVER (Pamlico Sout	Tar Pamlico	Cadmium, Chromium, Nickel
29-10-(3)	Broad Creek	Tar Pamlico	Chromium, Nickel
29-19-(5.5)	Bath Creek	Tar Pamlico	Cadmium, Chromium, Nickel
29-34-(5)	Pungo River	Tar Pamlico	Chromium, Nickel
29-34-34-(2)	Pantego Creek	Tar Pamlico	Chromium, Nickel
29-34-35	Pungo Creek	Tar Pamlico	Chromium, Nickel
29-6-(5)	Chocowinity Bay	Tar Pamlico	Chromium, Nickel
29-9	Blounts Bay (inside a line from	Tar Pamlico	Chromium, Nickel
8-(1)a	WATAUGA RIVER	Watauga	Cadmium
8-(1)b	WATAUGA RIVER	Watauga	Cadmium
19-(10.5)	New River	White Oak	Chromium, Nickel
19-(15.5)	New River	White Oak	Cadmium, Chromium, Nickel
19-12	Brinson Creek	White Oak	Chromium, Nickel
19-14	Wilson Bay	White Oak	Chromium, Nickel
19-16-(3.5)a	Northeast Creek	White Oak	Chromium, Nickel
19-17-(6.5)	Southwest Creek	White Oak	Chromium, Nickel
19-17-(6.5)	Southwest Creek	White Oak	Chromium, Nickel
20-(18)a1	WHITE OAK RIVER	White Oak	Chromium, Nickel
20-(18)a1	WHITE OAK RIVER	White Oak	Chromium, Nickel
21-32	Calico Creek	White Oak	Cadmium, Chromium, Nickel
21-35-1-7a	Ward Creek	White Oak	Arsenic, Cadmium, Chromium, Nickel
21-35-1b4	North River	White Oak	Arsenic, Cadmium, Chromium, Nickel
21-35-7-10-4	Broad Creek (Nelson Bay)	White Oak	Chromium, Nickel

Appendix F: Assessment Units where further investigation is required for potential impairments of copper and/or zinc

Assess-ment Unit #	Waterbody Name	NC Basin	Impair-ment	NC DWQ Notes	Progress of Investigation
10b	New River (North Carolina Portion)	New	Copper	Benthos station KB34 co-located with K7900000 has had Excellent or Good bioclassifications since 1983. There are no identified sources of copper or zinc in the watershed upstream in Virginia -2008 NAIP (National Aerial Imagery Program). DWQ will pursue a natural conditions study for this	DWQ reported some more recent monitoring data for this Assessment Unit that indicates no copper or zinc impairment. This waterbody-pollutant combination is in Category 3a1 on the 2014 303d list. Recommend high priority for followup monitoring.
			Zinc		
12-(124.5)c	YADKIN RIVER (including Tuckertown Lake, Badin Lake)	Yadkin	Copper	Copper, chlorophyll a, and turbidity exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. Recommend high priority for followup monitoring.
12-108-21c	Second Creek (North Second Creek)	Yadkin	Copper	Benthos station QB504 co-located with Q4165000 has only been sampled once in 2008. There are no identified sources of copper-2008 NAIP. DWQ will continue to monitor copper to determine if the exceedances are regular and ongoing.	No update available. This waterbody-pollutant combination is in Category 3a1 on the 2014 303d list. Recommend high priority for followup monitoring.
12-110b	Grants Creek	Yadkin	Copper	Copper or zinc Assessment exceedances not assessed in category 5 due to insufficient samples N<10.	DWQ reported some more recent monitoring data for this Assessment Unit that indicates no copper or zinc impairment. This waterbody-pollutant combination is in Category 1 on the 2014 303d list.
			Zinc		
13-17-36-(5)a1	Richardson Creek	Yadkin	Copper	Data extrapololated from 13-17-36-(5)a2	EPA added this waterbody-pollutant combination to this list in the 2014 list cycle. No Data available for this Assessment Unit. Recommend high priority for followup monitoring.

Appendix F: Assessment Units where further investigation is required for potential impairments of copper and/or zinc

13-17-36-9-(4.5	Stewarts Creek [Lake Twitty (Lake Stewart)]	Yadkin	Copper	Data not available to determine if Copper has exceeded criteria.	EPA added this waterbody-pollutant combination to this list in the 2014 list cycle. No Data available for this Assessment Unit. Recommend high priority for followup monitoring.
13-17-40-(1)	Lanes Creek	Yadkin	Copper Zinc	Copper and zinc exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. Recommend high priority for followup monitoring.
13-17-40-10	Barkers Branch	Yadkin	Copper	Copper exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. Recommend high priority for followup monitoring.
13-2-3-3-(0.7)	Back Creek (Back Creek Lake)	Yadkin	Copper	Copper exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. Recommend high priority for followup monitoring.
13-45-(1)	Marks Creek (Water Lake)	Yadkin	Copper	Chorophyll a and copper exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. Recommend high priority for followup monitoring.
16-(1)d2	HAW RIVER	Cape Fear	Zinc	Zinc exceedances not assessed in category 5 due to insufficient samples N<10.	This Assessment Unit was re-segmented or re-named. The new AU # is 16-(10.5)c. No update available. Recommend high priority for followup monitoring.
17-(4)b	DEEP RIVER	Cape Fear	Zinc	Zinc exceedances not assessed in category 5 due to insufficient samples N<10.	Data available for this Assessment Unit indicates no impairment. This waterbody-pollutant combination is in Category 1 on the 2014 303d list.
22-40-(2.5)	Smith River	Roanoke	Copper	From a point 0.8 mile downstream of Rockingham County SR 1714 (Aiken Road) to Fieldcrest Mills Water Supply Intake	EPA added this waterbody-pollutant combination to this list in the 2014 list cycle. No Data available for this Assessment Unit. Recommend high priority for followup monitoring.

Appendix F: Assessment Units where further investigation is required for potential impairments of copper and/or zinc

22-40-(3)	Smith River	Roanoke	Copper	From Fieldcrest Mills Water Supply Intake to Dan River	EPA added this waterbody-pollutant combination to this list in the 2014 list cycle. No Data available for this Assessment Unit. Recommend high priority for followup monitoring.
22-58-12-6b	Marlowe Creek	Roanoke	Copper	Zinc and Copper exceedances not assessed in category 5 due to insufficient samples N<10.	**This waterbody-pollutant combination was listed in Category 5 (Impaired) on the 2008 - 2012 303(d) lists. NC proposed to delist in 2014. EPA will re-list this waterbody for copper.**
22-58-12-6b	Marlowe Creek	Roanoke	Zinc	Zinc and copper exceedances not assessed in category 5 due to insufficient samples N<10.	**This waterbody-pollutant combination is listed in Category 5 (Impaired) on the 2008- 2014 303(d) lists.**
27-(118)a2	NEUSE RIVER Estuary	Neuse	Copper	Copper exceeds by exactly 10% at nearby J9930000. J9810000 is a mid channel station with no nearby sources. Not 95% confident in 10% exceedance of standard. DWQ will continue to monitor.	No update available. This waterbody-pollutant combination is in Category 3a1 on the 2014 303d list. Recommend high priority for followup monitoring.
27-(49.5)a	NEUSE RIVER	Neuse	Copper	Benthos stationJB34 co-located with J5250000 has had Good bioclassifications since 1995. Do not have 95% confidence in copper exceedance of standard.There are no identified sources of copper in the watershed. DWQ will pursue a natural conditions study for this.	No update available. This waterbody-pollutant combination is in Category 3a1 on the 2014 303d list. Recommend high priority for followup monitoring.
27-(96)b2	NEUSE RIVER Estuary	Neuse	Copper	J8900800 is a mid channel station with no nearby sources. DWQ will continue to monitor stations in immediate upstream freshwater do not exceed criteria.	**This Assessment Unit was listed in Category 5 (Impaired) on the 2010 and 2012 303(d) lists. NC proposed to delist in 2014. EPA will re-list this waterbody for copper.**

Appendix F: Assessment Units where further investigation is required for potential impairments of copper and/or zinc

27-23-(2)	Smith Creek	Neuse	Zinc	Zinc exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. This waterbody-pollutant combination is in Category 3a2 on the 2014 303d list. Recommend high priority for followup monitoring.
27-33-(10)c	Crabtree Creek	Neuse	Copper	Copper exceedances not assessed in category 5 due to insufficient samples N<10.	No update available. Recommend high priority for followup monitoring.
28-11e	Fishing Creek	Tar-Pamlico	Zinc Copper	Do not have 95% confidence in copper and zinc Exceedances. Co-located Benthos at OB10 has remained stable or improved since 1990. Co-located fish community at OF17 has improved since 1992 and is currently Excellent.	No update available. This waterbody-pollutant combination is in Category 3a1 on the 2014 303d list. Recommend high priority for followup monitoring.
29-6-(5)	Chocowinity Bay	Tar-Pamlico	Copper	O7710000 is a mid-channel station with no nearby sources. Immediate upstream freshwater stations do not exceed criteria. DWQ will continue to monitor	**This Assessment Unit was listed in Category 5 (Impaired) on the 2010 and 2012 303(d) lists. NC proposed to delist in 2014. EPA will re-list this waterbody for copper.**
13-17b1	Rocky River	Yadkin	Copper	From Clarke Creek to Mallard Creek	EPA added this waterbody-pollutant combination to this list in the 2014 list cycle. The Assessment Unit, 13-17b, was resegmented in the 2014 303(d) list cycle into three segments. The middle segment, 13-17b2, remains on the 303(d) for copper. The other two segments have no copper data associated with them. Recommend these two segments receive high priority for follow up monitoring.
13-17b3	Rocky River	Yadkin	Copper	From Reedy Creek to Irish Buffalo Creek	

United States Environmental Protection Agency Region 4
Science and Ecosystem Support Division
980 College Station Road
Athens, Georgia 30605-2720

Pigeon River Dioxin High Volume Sampling Quality Assurance Project and Study Plan Waynesville, NC March 2014

SESD Project Identification Number: 14-0123

Requestor:
David Melgaard
Monitoring and Information Analysis Section
Region 4, Water Protection Division
61 Forsyth Street
Atlanta, GA 30303

SESD Project Leader:
Derek Little, PE
Water Quality Section
Region 4, SESD
980 College Station Road
Athens, GA 30605-2720

Title and Approval Sheet

Title:	Pigeon River Dioxin High Volume Sampling
Quality Assurance Project Plan:	Category 2

Prepared by:

Derek Little, PE Environmental Engineer	4/21/14 Date

Approvals:

Stacey Box, Chief Water Quality Section Ecological Assessment Branch	4/21/14 Date

This quality assurance project plan (QAPP) has been prepared according to:
EPA Requirements for Quality Assurance Project Plans (EPA QA/R5 EPA/240/B-01/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March 2001 (USEPA, 2001).

This document will be used to ensure that environmental and related data collected, compiled, and/or generated for this project are of the type, quantity, and quality required for their intended purposes within the limitations of available resources.

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1.0 Distribution List for the Final QAPP

Requestor:	David Melgaard Monitoring and Information Analysis Section Region 4, Water Protection Division 61 Forsyth Street Atlanta, GA 30303

2.0 Project Organization

Requesting Programs: David Melgaard, EPA, Water Protection Division

Responsibilities: WPD requested SESD support in sampling for dioxins.

Principal Data Users: David Melgaard, EPA, Water Protection Division

Responsibilities: The WPD will be the end user of the analytical data collected and responsible for any decisions made based on the data.

Project Leader: Derek Little, EPA, Science & Ecosystem Support Division

Responsibilities: The project leader is responsible for planning and implementing the field study to meet the data quality objectives.

The project leader is responsible for:

- field reconnaissance for study planning
- quality assurance project plan preparation (QAPP)
- ensuring QAPP is implemented as written
- all data collection activities
- collation of study data
- report preparation

Table 1: Project Participants

Name	Organization	Responsibilities
Derek Little	EPA, SESD	Project Leader, Sonde Calibration, Logbook and records, field sampling oversight, pictures, and procurement of equipment, supplies and analytical services
Jerry Ackerman	EPA, SESD	Infiltrex 300® pump operation and preparation
Greg White	EPA, SESD	Field Safety Officer, Sample assistance, GPS operation.
Stacey Box	EPA, SESD	Backup Infiltrex 300® Operator
David Melgaard	EPA, WPD	Oversight and sample assistance

3.0 Introduction

The EPA Region 4 Water Protection Division (WPD) requested the assistance of Region 4 Science and Ecosystem Support Division (SESD) Ecological Assessment Branch (EAB) in conducting trace level water sampling for dioxins in the Pigeon River and the Waterville Reservoir near Waynesville, North Carolina.

Dioxins refer to a group of toxic chemical compounds that share certain chemical structures and biological characteristics. Specifically, dioxins refer to 2,3,7,8-substituted dibenzo-p-dioxins and dibenzofurans (CDDs/CDFs) in this document. Dioxins are formed in the production of some chlorinated organic compounds, some herbicides and were a historic byproduct from chlorine bleaching of wood pulp. Adverse health effects from long term exposure to dioxins in excess of the maximum contaminant level (MCL) of 30 parts per quadrillion (ppq) in drinking water are known to cause reproduction difficulties and increase the risk of cancer (Mukerjee, 1985).

The Pigeon River and the Waterville Lake were historically contaminated by dioxins from historic paper mill processing along the river. Over the past several years EPA, state governments, and industry have worked together to eliminate known and measurable industrial dioxin emissions. A maximum contaminant level goal (MCLG) for dioxin has been set at zero. To help determine if dioxins occur in surface waters in the reservoir and, if so, at what levels, sample analysis at trace level amounts of 0.013 ppq (parts per quadrillion) is needed. SESD will utilize a high volume water sampler (Infiltrex 300®) in conjunction with XAD resin to obtain samples at trace levels.

4.0 Study Area

The Pigeon River flows northwesterly from Canton, North Carolina into Tennessee where it joins the French Broad River. The Pigeon River is impounded forming Waterville Lake by the Walters Dam. Completed in 1930, the Walter Dam is 180 feet tall and 800 feet long and feeds through an underground concrete tunnel 6.2 miles to the Duke Energy power house where it discharges at the confluence of Big Creek and reforms the Pigeon River flowing into Tennessee.

Table 2 provides a list of proposed sampling locations and access points. PR01 is located upstream of Evergreen Packing, previously Champion International, paper mill in Canton, NC. PR02, PR03, and PR04 are downstream of the paper mill. PR02 will provide a riverine sample while PR03 and PR04 will be within the Waterville Reservoir. Figure 1 and Figure 2 provide maps of the sampling locations and a detail of the lake samples respectively. Table 3 provides an overview of the tentative sampling schedule.

Table 2: Sampling Locations

Description	Station ID	Longitude	Latitude
Access Road to Dam	Nonsample	-83.0450069640	35.6974031507
Canton Park River Sample	PR01	-82.8433970000	35.5246630000
Iron Tree Road River Sample	PR02	-82.9515454042	35.5719524382
Elkhound Road Lake Sample	PR03	-83.0343598889	35.6756705239
Duke Energy Dock Sample	PR04	-83.0487613741	35.6952425418

Table 3: Sampling Schedule

Date	Tentative Duties
Sunday May 4, 2014	1. Travel from SESD 2. Calibration of data sondes 3. Preparation of Infiltrex 300®
Monday May 5, 2014	1. Sampling at PR01 2. End check data sondes 3. Preparation of Infiltrex 300®
Tuesday May 6, 2014	1. Sampling at PR02 2. End check data sondes 3. Preparation of Infiltrex 300®
Wednesday May 7, 2014	1. Sampling at PR03 2. End check data sondes 3. Preparation of Infiltrex 300®
Thursday May 8, 2014	1. Sampling at PR04 2. End check data sondes 3. Preparation of Infiltrex 300®
Friday May 9, 2014	1. Contingency sampling day 2. Travel to SESD

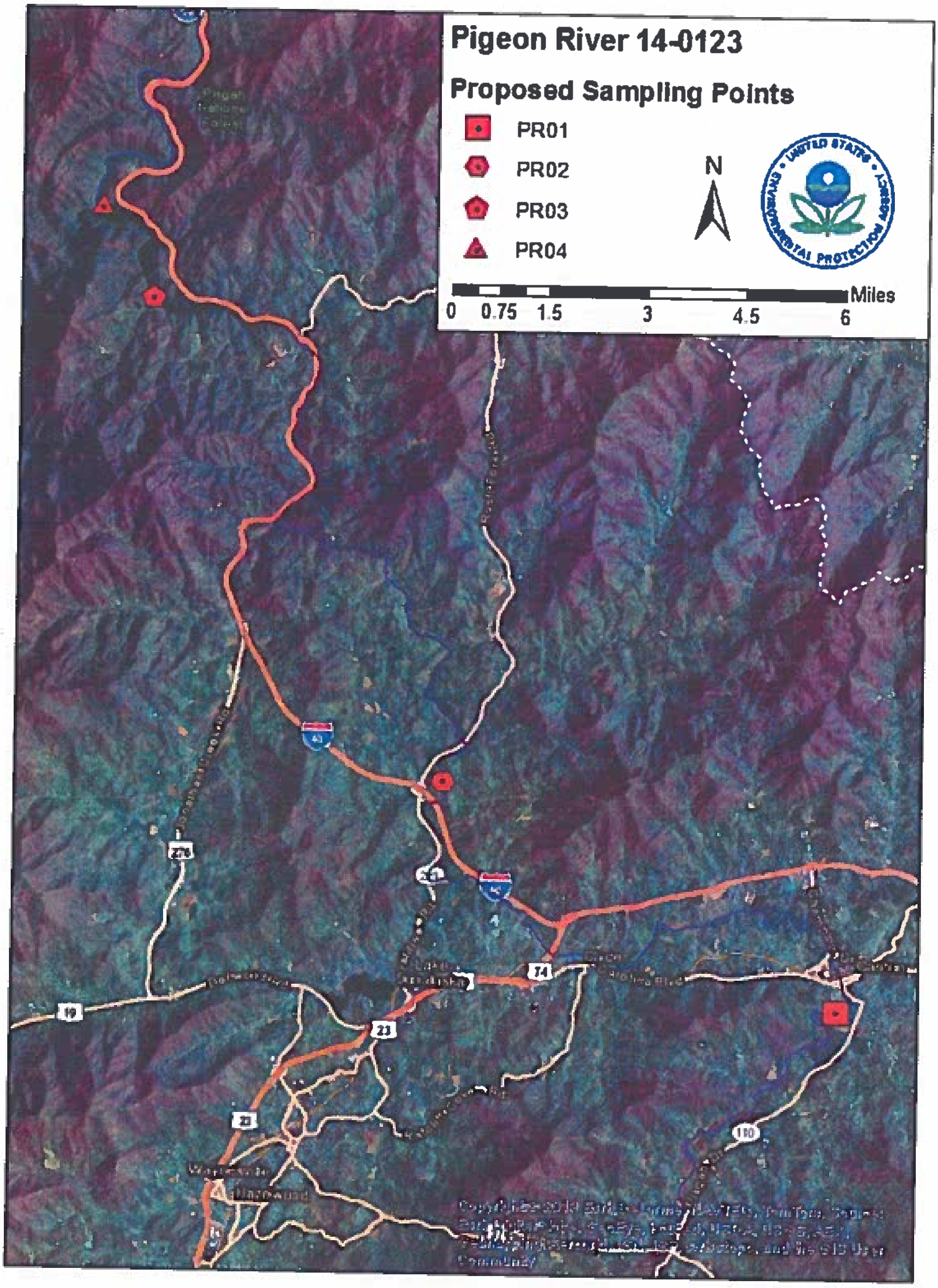

Figure 1: Site Overview Map

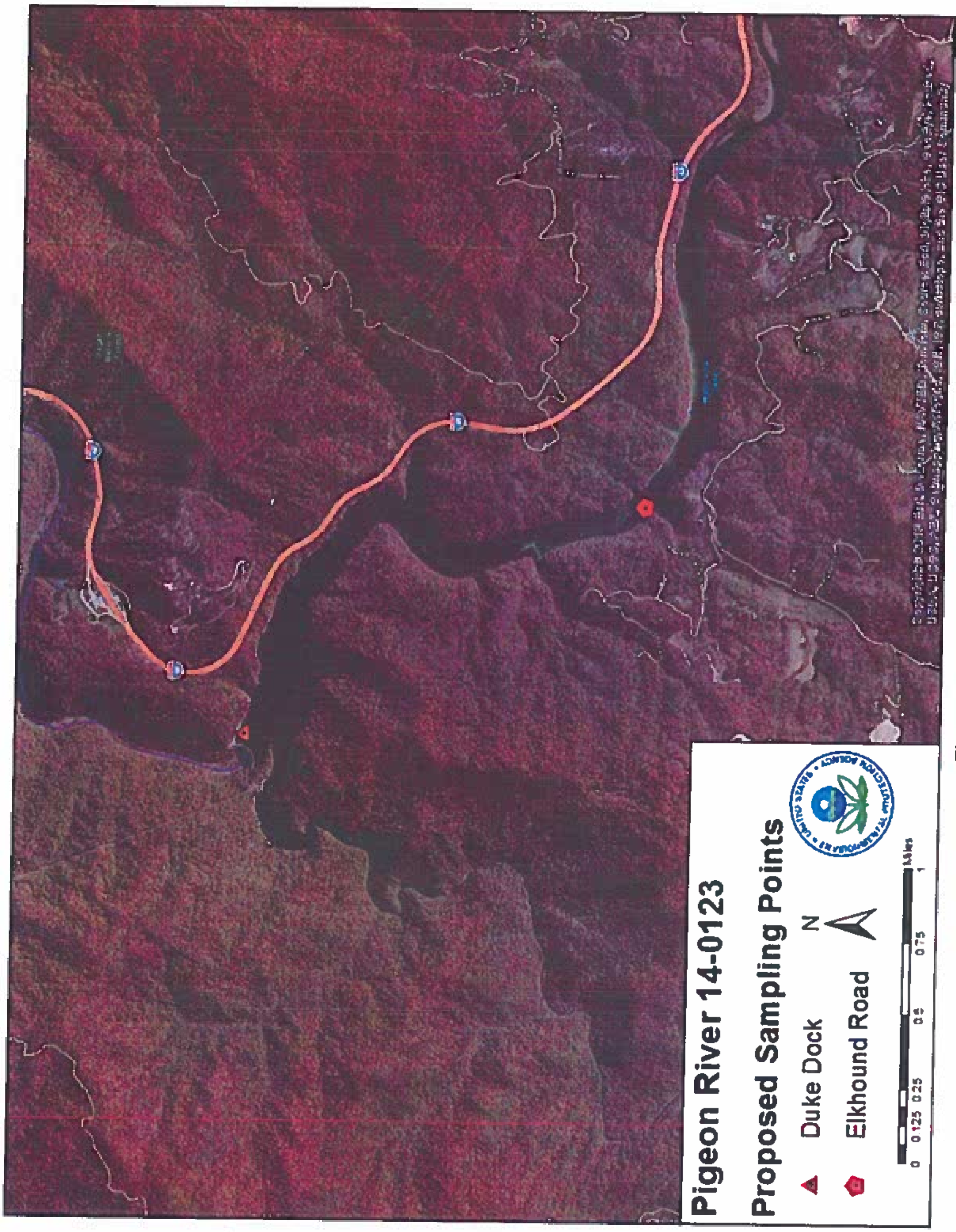

Figure 2: Lake Detail Map

5.0 Field Methods

During the week of May 4th, 2014 SESD will collect samples from four sites: 2 along the Pigeon River and 2 from Waterville Lake. The first Pigeon River sample (PR01) will be taken upstream of the Evergreen Packing plant off of Penland Street upstream of the Pigeon Street Bridge in Canton, NC. The second Pigeon River sample (PR02) will be collected off of Iron Tree Drive in Clyde, NC. Landowner consent has been obtained for sampling at PR03, 270 Elkhound Road, Waynesville, NC. Duke Energy has agreed to allow the use of their dock near the dam for sampling (PR04). A canoe will be used to place a buoy and weight for mooring the sampling line within the lake and river, where not wadeable. The Infiltrex 300® will be assembled and operated from the shore at all sites in accordance with SESD Operating Procedure for Trace Organics Sampling Using an Infiltrex 300® High Volume Sampler (SESDPROC-502-R3, 2012). All field sampling equipment will be checked out and tracked according to the SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-108-R4, 2013).

5.1 High Volume Sampling

The Infiltrex 300® sampler is designed to remove particulate and dissolved fractions of organic constituents *in situ* by passing a high volume of water through a one micrometer glass fiber filter and a packed XAD-2 resin column. The particulate (filter) and dissolved fractions (column) will be analyzed separately for polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) using a modified version of EPA method 1613: Tetra-Through-Octa Chlorinated Dioxins and Furans By Isotope Dilution HRGC/HRMS, Revision B (U.S. EPA, 1994), see Appendix B Axys Method Modification of 1613B for clarification.

The Infliltrex 300® sampler consists of a metal frame which houses a positive displacement gear pump, a flow meter, a flow rate/total volume pumped display, a pressure gauge, control box, and two removable stainless steel canisters which hold glass fiber filters. Two stainless steel columns packed with XAD-2 are attached during sample collection. Teflon tubing will be used for inlet and outlet connections. Figure 3 provides a schematic of flow through for the Infiltrex 300®. The unit is equipped with two glass fiber canisters allowing independent flow control, allowing for no down time if replacement of filters is required. Sample flow rates will range from 1.25 to 1.65 liters per minute and for periods of 10 to 13 hours to pass 1,000 liters of water over the columns. These sampling rates combined with the XAD-2 resin allow for low level detections of dioxins (0.013 ppq).

Field investigators will monitor the flow rate and pressure of the sampler throughout the sampling period, recording both at a minimum of 30 minute intervals. Based on manufacturer recommendations, glass fiber filters will be changed if pressure reaches 20 psi. A system blank will be run, prior to going into the field, using ultra pure water obtained from Axys Environmental.

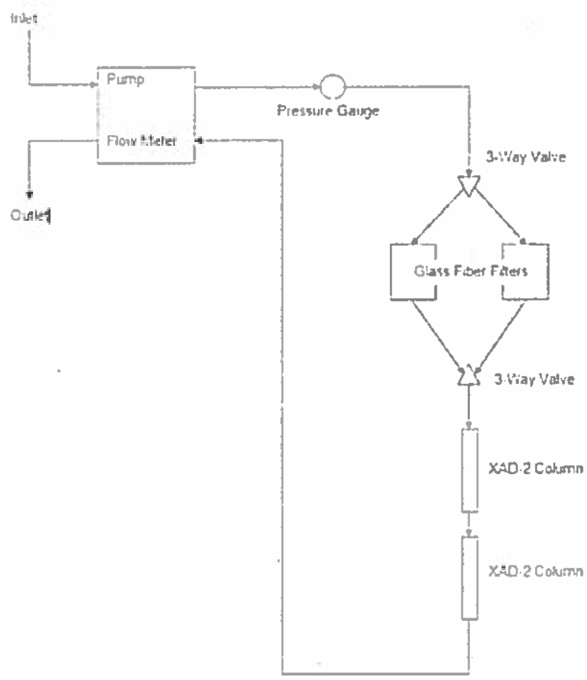

Figure 3: Infiltrex 300® Diagram

5.2 *In situ* and Surface Water Sampling

In addition to the samples collected with the Infiltrex 300®, grab samples for total suspended solids (TSS) and *in situ* measurements will be collected via multiparameter data sondes during the sampling process in accordance with SESD Operating Procedures for Surface Water Sampling (SESDPROC-201-R3, 2013) and *in situ* Water Quality Monitoring (SESDPROC-111-R3, 2013). Data sondes will be deployed to log at 5 minute intervals during the operation of the Infiltrex 300® and collect measurements of temperature, pH, specific conductance, dissolved oxygen and turbidity. This data will provide information regarding the variability of water quality during the sampling time and used to assist in the assessment of dioxin data.

Table 4: Measurement Uncertainties

In situ and Field Parameters	Units	Measurement Technology	Sensitivity of Primary Equipment
Dissolved Oxygen	mg/l	Luminescent DO Probe	± 0. 1 mg/l ± 1% Reading
Temperature	°C	LDO Thermistor	± 0.3 °C
pH (Sonde)	SU	Glass electrode	± 0.2 SU
Specific Conductance (Sonde)	µmho	Nickel electrode cell	± 0.5% of reading
Turbidity (Sonde)	NTU	Optical Probe	greater of ± 10% or 2 NTU
Latitude/Longitude	decimal degrees	DGPS/GPS based on NAD83	± 10 m (w/ selective availability disabled)

5.3 Sample Handling and Custody

Upon the completion of a sample, the columns will be capped, double bagged in plastic zip lock bags, placed in a cooler and iced using frozen gel packs. Glass fiber filters will be placed in precleaned glass containers, capped and stored on frozen gel packs along with columns. TSS samples will be collected in one liter, polyethylene containers, bagged, and placed on ice in a cooler separate from the columns immediately following collection. Holding times for TSS samples is 7 days (SESD Analytical Services Branch, 2012).

Upon return to SESD, glass fiber filters and XAD-2 resin columns will be packed into coolers and shipped to the analytical laboratory. TSS samples will be delivered to the custody room for distribution to the ASB laboratory. All samples will be handled and custody maintained in accordance with the SESD Operating Procedure for Sample and Evidence Management (SESDPROC-005-R2, 2013) and following guidance from the Analytical Services Branch Laboratory Operations and Quality Assurance Manual (SESD Analytical Services Branch, 2012).

6.0 Documentation and Records

Field logbooks will be maintained according to SESD Operating Procedure for Logbooks (SESDPROC-010-R5, 2013) during the field study. Following completion of the study, logbooks will be maintained by the project leader with the project file according to SESD Operating Procedure for Control of Records (SESDPROC-002-R5, 2010). A copy of the final report will be provided to the Water Protection Division and a copy of the final report will be maintained in the

SESD Records Center. Final report distribution and storage will be conducted following the SESD Report Preparation and Distribution Operating Procedure (SESDPROC-003-R4, 2013).

7.0 Quality Assurance and Quality Control

Quality control procedures will be utilized in the field and during preparation of equipment to ensure that reliable data is obtained. Sample and filter blanks will be collected by SESD and analyzed by the contractor.

With the exception of the stainless steel columns and glass fiber filters, all equipment that will come in direct contact with the sample during collection will be decontaminated at the SESD laboratory prior to use according to the procedures outlined in SESD Operating Procedure for Trace Organics Sampling Using an Infiltrex 300® High Volume Sampler (SESDPROC-502-R3, 2012). Columns will be cleaned and packed with XAD-2 resin by the analytical contractor. A system blank will be collected prior to field sampling operations. Filter and XAD samples from the system blank will be analyzed to ensure that no dioxin contaminants were present in the decontaminated equipment.

All calibration standards, field equipment, field supplies and field consumables will be maintained in accordance with SESD Operating procedure for Equipment Inventory and Management (SESDPROC-108-R4, 2013).

All data derived from SESD field measurements and sampling will be reviewed, verified, validated and deemed usable in accordance with the SESD Operating Procedure for Report Preparation and Distribution (SESDPROC-003-R4, 2013).

8.0 Project Management

Sampling and data collection will be managed through the Ecological Assessment Branch with guidance from David Melgaard of the Water Protection Division (WPD). End users of data will be the WPD. Assessments will be conducted during the field investigation according to the SESD Operating Procedure for Project Planning (SESDPROC-106-R2, 2010) to ensure the QAPP is being implemented as approved. The project leader is responsible for all corrective actions while in the field.

The project leader will be responsible for notifying the project requestor and appropriate SESD management if any circumstances arise during the field investigation that may adversely impact the quality of the data collected.

9.0 Project Schedule

SESD plans to begin work during May 4, 2014 if weather conditions are favorable to sampling. If time permits samples will be shipped from the field. if not shipping will be done from SESD.

10.0 References

Mukerjee, D. C. (1985). *Health Risk Assessment Approach for 2,3,7,8-Tetrachlorodibenzo-P-Dioxin.* Washington, DC, EPA/600/8-85-013 (NTIS PB86-122546/AS): Environmental Protection Agency Office of Research and Development.

SESD Analytical Services Branch. (2012). *Laboratory Operations and Quality Assurance Manual (ASB LOQAM).* Athens, GA: U.S. EPA Region 4.

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SESDPROC-108-R4. (2013). *SESD Operating Procedure for Equipment Inventory and Management.* Athens, GA: U.S. EPA Region 4.

SESDPROC-111-R2. (2009). *SESD Operating Procedure for In Situ Water Quality Monitoring.* Athens: Region 4.

SESDPROC-111-R3. (2013). *SESD Operating Procedure for In Situ Water Quality Monitoring.* Athens, GA: U.S. EPA Region 4.

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SESDPROC-201-R3. (2013). *SESD Operating Procedure for Surfacewater Sampling.* Athens: Region 4.

SESDPROC-502-R3. (2012). *SESD Operating Procedure for Trace Organics Sampling using an Infiltrex(R) 300 High Volume Sampler.* Athens, GA: U.S. EPA Region 4.

U.S. EPA. (1994). *Method 1613: Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS, Revision B.* Washington: U.S. EPA.

Appendix A: Data Quality Objectives

STEP	DATA QUALITY OBJECTIVES	DESCRIPTION
1	State the problem: • Identify the members of the planning team. • Define the problem • Identify the primary decision maker of the planning team. • Specify the available resources and relevant deadlines for the study.	Planning Team: Derek Little, EPA, Region 4, SESD* Stacey Box, EPA Region 4, SESD David Melgaard, EPA Region 4, WPD *Primary decision makers for field efforts. The primary objective of this study is to collect four dioxin samples along the Pigeon River and the Waterville Reservoir. A high volume sampler will be used to sample for low level detection with contract analysis. Weather conditions permitting, sampling will take place by May 4, 2014.
2	Identify the decision • Identify the principal study question. • Define the action that could result from resolution of the principal study question.	The data collected will be used to assist in decisions related to 303(d) listing status of the reservoir for dioxin.
3	Identify the inputs to the decision • Identify the information that will be required to resolve the decision statement. • Identify the information that is needed to establish the action level. • Confirm that analytical methods exist to provide the data.	A sample will be collected upstream of the known historic source of dioxin for comparison. Samples are planned for the river and reservoir. The project has been planned within the limitations of time and personnel resources. The QAPP and the SESD Operating Procedures listed in the bibliography section provide more specific details on sampling procedures and study methods.

STEP	DATA QUALITY OBJECTIVES	DESCRIPTION
4	Define Study Boundaries • Specify the characteristics that define the population of interest. • Define the spatial boundary. • Define the temporal boundary. • Define the scale of decision making. • Identify practical constraints on the data collection.	See map for sampling locations. Upper boundary is upstream of the papermill in Canton, NC. The lower boundary is the dam of the Waterville Reservoir. Access is limited for the study area due to the nature of topography along the river and the lake.
5	Develop a Decision Rule • Specify the statistical parameter that characterizes the population (parameter of interest). • Specify the action level for the study. • Develop a decision rule.	There are no action levels for the study. All data to be generated by this study were requested to meet SESD's needs. No decision rule – SESD will make the final decision regarding the application of the data.
6	Specify Decision Error Limits • Determine the possible range of the parameters of interest. • Identify the decision errors and choose the null hypothesis. • Specify a range of possible parameter values where the consequences of decision errors are relatively minor (gray region). • Assign probability limits to points above and below the gray region that reflect the tolerable probability for the occurrence of decision errors.	Not applicable due to authoritative sampling approach.

STEP	DATA QUALITY OBJECTIVES	DESCRIPTION
7	Optimize the Design for Obtaining Data • Review the DQO outputs and existing environmental data. • Develop general data collection design alternatives. • Formulate the mathematical expressions needed to solve the design problems for each data collection design alternative. • Select the optimal sample size that satisfies the DQOs for each data collection design alternative. • Select the most resource-effective data collection deign that satisfies all of the DQOs. • Document the operational details and theoretical assumptions of the selected design in the sampling and analysis plan.	Authoritative sampling approach selected to meet study DQOs.

Appendix B Axys Method Modification of 1613B

ANALYSIS OF POLYCHLORINATED DIOXINS AND FURANS BY EPA METHPD 1613B

Samples are spiked with a suite of isotopically labeled surrogate standardsprior to analysis, solvent extracted,. and cleaned up through a series of chromatographic columns that may include gel permeation, silica, Florisl, carbon.Celite, and alumnia columns. The extract is concentrated and spiked with an isotopically labeled recovery (internal) standard. Analysis is performed using a high-resolution mass spectrometer coupled to a high resolution gas chromatograph equipped with a DB-5 capillary chromatography colum (60 m, 0.25 mm i.d., 0.1 µm film thickness). A second column, DB-225 (30 m, 0.25 mm i.d., 0.15 µm film thickness), is used for confirmation of 2,3,7,8 –TCDF identification. All procedures are carried out according to protocols as described in EPA Method 1613B, with the significant modifications summarized below. The data are evaluated against QC criteria presented in Tables 1 and 2.

Method Modifications:

Section 2.1.2

Non-aqueous liquid from multiphase sample is combined with solid phase and extracted by Dean-Stark soxhlet.

Section 7.2.1

Anhydrous sodium sulphate (Na_2SO_4) is purchased as powder form (not granular) and is baked overnight prior to use. There is no solvent rinse with dichlormethane.

Section 7.10

The concentration of the labeled compound spiking solution is 100 ng/mL (except for OCDD which is 200 ng/mL) and the sample spiking volume is 20 µL. The resulting concentrations in the final extracts are specified in the method.

Section 7.11

The concentration of the clean-up standard spiking solution is 10 ng/mL and the sample spiking volume is 20 µL. The resulting concentrations in the final extracts are specified in the method.

Sections 7.13, 14.0, 15.0

An additional lower level calibration solution, 0.2 times the concentration of CS1, is prepared and included in the initial calibration series. Initial calibration is based on a six-point series.

Section 7.14

The concentration of the PAR spiking solutions is 0.2/1.0/2.0 ng/mL for tetra/penta, hexa, hepta, hexa/octas respectively and the spiking volume is 1 mL. The resulting final concentrations in the extracts are as specified in the method.

Section 9.3.3, Table 7

Acceptance criteria for the percent recovery of surrogate standards in samples have been revised. Criteria that are higher than 130% have been lowered to 130%, as presented in Table 1.

Section 11.5

Aqueous samples containing >1% visible solids are prepared and extracted using the same procedure as samples containing ≤1% visible solids. This involves extracting the solids by soxhlet and the filtrate by separatory funnel extraction and combining the extract from the two phases.

Section 12.0

Samples with sufficiently low moisture content may be mixed with Na_2SO_4 and extracted using regular soxhlet apparatus in 80:20 toluene:acetone.

Section12.4

The equilibrium time for the sodium sulfate drying step is that required to produce a dry, free flowing powder (minimum thirty minutes). This may be less that the 12-hour minimum specified in EPA 1613B.

Section 12.5.1

Samples are spiked with cleanup standard right after extraction and before reduction; not spiked into the separatory funnels containing the extracts prior to the acid/base wash.

Section 12.6.1.1

Rotary evaporator baths are maintained at 35°C. Mimic proofs are collected instead of collecting proofs each day and archiving.

Section 13.0

Extracts may be cleaned up on silica, alumina and carbon chromatographic columns using a Fluid Management System (FMS) automated cleanup system.

Section 13.7

Gravimetric lipid analysis is carried out on two subsamples of the extract.

Section14.0, 15.0, 16.0, Table 8, Table 9

M/Z channels 354/356 and 366/368 are used to confirm and quantify the native and surrogate penta-substituted dioxins, respectively; this change from the method's specification is made in the instrument method in order to avoid a persistent interference in the 356/358 and 368/370 M/Z channels. The theoretical raio for the P5CDD M/M+2 ions is 0.61; therefore, the acceptance range is 0.52-0.70.

Section 15.3.5, Table 6

Acceptance criteria for calibration verification concentrations have been modified, as presented in Table1, so that ranges do not exceed 70-130% of the test concentration.

Section 17.0

$Conc_i$ – the concentration of target analytes, and the labeled compound concentrations and recoveries, are calculated using the equations below. These procedures are equivalent to those described in the method but are more direct.

$$Conc_i = \frac{A_i}{A_{si}} \times \frac{M_{si}}{RRF_{i,si}} \times \frac{1}{M_x}$$

where A_i	=	summed areas of the primary and secondary m/z's for the analyte peak of interest (compound *i*)
A_{si}	=	summed areas of the primary and secondary m/z's for the labeled surrogate peak used to quantify *i*
M_x	=	mass of sample taken for analysis
M_{si}	=	mass of labeled surrogate (compound *si*)added to sample as calculated by concentration of standard spiked (pg/mL) multiplied by the volume spike (mL)
$RRF_{i,si}$	=	mean relative response factor of *i* to *si* from the five-point calibration range and defined individually as:

$$\frac{A_i}{A_{si}} \times \frac{M_{si}}{M_i}$$

<u>Calculation of Surrogate Standard Concentrations and Percent Recoveries</u>

Concentrations of surrogate standards are calculated using the following equation:

$$Conc_{si} = \frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{RRF_{si,rs}}$$

and, the percent recoveries of the surrogate standards are calculated using the following equation:

$$\%Recovery = \frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{RRF_{si,rs}} \times \frac{1}{M_{si}} \times 100$$

where:

A_{rs} and A_{si} are the summed peak areas (from the primary and secondary m/z channels) of recovery standard and labeled surrogate added to the sample;

M_{rs} and M_{si} are the masses of recovery standard and labeled surrogate added to the sample, and;

$RRF_{si,rs}$ is the mean relative response factor of the labeled surrogate to the recovery standard as determined by the five –point calibration range and defined individually as:

$$\frac{A_{si}}{A_{rs}} \times \frac{M_{rs}}{M_{si}}$$

Section 17.5

Extracts may be diluted with solvent and re-analyzed by GC/MS isotope-dilution to bring the instrumental response to within the linear range of the instrument. For very high-level samples where a smaller sample aliquot may not be representative, extracts may be diluted and re-spiked with labeled quantification standards and re-analyzed by GC/MC to bring the instrumental response analytes within range. Final results may be recovery corrected using the mean recovery of labeled quantification standards

Table 1. QC Acceptance Criteria for PCDD/F in CAL/VER, IPR, OPR and Test Samples[1]

	Test Conc ng/mL	IPR[2]		OPR[3] (%)	I-CAL %	CAL/VER[4] (%)	Labelled Cmpd %Rec. in Sample	
		RSD (%)	X(%)				Warning Limit	Control Limit
Native Compound								
2,3,7,8-TCDD	10	28	83-129	70-130	20	78-129	-	-
2,3,7,8-TCDF	10	20	87-137	75-130	20	84-120	-	-
1,2,3,7,8-PeCDD	50	15	76-132	70-130	20	78-130	-	-
1,2,3,7,8-PeCDF	50	15	86-124	80-130	20	82-120	-	-
2,3,4,7,8-PeCDF	50	17	72-150	70-130	20	82-122	-	-
1,2,3,4,7,8-HxCDD	50	19	78-152	70-130	20	78-128	-	-
1,2,3,6,7,8-HxCDD	50	15	84-124	76-130	20	78-128	-	-
1,2,3,7,8,9-HXCDD	50	22	74-142	70-130	35	82-122	-	-
1,2,3,4,7,8-HxCDF	50	17	82-108	72-130	20	90-112	-	-
1,2,3,6,7,8-HxCDF	50	13	92-120	84-130	20	88-114	-	-
1,2,3,7,8,9-HxCDF	50	13	84-122	78-130	20	90-112	-	-
2,3,4,6,7,8-HxCDF	50	15	74-158	70-130	20	88-114	-	-
1,2,3,4,6,7,8-HpCDD	50	15	76-130	70-130	20	86-116	-	-
1,2,3,4,6,7,8-HpCDF	50	13	90-112	82-122	20	90-110	-	-
1,2,3,4,7,8,9-HpCDF	50	16	86-126	78-130	20	86-116	-	-
OCDD	100	19	86-126	78-130	20	79-126	-	-
OCDF	100	27	74-146	70-130	35	70-130	-	-
Surrogate Standards								
$^{13}C_{12}$-2,3,7,8-TCDD	100	37	28-134	25-130	35	82-121	40-120	25-130
$^{13}C_{12}$-2,3,7,8-TCDF	100	35	31-113	25-130	35	71-130	40-120	24-130
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	39	27-184	25-150	35	70-130	40-120	25-130
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	34	27-156	25-130	35	76-130	40-120	24-130
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	38	16-279	25-130	35	77-130	40-120	21-130
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	41	29-147	25-130	35	85-117	40-120	32-130
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	38	34-122	25-130	35	85-118	40-120	28-130
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	43	27-152	25-130	35	76-130	40-120	26-130
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	35	30-122	25-130	35	70-130	40-120	26-123
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	40	24-157	25-130	35	74-130	40-120	29-130
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	37	29-136	25-130	35	73-130	40-120	28-130
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	35	34-129	25-130	35	72-130	40-120	23-130
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	41	32-110	25-130	35	78-129	40-120	28-130
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	40	28-141	25-130	35	77-129	40-120	26-130
$^{13}C_{12}$-OCDD	200	48	20-138	25-130	35	70-130	25-120	17-130
Cleanup Standard								
$^{37}Cl_4$-2,3,7,8-TCDD	10	36	39-154	31-130	35	79-127	40-120	35-130

[1] QC acceptance criteria for IPR, OPR, and samples based on a 20 µL extract final volume
[2] IPR: Initial Precision and Recovery demonstration
[3] OPR: Ongoing Precision and Recovery test run with every batch of samples.
[4] CAL VER: Calibration Verification test run at least every 12 hours

Table 2. QC Specifications for QC Samples, Instrumental Analysis, and Analyte Quantification

QC Parameter	Specification
Analysis Duplicate	Must agree to within ±20% of the mean (applicable to concentrations >10 times the DL)[1]
Procedural Blank	**Blood:** TCDD/F <0.2 pg/sample, PeCDD/F <0.5 pg/sample, HxCDD/F and HpCDD/F <1.0 pg/ sample, OCDD/F<5 pg/sample **Other Matrices:** TCDD/F <0.5 pg/sample, PeCDD/F, HxCDD/F, HpCDD/F <1.0 pg/sample, OCDD/F <5 pg/sample Higher levels acceptable where all sample concentrations a >10X the blank
Detection Limit	SDL Requirements **Blood:** Tetra-penta-CDD/F 0.2 pg/sample Hexa-octa-CDD/F 0.5 pg/sample **Other Matrices:** 1 pg/sample
Instrument Carryover: Toluene Blank	A. 1st toluene blank following CAL-VER must have <0.6 pg TCDD and <25 pg OCDD B. 2nd toluene blank following CAL-VER must have <0.2 pg TCDD and <0.8 pg Pe – HpCDD/F, and <0.5 pg OCDD.
Samples	<10% contribution from preceding sample (based on observed instrument carryover <10% contribution from preceding sample (based on observed instrument carryover rate)
Analyte/Surrogate Ratios	Response must be within the calibrated range of the instrument. Coders may use data from more than one chromatogram to get the responses in the calibrated range.
Ion Ratios	Must be within ±15% of theoretical
Sensitivity	S:N≥10:1 for all compounds for 0.1 pg/µL (CS-0.2), plus For bloods: S:N≥3:1 for 0.025 pg/µL 2,3,7,8-T4CDD

[1] Duplicate criterion is a guideline; final assessment depends upon sample characteristics, overall batch QC and on-going lab performance.

END OF REPORT

2014 Draft Category 5 Water Quality Assessments-303(d) List

Broad River Basin

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
AU Description:				

NC River Basin **Broad River Basin**
Subbasin **Upper Broad River**

2014 AU Number	AU Name	AU Length Area	AU Units	Classification
9-53-9	**Jakes Branch**	**5.5**	**FW Miles**	**C**

From source to Buffalo Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fish Community Fair (Nar, AL, FW)**	**2012**	**2014**
5	**EC**	**Benthos Fair (Nar, AL, FW)**	**2012**	**2014**

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
AU Description:				

NC River Basin **Cape Fear River Basin**

Subbasin **Cape Fear River**

18-88-9-3-3 **Dutchman Creek Outlet Channel** **78.3 S Acres** **SA;HQW**

From Intracoastal waterway to Dutchman Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2011	2014
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2006

18-76-1 **Greenfield Lake** **75.3 FW Acres** **C;Sw**

Entire Lake

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2014

18-88-9b **Intracoastal Waterway** **96.6 S Acres** **SA;HQW**

From Dutchmans Creek outlet channel to mouth of Cottage Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2010	2014
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2006

Subbasin **Deep River**

17-40-2 **Persimmon Creek** **2.9 FW Miles** **C**

From source to Big Buffalo Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2014

Subbasin **Haw River**

16-30-(0.5)a **Collins Creek** **3.2 FW Miles** **WS-V;NSW**

From source to a point 0.6 miles downstream of SR 1006

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Poor (Nar, AL, FW)	2012	2014

16-41-1-12-(1) **Third Fork Creek** **5.2 FW Miles** **WS-V;NSW**

From source to a point 2.0 miles upstream of NC Hwy. 54

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Zinc (50 µg/l, AL, FW)	2012	2008
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2008
5	EC	Hardness (100 mg/L, WS, WS)	2012	2014

Subbasin **Little River-Cape Fear River**

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
	AU Description:			

18-27-(3)b	Cross Creek (Big Cross Creek)	1.4	FW Miles	C
	From Hillsboro Street to Blounts Creek			

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2008	2010
5	EC	pH (6 su, AL, FW)	2012	2014

18-16-1-(2)	Kenneth Creek	3.9	FW Miles	WS-IV
	From Wake-Harnett County Line to Neils Creek			

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2007	1998
5	EC	pH (6 su, AL, FW)	2012	2012
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2014

18-28ut3	Ut to Locks Creek	1.9	FW Miles	
	From source to Locks Creek			

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2010
5	EC	Mercury (0.012 µg/l, FC, FW)	2012	2014
5	EC	pH (6 su, AL, FW)	2012	2010

Subbasin Northeast Cape Fear River

18-74-63-2	Burnt Mill Creek	4.6	FW Miles	C;Sw
	From source to Smith Creek			

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Poor (Nar, AL, FW)	1998	1998
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
	AU Description:			

NC River Basin **Catawba River Basin**

Subbasin **Catawba River**

11-139 **Waxhaw Creek** **16.3 FW Miles** **C**

From source to North Carolina-South Carolina State Line

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Poor (Nar, AL, FW)	2012	2014

11-138-1 **West Fork Twelvemile Creek** **12.9 FW Miles** **C**

From source to Twelvemile Creeek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Poor (Nar, AL, FW)	2012	2014

Subbasin **Catawba River Headwaters**

11-(75) **CATAWBA RIVER (Lake Norman below elevation 76** **31,331.6 FW Acres** **WS-IV,B;CA**

From Lyle Creek to Cowan's Ford Dam

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

11-(117) **CATAWBA RIVER (Lake Wylie below elevation 570)** **375.3 FW Acres** **WS-IV;CA**

From Mountain Island Dam to Interstate Highway 85 Bridge at Belmont

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

11-(122) **CATAWBA RIVER (Lake Wylie below elevation 570)** **601.1 FW Acres** **WS-IV,B;CA**

From I-85 bridge to the upstream side of Paw Creek Arm of Lake Wylie, Catawba River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

11-(114) **CATAWBA RIVER (Mountain Island Lake below elev** **1,937.1 FW Acres** **WS-IV,B;CA**

From Water Intake at River Bend Steam Station to Mountain Island Dam (Town of Mount Holly water supply intake)

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

11-119-2-(0.5) **Killian Creek** **11.6 FW Miles** **C**

From source to Anderson Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Fair (Nar, AL, FW)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

11-69-(0.5)b **Lower Little River** **6.2 FW Miles** **C**

From Lambert Fork to a point 0.5 mile upstream of mouth of Stirewalt Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Fair (Nar, AL, FW)	2012	2014

Subbasin South Fork of the Catawba River

11-(123.5)a **CATAWBA RIVER (Lake Wylie below elevation 570)** **4,294.0 FW Acres** **WS-V,B**

From the upstream side of Paw Creek Arm of Lake Wylie to North Carolina-South Carolina State Line

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

11-(123.5)b **CATAWBA RIVER (Lake Wylie South FK Catawba Ar** **1,291.0 FW Acres** **WS-V,B**

South Fork Catawba River Arm of Lake Wylie

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Copper (7 µg/l, AL, FW)	2008	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

11-129-16-(4) **Long Creek** **15.3 FW Miles** **C**

From Mountain Creek to South Fork Catawba River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Poor (Nar, AL, FW)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
AU Description:				

NC River Basin **Chowan River River Basin**

Subbasin **Chowan River**

25-24-2	Cricket Swamp	8.3	FW Miles	C;NSW

From source to Salmon Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	pH (6 su, AL, FW)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin Subbasin **French Broad River Basin**

6-3-10b **Tucker Creek** **0.2 FW Miles** **C;Tr**

From Fish Farm North to Fork French Broad River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Benthos Fair (Nar, AL, FW)**	2011	2014

Subbasin **French Broad River**

6-52-(6.5) **Boylston Creek** **6.1 FW Miles** **WS-IV**

From a point 0.3 mile upstream of Murray Branch to French Broad River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Benthos Fair (Nar, AL, FW)**	2012	2014

6-96-(11.3) **Ivy Creek (River)** **0.5 FW Miles** **WS-II;HQW,CA**

From Adkins Branch to a point 0.6 mile downstream of Adkins Branch (Town of Mars Hill water supply intake)

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	2011	2014

6-96-(0.5)a **Ivy Creek (River)** **6.5 FW Miles** **WS-II;HQW**

From source to Little Ivy Creek Adkins Branch

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	2011	2014

6-96-10a **Little Ivy Creek (River)** **2.6 FW Miles** **WS-II;HQW**

From California Creek to State Route 1547

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	2011	2014

6-96-10b **Little Ivy Creek (River)** **2.1 FW Miles** **WS-II;HQW**

From State Route 1547 to Ivy Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	2011	2014

6-84e **Newfound Creek** **1.7 FW Miles** **C**

From Dix Creek to French Broad River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Fish Community Fair (Nar, AL, FW)**	2012	2014
5	EC	**Benthos Fair (Nar, AL, FW)**	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
	AU Description:			

6-76-5b **South Hominy Creek** **7.7 FW Miles** **C;Tr**

From Warren Creek to Hominy Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Benthos Fair (Nar, AL, FW)**	**2012**	**2014**

6-112-5-2 **Wolf Laurel Branch** **2.1 FW Miles** **C;Tr,ORW**

From source to Puncheon Fork

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Turbidity (10 NTU, AL, Tr)**	**2012**	**2014**

Subbasin Nolichucky River

7-2-40 **Grassy Creek** **5.9 FW Miles** **C;Tr**

From source to North Toe River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fish Community Fair (Nar, AL, FW)**	**2012**	**2014**

Subbasin Pigeon River

5-32 **Fines Creek** **9.7 FW Miles** **C**

From source to Pigeon River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fish Community Fair (Nar, AL, FW)**	**2012**	**2014**

5-16-(16)a **Richland Creek** **1.6 FW Miles** **C**

From Lake Junaluska Dam to Jones Cove Branch

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fish Community Fair (Nar, AL, FW)**	**2012**	**2014**

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin: Hiwassee River Basin
Subbasin: Hiwassee River

1-(16.5)b **HIWASSEE RIVER (Mission Reservoir)** **4.7 FW Miles** **WS-IV**

From Tusquitee Creek to Calhoun Creek below Mission Reservoir

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	**2011**	**2014**

1-52d **Valley River** **3.2 FW Miles** **C;Tr**

From Marble Creek above Murphy to Hiwassee River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	**2011**	**2014**

1-52c **Valley River** **7.7 FW Miles** **C;Tr**

From Venegeance Creek near Marble to Marble Creek above Murphy

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Fecal Coliform (GM 200/400 5 in 30, REC, FW)**	**2011**	**2014**

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
	AU Description:			

NC River Basin **Lumber River Basin**

Subbasin **Long Bay-Atlantic Ocean**

15-25d **Intracoastal Waterway** **315.6 S Acres** **SA;HQW**

From NCSC state line to western mouth of Still Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterococcus (GM 35, REC, SW) 5n30	2010	2014
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2006

Subbasin **Lumber River**

14-22-13-3 **Long Branch** **3.4 FW Miles** **C;Sw**

From source to Little Swamp

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Mercury (0.012 µg/l, FC, FW)	2012	2014

Subbasin **Waccamaw River**

15-2-6-3 **Friar Swamp (Council Millpond)** **11.6 FW Miles** **C;Sw:+**

From source to Big Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Severe (Nar, AL, FW)	2011	2014

15-17-1-11 **Juniper Swamp** **6.7 FW Miles** **C;Sw**

From North Carolina-South Carolina State Line to Grissett Swamp

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Severe (Nar, AL, FW)	2011	2014

15-4b **White Marsh** **12.6 FW Miles** **C;Sw**

From Richardson Swamp to Waccamaw River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Severe (Nar, AL, FW)	2011	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin **Neuse River Basin**

Subbasin **Lower Neuse River**

27-125-(6)a **Dawson Creek** **121.2 S Acres** **SA;HQW,NSW**

From mouth of Tarkiln Creek to 0.03 miles upstream of Neuse River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2012	2014
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2008

27-125-(6)b **Dawson Creek** **1.0 S Acres** **SA;HQW,NSW**

From 0.03 miles upstream of Neuse River to Neuse River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2012	2014

Subbasin **Upper Neuse River**

27-37 **Beddingfield Creek** **3.7 FW Miles** **C;NSW**

From source to Neuse River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

27-43-15-(4)a1 **Middle Creek** **4.5 FW Miles** **C;NSW**

From dam at Sunset Lake to small impoundment upstream of US 401

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Poor (Nar, AL, FW)	2011	2014

27-52-(1)b **Mill Creek (Moorewood Pond)** **11.3 FW Miles** **C;NSW**

From source to Stone Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2014

27-57-12 **Snipes Creek** **5.5 FW Miles** **C;NSW**

From source to Little River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2014

27-33-14aut8 **UT MINE CR** **2.0 FW Miles**

Source to MINE CR

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Poor (Nar, AL, FW)	2011	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
AU Description:				
27-43-(5.5)but	**UT to Swift Creek (Lake Benson)**	**2.7**	**FW Miles**	
From Source to Lake Benson				

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	**EC**	**Benthos Fair (Nar, AL, FW)**	**2012**	**2014**

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin: Pasquotank River Basin
Subbasin: Albemarle Sound

30-19-1b **Colington Creek** 0.4 S Acres SC

Wildlife Ramp on Bayview Dr.

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2010	2014

30-1c **Currituck Sound** 0.1 S Acres SC

Southern Shores Private Soundside Access

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2010	2014

30-1a1 **Currituck Sound** 69,301.2 S Acres SC

From source to Wright Memorial Bridge at Albemarle Sound

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2010	2014

30-3-(12) **Pasquotank River** 9,185.6 S Acres SB

From a line across River from Hospital Point to Cobb Point to a line across River from Miller Point to Pool Point

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Copper (3 µg/l, AL, SW)**	2008	2008
5	EC	pH (6.8 su, AL, SW)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin Roanoke River Basin

Subbasin Dan River Headwaters

22-27-(7.5) **Belews Creek (including Belews Lake below elevati** **1,283.8 FW Acres** **WS-IV**

From a point 1.8 mile downstream of the Forsyth-Stokes County Line to Dan River, excluding the Arm of Belews Lake described below which are classified "WS-IV&B"

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Water Temperature (32ºC, AL, LP&CP)**	2012	2014

22-27-(7) **Belews Creek (including Belews Lake below elevati** **789.7 FW Acres** **C**

From Southern Railroad Bridge to to a point 1.8 mile downstream of Forsyth-Stokes County Line

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Water Temperature (32ºC, AL, LP&CP)**	2012	2014

Subbasin Roanoke River

23-55 **Welch Creek** **13.3 FW Miles** **C;Sw**

From source to Roanoke River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	pH (4.3 su, AL, Sw)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin Tar-Pamlico River Basin

Subbasin Pamlico River

29-(1) **PAMLICO RIVER (Upper Pamilco Segment)** **739.5 S Acres** **SC;NSW**

From U.S. Hwy. 17 bridge to line 0.75 miles downstream of Runyon Creek and 0.5 miles downstream of Rodman Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	pH (6.8 su, AL, SW)	2012	2014

Subbasin Pamlico Sound

29-49a **Swanquarter Bay** **136.2 S Acres** **SA;ORW**

DEH closed area west of Swanquarter

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2009	2014
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2008

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin White Oak River Basin

Subbasin

18-87-10a5 **Topsail Sound** **2.4 S Acres** **SA;HQW**

Surf City Marina

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2012	2014

18-87-10a2 **Topsail Sound** **88.9 S Acres** **SA;HQW**

Sound south of ICWW and east of NC50

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Conditionally Approved Open Growing Area (Fecal, SH, SA)	2012	2014

18-87-10a4 **Topsail Sound** **2.7 S Acres** **SA;HQW**

Conditional area at Surf City Marina

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Conditionally Approved Closed Growing Area (Fecal, SH, SA)	2012	2014

18-87-10a3 **Topsail Sound** **3.2 S Acres** **SA;HQW**

Prohibited area around 210 bridge

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2012	2014

Subbasin New River

18-87-23b **Howe Creek** **17.4 S Acres** **SA;ORW**

From downstream of station HW DT to between Station HWGP and HWFP

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2006
5	EC	Dissolved Oxygen (5 mg/l, AL, SW)	2012	2014

18-87-31b **Myrtle Sound Shellfishing Area** **65.1 S Acres** **SA;HQW**

North of ICWW

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2011	2014
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2010	2012

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

18-87-0.5 **Stump Sound ORW Area** **939.9 S Acres** **SA;ORW**

All waters between the s edge of the White Oak RB to the western end of Permuda Is. exclusive of the restricted area

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2009	2014
5	EC	Conditionally Approved Open Growing Area (Fecal, SH, SA)	2010	2006

Subbasin White Oak River

21-35-(0.5)b **Back Sound** **870.1 S Acres** **SA;HQW**

Portion of the following in subbasin 030504 From Newport River to a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marsh

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2012	2014

19-41-(14.5)a **Intracoastal Waterway** **108.4 S Acres** **SA;ORW**

From the northeast mouth of Goose Creek to the southwest mouth of Queen Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2009	2014
5	EC	Conditionally Approved Open Growing Area (Fecal, SH, SA)	2010	2002

21-(1)a **Newport River** **8.3 FW Miles** **C**

From source to Black Creek Little Creek Swamp

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2014

21-(1)b **Newport River** **2.9 FW Miles** **C**

From Black Creek to Little Creek Swamp

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Dissolved Oxygen (4 mg/l, AL, FW)	2012	2014

20-(18)a1 **WHITE OAK RIVER** **792.6 S Acres** **SA;HQW**

DEH closed area from Hunters Creek to DEH closure line.

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	pH (6.8 su, AL, SW)	2012	2014

20-32 **White Oak River Restricted Area** **267.6 S Acres** **SC**

That portion of White Oak River within an area bounded by a line running in an easterly direction from a point below Foster Creek to east end of Swansboro Bridge (N.C. Hwy. 24)

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Enterrococcus (GM 35, REC, SW) 5n30	2009	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

NC River Basin Yadkin-Pee Dee River Basin

Subbasin Lake Tillery-Pee Dee River

13-20a **Brown Creek** 16.5 FW Miles C

From N.C.-S.C. State Line to mouth of Lick Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Poor (Nar, AL, FW)	2011	2014

13-16 **Clarks Creek** 12.6 FW Miles C

From source to Pee Dee River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

13-5-(0.7) **Mountain Creek** 7.3 FW Miles WS-IV

From Stanly County SR 1542 to a point 0.5 mile upstream of mouth

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Fair (Nar, AL, FW)	2011	2014

13-(1) **PEE DEE RIVER (including Lake Tillery below norma** 4,845.5 FW Acres WS-IV,B;CA

From mouth of Uwharrie River to Norwood Dam

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

Subbasin Rocky River

13-17-31-5 **Big Bear Creek** 19.9 FW Miles C

From source to Long Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Fish Community Fair (Nar, AL, FW)	2011	2014

13-17c1 **Rocky River** 2.8 FW Miles C

From the Irish Buffalo Creek to Hamby Branch

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Copper (7 µg/l, AL, FW)	2008	2008
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

Subbasin South Yadkin River

12-108-11-3 **Patterson Creek** 10.6 FW Miles C

From source to Rocky Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

Subbasin Yadkin River

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
AU Description:				

12-118.5a **Abbotts Creek Arm of High Rock Lake** **3.7 FW Miles** **WS-V,B**

From source at I-85 to NC 47

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Chlorophyll a (40 µg/l, AL, NC)**	2012	2008
5	EC	**PCB Fish Tissue Advisory (Advisory, FC, NC)**	2012	2014

12-126-(3) **Lick Creek** **7.1 FW Miles** **WS-IV**

From East Branch Lick Creek to a point 1.0 mile upstream of Davidson County SR 2501

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Fish Community Fair (Nar, AL, FW)**	2011	2014
5	EC	**Benthos Fair (Nar, AL, FW)**	2011	2008

12-117-(3)b **Second Creek Arm of High Rock Lake** **547.5 FW Acres** **WS-IV,B**

From SR1002 to High Rock Lake

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**pH (9.0, AL, FW)**	2012	2008
5	EC	**Chlorophyll a (40 µg/l, AL, NC)**	2012	2008
5	EC	**PCB Fish Tissue Advisory (Advisory, FC, NC)**	2012	2014

12-117-(3)a **Second Creek Arm of High Rock Lake** **400.2 FW Acres** **WS-IV,B**

From a point 1.7 miles downstream of Rowan County SR 1004 to SR1002

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Chlorophyll a (40 µg/l, AL, NC)**	2012	2008
5	EC	**PCB Fish Tissue Advisory (Advisory, FC, NC)**	2012	2014

13-2-(1.3)ut6 **UT to Uwharrie River** **2.8 FW Miles**

From Source to Uwharrie

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Arsenic (10 µg/l, HH, NC)**	2012	2014

12-(114)b2 **YADKIN RIVER (including lower portion of High Roc** **859.0 FW Acres** **WS-IV,B**

Lower Abbots Creek Arm Above NC 8

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	**Chlorophyll a (40 µg/l, AL, NC)**	2012	2008
5	EC	**PCB Fish Tissue Advisory (Advisory, FC, NC)**	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
	AU Description:			

12-(114)a **YADKIN RIVER (including lower portion of High Roc** **478.1 FW Acres** **WS-IV,B**

From a line across High Rock lake from the downstream side of mouth of Crane Creek to Second Creek Arm of High Rock Lake

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	pH (9.0, AL, FW)	2012	2008
5	EC	Turbidity (25 NTU, AL, FW acres & SW)	2012	2010
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

12-(124.5)a **YADKIN RIVER (including lower portion of High Roc** **10.8 FW Acres** **WS-IV,B;CA**

From a point 0.6 mile upstream of dam of High Rock Lake to High Rock Dam

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

12-(114)b1 **YADKIN RIVER (including lower portion of High Roc** **2,627.0 FW Acres** **WS-IV,B**

From Second Creek Arm of High Rock Lake to above the dam

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	pH (9.0, AL, FW)	2012	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

12-(114)b3 **YADKIN RIVER (including lower portion of High Roc** **861.0 FW Acres** **WS-IV,B**

Lower Flat Swamp Creek Arm above railroad bridge

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

12-(124.5)c **YADKIN RIVER (including Tuckertown Lake, Badin L** **7,937.8 FW Acres** **WS-IV,B;CA**

From the mouth of Cabin Creek to Badin Lake

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	pH (9.0, AL, FW)	2012	2014

12-(108.5)b4 **YADKIN RIVER (including upper portion of High Roc** **1,351.5 FW Acres** **WS-V**

Crane Creek Arm of High Rock Lake

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:

AU Description:

12-(108.5)b3 **YADKIN RIVER (including upper portion of High Roc** **801.5 FW Acres** **WS-V**

From downstream side Swearing Creek Arm to downstream side of Crane Creek Arm

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	Turbidity (25 NTU, AL, FW acres & SW)	2012	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

12-(108.5)b2 **YADKIN RIVER (including upper portion of High Roc** **2,927.9 FW Acres** **WS-V**

From Buck Steam Plant to a line across High Rock Lake at the downstream side Swearing Creek Arm

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Turbidity (25 NTU, AL, FW acres & SW)	2012	2014
5	EC	Chlorophyll a (40 µg/l, AL, NC)	2012	2008
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

12-(108.5)b1 **YADKIN RIVER (including upper portion of High Roc** **487.9 FW Acres** **WS-V**

From mouth of Grants Creek to Buck Steam Statio

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	PCB Fish Tissue Advisory (Advisory, FC, NC)	2012	2014

Subbasin Yadkin River Headwaters

12-83-(1.5) **Forbush Creek** **4.9 FW Miles** **WS-IV**

From a point 0.4 mile upstream of Yadkin County SR 1600 to Yadkin River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

12-63-10-(2) **Little Fisher River** **8.9 FW Miles** **C**

From Surry County SR 1615 to Fisher River

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

12-83-2-(0.7) **Logan Creek** **2.6 FW Miles** **WS-IV**

From a point 0.4 mile upstream of mouth of Loney Creek to Forbush Creek

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Benthos Fair (Nar, AL, FW)	2011	2014

2014 AU Number:	AU Name:	AU Length Area:	AU Units:	Classification:
AU Description:				
12-94-(0.5)b2b	Muddy Creek	3.0	FW Miles	C
From Silas Creek to SR 2995				

IRCategory:	ACS:	Parameter Of Interest:	Collection Year:	303(d) yr:
5	EC	Zinc (50 µg/l, AL, FW)	2008	2010
5	EC	Turbidity (50 NTU, AL, FW miles)	2012	2014

Appendix I: Water quality limited segments removed from the 2012 Section 303(d) list

Assessment Unit#	Name	Description	Basin	Parameter Proposed for Delisting	Justification (more complete descriptions, below table)
9-(40.5)	BROAD RIVER	From a point approximately 0.3 mile downstream of Cane Creek to a point 0.5 mile upstream of the Town of Shelby proposed water supply intake.	Broad	Water Temperature	More Recent/New Data
9-41-12-(5.5)	Cane Creek	From mouth of Fork Creek to Second Broad River	Broad	Fish Community	More Recent/New Data
9-55-1-(10)	North Pacolet River	From North Carolina Highway # 108 at Lynn to North Carolina-South Carolina State Line	Broad	Fish Community	More Recent/New Data
16-(1)c1	HAW RIVER	From SR 2426 to Troublesome Creek at US29	Cape Fear	Copper*	Change in asmnt Methods
16-(1)c2	HAW RIVER	From Troublesome Creek to 0.9 miles downstream of Troublesome Creek	Cape Fear	Turbidity	Change in asmnt Methods
16-(10)	HAW RIVER	From a point 0.5 mile downstream of SR2711 to a point 0.1 mile upstream of SR2712	Cape Fear	Turbidity	Change in asmnt Methods
16-(10.5)a	HAW RIVER	From a point 0.1 mile upstream of SR2712 to NC 87	Cape Fear	Turbidity	Change in asmnt Methods
16-(28.5)	HAW RIVER	From a point 0.4 miles downstream of Cane Creek (South side of Haw River) to Town of Pittsboro water supply intake	Cape Fear	Turbidity	More Recent/New Data
16-(28.75)	HAW RIVER	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.	Cape Fear	Turbidity	More Recent/New Data
16-(28.875)	HAW RIVER	From the Town of Pittsboro water supply intake (located approximately 0.15 mile west of U.S. 15/501) to a point 0.4 mile downstream of Brooks Branch.	Cape Fear	Turbidity	More Recent/New Data
16-(37.3)	HAW RIVER	From a point 0.5 mile downstream of US Hwy 64 to approximately 1.0 mile below US Hwy 64	Cape Fear	pH	Inconsistent with Methods
16-(37.3)	HAW RIVER	From a point 0.5 mile downstream of US Hwy 64 to approximately 1.0 mile below US Hwy 64	Cape Fear	Turbidity	Inconsistent with Methods
16-(37.5)a1	Haw River (B. Everett Jordan Lake below normal pool elevatio	From approximately 1.0 mile below U.S. Hwy. 64 to downstream of Stinking Creek Arm	Cape Fear	pH	More Recent/New Data

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16-(37.5)a1	Haw River (B. Everett Jordan Lake below normal pool elevatio	From approximately 1.0 mile below U.S. Hwy. 64 to downstream of Stinking Creek Arm	Cape Fear	Turbidity	More Recent/New Data
16-(37.5)a2	Haw River (B. Everett Jordan Lake below normal pool elevatio	From downstream of Stinking Creek Arm to dam at B. Everett Jordan Lake	Cape Fear	pH	More Recent/New Data
16-(37.5)a2	Haw River (B. Everett Jordan Lake below normal pool elevatio	From downstream of Stinking Creek Arm to dam at B. Everett Jordan Lake	Cape Fear	Turbidity	More Recent/New Data
16-(37.5)b	Haw River (B. Everett Jordan Lake below normal pool elevatio	Robeson Creek Arm of Jordan Reservoir	Cape Fear	pH	More Recent/New Data
16-(6.5)	HAW RIVER	From a point 0.9 miles downstream of Troublesome Creek to a point 0.5 miles downstream of SR2711	Cape Fear	Turbidity	Change in asmnt Methods
16-11-(9)b	Reedy Fork (Hardys Mill Pond)	From Buffalo Creek to Haw River	Cape Fear	Zinc *	Change in asmnt Methods
16-11-14-2c	South Buffalo Creek	From US 70 to Buffalo Creek	Cape Fear	Copper*	Change in asmnt Methods
16-41-1-(11.5)a	New Hope Creek	From a point 0.3 mile upstream of Durham County SR 2220 to SR 2220	Cape Fear	Turbidity	More Recent/New Data
16-41-1-(11.5)b	New Hope Creek	From SR 2220 to I 40	Cape Fear	Turbidity	More Recent/New Data
16-41-1-(11.5)c	New Hope Creek	From I-40 to a point 0.8 mile downstream of Durham County SR 1107	Cape Fear	Turbidity	More Recent/New Data
16-41-1-12-(1)	Third Fork Creek	From source to a point 2.0 miles upstream of NC Hwy. 54	Cape Fear	Copper*	Change in asmnt Methods
16-41-1-12-(2)	Third Fork Creek	From a point 2.0 miles upstream of NC HWY. 54 to New Hope Creek	Cape Fear	Copper*	Change in asmnt Methods
16-41-1-15-2-(1)	Booker Creek (East-wood Lake)	From source to dam at Eastwood Lake	Cape Fear	Benthos	Pollutant Identified
16-41-1-17-(0.7)a	Northeast Creek	From US Hwy 55 to Durham Triangle WWTP	Cape Fear	Dissolved Oxygen	Not Required
16-41-1-17-(0.7)a	Northeast Creek	From US Hwy 55 to Durham Triangle WWTP	Cape Fear	Turbidity	More Recent/New Data
16-41-1-17-(0.7)b1	Northeast Creek	From Durham Triangle WWTP to Kit Creek	Cape Fear	Turbidity	Change in asmnt Methods
16-41-1-17-(0.7)b2	Northeast Creek	From Kit Creek to a point 0.5 mile downstream of Panther Creek	Cape Fear	Copper*	Change in asmnt Methods
16-41-1-17-(0.7)b2	Northeast Creek	From Kit Creek to a point 0.5 mile downstream of Panther Creek	Cape Fear	Turbidity	Change in asmnt Methods
16-41-2-(5.5)b	Morgan Creek	From Meeting of the Waters to Chatham County SR 1726 (Durham County SR 1109)	Cape Fear	NO2+NO3-N	More Recent/New Data

16-41-2-(9.5)	Morgan Creek (including the Morgan Creek Arm of New Hope River Arm of B. Everett Jordan Lake)	From Chatham County SR 1726 (Durham County SR 1109) to New Hope Creek Arm of New Hope River Arm of B. Everett Jordan Lake	Cape Fear	pH	Change in asmnt Methods
17-(10.5)d2	DEEP RIVER	From Gabriels Creek to Brush Creek	Cape Fear	Copper*	Change in asmnt Methods
17-(4)a	DEEP RIVER	From dam at Oakdale Cotton Mills, Inc. to SR 1113	Cape Fear	Dissolved Oxygen	More Recent/New Data
17-(4)b	DEEP RIVER	From Kivett Drive to Coltrane Mill Road	Cape Fear	Turbidity	Change in asmnt Methods
17-12b1	Haskett Creek	From SR 2149 to Asheboro WWTP Outfall Deep River	Cape Fear	Copper	Flaws
17-12b1	Haskett Creek	From SR 2149 to Asheboro WWTP Outfall Deep River	Cape Fear	Turbidity	More Recent/New Data
17-12b2	Haskett Creek	From Asheboro WWTP Outfall to Deep River	Cape Fear	Turbidity	More Recent/New Data
17-3-(0.3)	West Fork Deep River	From source to a point 0.3 mile downstream of Guilford County SR 1850	Cape Fear	Turbidity	Change in asmnt Methods
17-3-(0.7)a	West Fork Deep River(Oak Hollow Reservoir)	From a point 0.3 mile downstream of Guilford County SR 1850 to SR 1818	Cape Fear	Turbidity	Change in asmnt Methods
17-43-(5.5)a	Rocky River	Siler City upper reservoir from 0.3 miles upstream of dam to the dam- (Turner Reservoir Critical Area).	Cape Fear	Dissolved Oxygen	Change in asmnt Methods
17-43-10b2	Loves Creek	From US 421 to Siler City WWTP	Cape Fear	Dissolved Oxygen	Change in asmnt Methods
18-(16.7)	CAPE FEAR RIVER	From Lillington water supply intake to Upper Little River	Cape Fear	Copper*	Change in asmnt Methods
18-(4.5)	CAPE FEAR RIVER	From a point 0.5 mile upstream of NC Hwy 42 to NC Hwy 42 (Sanford water supply intake)	Cape Fear	Chlorophyll a	More Recent/New Data
18-(71)a1	CAPE FEAR RIVER	From upstream mouth of Toomers Cr. To Railroad bridge at Navassa	Cape Fear	Copper	Change in asmnt Methods (however, available data indicates only 1 or fewer exceedances in 3 years)
18-(71)a1	CAPE FEAR RIVER	From upstream mouth of Toomers Cr. To Railroad bridge at Navassa	Cape Fear	Turbidity	More Recent/New Data
18-(71)a2	CAPE FEAR RIVER	From Railroad bridge at Navassa to Greenfield Creek	Cape Fear	Copper	More Recent/New Data
18-(71)a2	CAPE FEAR RIVER	From Railroad bridge at Navassa to Greenfield Creek	Cape Fear	Turbidity	Change in asmnt Methods
18-(71)a3	CAPE FEAR RIVER	From Greenfield Creek to Barnards Creek	Cape Fear	pH	More Recent/New Data
18-(71)a3	CAPE FEAR RIVER	From Greenfield Creek to Barnards Creek	Cape Fear	Turbidity	More Recent/New Data

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18-(71)a4	CAPE FEAR RIVER	From Barnards Creek to 0.6 miles downstream of Barnards Creek	Cape Fear	Copper	More Recent/New Data
18-(71)a4	CAPE FEAR RIVER	From Barnards Creek to 0.6 miles downstream of Barnards Creek	Cape Fear	Turbidity	More Recent/New Data
18-(71)a5	CAPE FEAR RIVER	From 0.6 miles downstream of Barnards Creek to 1.9 miles downstream of Mott Creek	Cape Fear	pH	More Recent/New Data
18-(71)a5	CAPE FEAR RIVER	From 0.6 miles downstream of Barnards Creek to 1.9 miles downstream of Mott Creek	Cape Fear	Turbidity	More Recent/New Data
18-(71)a6	CAPE FEAR RIVER	From 1.9 miles downstream of Mott Creek to a line across the river Between Lilliput Creek and Snows Cut	Cape Fear	Dissolved Oxygen	More Recent/New Data
18-(71)a6	CAPE FEAR RIVER	From 1.9 miles downstream of Mott Creek to a line across the river Between Lilliput Creek and Snows Cut	Cape Fear	pH	More Recent/New Data
18-(71)a6	CAPE FEAR RIVER	From 1.9 miles downstream of Mott Creek to a line across the river Between Lilliput Creek and Snows Cut	Cape Fear	Turbidity	More Recent/New Data
18-(71)b	CAPE FEAR RIVER	From a line across the river between Lilliput Creek and Snows Cut to a line across the river from Walden Creek to the Basin	Cape Fear	Arsenic *	Change in asmnt Methods
18-(71)b	CAPE FEAR RIVER	From a line across the river between Lilliput Creek and Snows Cut to a line across the river from Walden Creek to the Basin	Cape Fear	Nickel *	Change in asmnt Methods
18-(87.5)a	CAPE FEAR RIVER	Prohibited area north of Southport Restricted Area and west of ICWW in Cape Fear River	Cape Fear	Arsenic *	Change in asmnt Methods
18-28ut3	Ut to Locks Creek	From source to Locks Creek	Cape Fear	Arsenic *	Change in asmnt Methods
18-28ut3	Ut to Locks Creek	From source to Locks Creek	Cape Fear	Turbidity	Change in asmnt Methods
18-28ut3	Ut to Locks Creek	From source to Locks Creek	Cape Fear	Zinc *	Change in asmnt Methods
18-68-17	Colly Creek	From source to Black River	Cape Fear	pH	Natural Conditions
18-74-(61)	Northeast Cape Fear River	From mouth of Ness Creek to Cape Fear River	Cape Fear	Copper*	Change in asmnt Methods
18-74-39a	Burgaw Creek	From source to Osgood Branch	Cape Fear	Chlorophyll a	Change in asmnt Methods
18-88-8-4-1	Fishing Creek	From source to Bald Head Creek	Cape Fear	Conditionally Approved Closed Shellfish Growing Area	More Recent/New Data

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18-88-8-4b	Bald Head Creek	From DMF SS Station B2-18Z to Cape Fear River	Cape Fear	Conditionally Approved Closed Shellfish Growing Area	More Recent/New Data
18-88-9a	Intracoastal Waterway	From Channel Marker F1, R. "22" to Dutchmans Creek outlet channel	Cape Fear	Dissolved Oxygen	More Recent/New Data
11-(117)	CATAWBA RIVER (Lake Wylie below elevation 570)	From Mountain Island Dam to Interstate Highway 85 Bridge at Belmont	Catawba	pH	More Recent/New Data
11-(37)	CATAWBA RIVER (Rhodhiss Lake below elevation 995)	From Johns River to Rhodhiss Dam	Catawba	pH	More Recent/New Data
11-113-(2)	Johnson Creek	From a point 0.6 mile upstream of mouth to Mountain Island Lake, Catawba River	Catawba	Turbidity	Change in asmnt Methods
11-119-(0.5)	Dutchmans Creek	From source to a point 0.8 mile downstream of Taylors Creek	Catawba	Turbidity	Change in asmnt Methods
11-119-3-(2)	Stanley Creek	From a point 1.0 mile upstream of Gaston County SR 1918 to Dutchmans Creek	Catawba	Dissolved Oxygen	Change in asmnt Methods
11-129-(10.5)	South Fork Catawba River	From Town of High Shoals water supply intake to a point 0.6 mile upstream of N.C. Hwy. 275	Catawba	Turbidity	Change in asmnt Methods
11-129-(14.5)	South Fork Catawba River	From a point 0.6 mile upstream of N.C. Hwy. 275 to a point 0.4 mile upstream of Long Creek (Towns of Dallas, Gastonia & Ranlo water supply intakes)	Catawba	Turbidity	Change in asmnt Methods
11-129-(15.5)	South Fork Catawba River	From a point 0.4 mile upstream of Long Creek to Cramerton Dam and Lake Wylie at Upper Armstrong Bridge	Catawba	Turbidity	Change in asmnt Methods
11-129-15-(6)	Hoyle Creek	From a point 0.2 mile downstream of Mauney Creek to South Fork Catawba River	Catawba	Fish Community	More Recent/New Data
11-129-16-(4)	Long Creek	From Mountain Creek to South Fork Catawba River	Catawba	Turbidity	Change in asmnt Methods
11-129-3-(0.7)	Pott Creek	From a point 0.3 mile upstream of Lincoln County SR 1217 to South Catawba Fork River	Catawba	Fish Community	More Recent/New Data
11-129-5-(9.5)	Clark Creek	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba R.	Catawba	Copper*	Change in asmnt Methods
11-129-5-(9.5)	Clark Creek	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba R.	Catawba	Turbidity	Change in asmnt Methods

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11-135-10-1	South Crowders Creek	From source to South Fork Crowders Creek	Catawba	Dissolved Oxygen	Change in asmnt Methods
11-135c	Crowders Creek	From State Route 1122 to State Route 1131	Catawba	Benthos	More Recent/New Data
11-135d	Crowders Creek	From State Route 1131 to State Route 1108	Catawba	Fish Community	More Recent/New Data
11-137-1	Irwin Creek	From source to Sugar Creek	Catawba	Lead *	Change in asmnt Methods
11-137-1	Irwin Creek	From source to Sugar Creek	Catawba	Zinc *	Change in asmnt Methods
11-137-8c	Little Sugar Creek	From NC 51 to North Carolina-South Carolina State Line	Catawba	Benthos	Pollutant Identified
11-138	Twelvemile Creek	From source to North Carolina-South Carolina State Line	Catawba	Copper*	Change in asmnt Methods
11-138	Twelvemile Creek	From source to North Carolina-South Carolina State Line	Catawba	Dissolved Oxygen	More Recent/New Data
11-138	Twelvemile Creek	From source to North Carolina-South Carolina State Line	Catawba	Turbidity	More Recent/New Data
11-38-35	Parks Creek	From source to Johns River	Catawba	Benthos	More Recent/New Data
11-39-(0.5)b	Lower Creek	FromZack's Fork to Caldwell County SR 1143	Catawba	Fecal Coliform	More Recent/New Data
11-76-5-(0.7)	McLin Creek	From Catawba County SR 1734 to a point 0.2 mile upstream of Catawba County SR 1722	Catawba	Benthos	More Recent/New Data
25-4-(5)	Meherrin River	From a point 1.0 mile upstream from U.S. Highway 258 to Chowan River	Chowan	Dissolved Oxygen	Change in asmnt Methods
25a2a	CHOWAN RIVER	From near Riddicksville to Deep Creek	Chowan	Cadmium *	Change in asmnt Methods
7	NOLICHUCKY RIVER	From source to North Carolina-Tennessee State Line	French Broad	Copper*	Change in asmnt Methods
5-(7)c	PIGEON RIVER (Waterville Lake below elevation 2258)	From State Route 1642 (Main Street) to Crabtree Creek	French Broad	Benthos	More Recent/New Data
5-16-(11.5)d	Richland Creek (Lake Junaluska)	Lake Junaluska	French Broad	pH	Change in asmnt Methods
5-16-(16)b	Richland Creek	From Jones Cove Branch to Pigeon River	French Broad	Benthos	More Recent/New Data
6-(1)	FRENCH BROAD RIVER	From source to Nicholson Creek	French Broad	Turbidity	Change in asmnt Methods
6-(54.75)c	FRENCH BROAD RIVER	From NC 146 to Craggy Dam	French Broad	Turbidity	Change in asmnt Methods
6-(54.75)d	FRENCH BROAD RIVER	From Craggy Dam to Fletcher Martin Road	French Broad	Turbidity	Change in asmnt Methods
6-(54.75)f	FRENCH BROAD RIVER	From Sandymush Creek to North Carolina-Tennessee State Line	French Broad	Turbidity	Change in asmnt Methods

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6-2-(0.5)b	West Fork French Broad River	From Above trout farms to below trout farm	French Broad	Benthos	More Recent/New Data
6-55d	Mud Creek	From Byers Creek to French Broad River	French Broad	Benthos	More Recent/New Data
6-57-(9)a2	Cane Creek	From Hooper Creek to Cushion Branch	French Broad	Benthos	More Recent/New Data
6-76d	Hominy Creek	From Moore Creek to French Broad River	French Broad	Turbidity	More Recent/New Data
7-2-(21.5)	North Toe River	From a point 0.2 mile upstream of Pyatt Creek to a point 0.5 mile upstream of U.S. Hwy. 19E	French Broad	Copper*	Change in asmnt Methods
1-52c	Valley River	From Venegeance Creek near Marble to Marble Creek above Murphy	Hiwassee	Turbidity	Change in asmnt Methods
2-190-(3.5)	Cheoah River	From the Town of Robbinsville's proposed water supply intake, to Mountain Creek	Little Tennessee	Turbidity	More Recent/New Data
15-25-13	Calabash River	From source to North Carolina-South Carolina State Line	Lumber	Water Temperature	More Recent/New Data
15-25-2-(10)a	Shallotte River	From a line crossing the Shallotte River from a point 948 meters north of Shell Point on the east bank across to the south mouth of Middle Dam Creek to a line crossing the Shallotte River 459 meters north of Shell Point on the east bank across to a point	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-(10)b	Shallotte River	From a line crossing the Shallotte River from Shell Point across to the Swash to the Intracoastal Waterway.	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-(10)c	Shallotte River	From a line crossing the Shallotte River 459 meters north of Shell Point on the east bank across to a point 651 meters north of the Swash to a line crossing the Shallotte River from Shell Point across to the Swash.	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-(10)d1	Shallotte River	From mouth of Mill Pond to a line crossing the Shallotte River from a point 948 meters north of Shell Point on the east bank across to the south mouth of Middle Dam Creek.	Lumber	Fecal Coliform / Conditionally Approved Open Shellfish Growing Area	TMDL Complete
15-25-2-(10)d2	The Mill Pond	From a point 1.0 mile below Brunswick County SR 1145 to Shallotte River	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete

15-25-2-11-(2)	Sams Branch	From proposed dam approximately 3/4 mile upstream from Shallotte River channel to Shallotte River (0.585717439651489 S Miles)	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-12-(2)	The Swash	From source to Shallotte River	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-14	Shallotte Creek	From Bell Branch to Shallotte River	Lumber	Fecal Coliform / Conditionally Approved Open Shellfish Growing Area	TMDL Complete
15-25-2-15-(3)	Saucepan Creek	From source to Shallotte River	Lumber	Fecal Coliform / Conditionally Approved Closed Shellfish Growing Area	TMDL Complete
15-25-2-16	Jinnys Branch	From Brunswick County SR 1143 to Saucepan Creek	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-16-1-(2)	Goose Creek	From Brunswick County SR 1143 to Saucepan Creek	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
15-25-2-16-4-(2)	Shallotte River	Hughes Marina	Lumber	Fecal Coliform / Prohibited Shellfish Growing Area	TMDL Complete
27-(104)a	NEUSE RIVER Estuary	From a line across Neuse River from Johnson Point to McCotter Point to a line across Neuse River from 1.2 miles upstream of Slocum Creek to 0.5 miles upstream of Beard Creek (middle model segment)	Neuse	Chlorophyll a **	TMDL Complete
27-(104)b	NEUSE RIVER Estuary	From a line across Neuse River from 1.2 miles upstream of Slocum Creek to 0.5 miles upstream of Beard Creek to a line across Neuse River from Wilkinson Point to Cherry Point (bend model segment)	Neuse	Chlorophyll a **	TMDL Complete
27-(118)a1	NEUSE RIVER Estuary	From a line across Neuse River from Wilkinson Point to Cherry Point to a line across the river From Adams Creek to Wiggins Point (part of lower model segment)	Neuse	Chlorophyll a **	TMDL Complete

27-(118)a2	NEUSE RIVER Estuary	From a line across Neuse RiverFrom Adams Creek to Wiggins Point to Pamlico Sound (mouth of Neuse River described as a line running from Maw point to Point of Marsh)	Neuse	Chlorophyll a **	TMDL Complete
27-(22.5)c	NEUSE RIVER	From Crabtree Creek to Auburn Knightdale Road	Neuse	Copper*	Change in asmnt Methods
27-(22.5)c	NEUSE RIVER	From Crabtree Creek to Auburn Knightdale Road	Neuse	Turbidity	More Recent/New Data
27-(36)	NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	Neuse	Copper*	Change in asmnt Methods
27-(36)	NEUSE RIVER	From mouth of Beddingfield Creek to a point 0.2 mile downstream of Johnston County SR 1700	Neuse	Zinc *	Change in asmnt Methods
27-(38.5)	NEUSE RIVER	From a point 0.2 mile downstream of Johnston County SR 1700 to point 1.4 mile downstream of Johnston County SR 1908	Neuse	Copper*	Flaws
27-(49.5)	NEUSE RIVER	From a point 1.7 miles upstream of Bawdy Creek to a point 0.5 mile upstream of Richardson Bridge Road/SR 1201	Neuse	Turbidity	Change in asmnt Methods
27-(49.75)	NEUSE RIVER	From a point 0.5 miles upstream of Richardson Bridge Road/SR 1201 to Johnston County's intake at Richardson Bridge Road/SR 1201	Neuse	Turbidity	Change in asmnt Methods
27-(50.375)a	NEUSE RIVER	From Richardson Bridge Road/SR 1201 to a point 0.75 mile upstream of Mocassin Creek	Neuse	Turbidity	Change in asmnt Methods
27-(96)b2	NEUSE RIVER Estuary	From Trent River to a line across Neuse River from Johnson Point to McCotter Point (part of upper model segment)	Neuse	Copper*	Change in asmnt Methods
27-112	Slocum Creek	From source to Neuse River	Neuse	Chlorophyll a	Change in asmnt Methods
27-128-3a	Back Creek (Black Creek)	From source to Adams Creek excluding swimming area near mouth	Neuse	Chlorophyll a	More Recent/New Data
27-135b	South River	From a line crossing the South River at a point 97 meters north of mouth of Southwest Creek to a point 418 meters north of mouth of Doe Creek t Neuse River	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data

27-137-1	Sanborns Gut	From source to Trunagain Bay	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data
27-137-2	Big Gut	From source to Turnagain Bay	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data
27-137-3	Deep Gut	From source to Turnagain Bay	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data
27-137-4	Broad Creek	From source to Turnagain Bay	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data
27-137-4-2	Parsons Creek	From source to Broad Creek	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data
27-137-5	Abraham Bay	From source to Turnagain Bay	Neuse	Conditionally Approved Open Shellfish Growing Area	More Recent/New Data
27-137-6	Tump Gut	From source to Turnagain Bay	Neuse	Conditionally Approved Open Growing Area	More Recent/New Data
27-137-7	Mulberry Point Creek	From source to Turnagain Bay	Neuse	Conditionally Approved Open Growing Area	More Recent/New Data
27-148-1-6-1a	Old Canal	From Turnagain Bay to 0.6 miles towards Stump Bay	Neuse	Conditionally Approved Open Growing Area	More Recent/New Data
27-149-1-2	Merkle Hammock Creek	From source to Thorofare Bay	Neuse	Conditionally Approved Open Growing Area	More Recent/New Data
27-149-1-3	Barry Bay	From source to Thorofare Bay	Neuse	Conditionally Approved Open Growing Area	More Recent/New Data
27-33-(3.5)a	Crabtree Creek (Crabtree Lake)	From backwaters of Crabtree Lake to Cary WWTP	Neuse	Turbidity	More Recent/New Data
27-34-(4)b	Walnut Creek	From UT 0.6 miles west of I-440 to Neuse River	Neuse	Copper*	Change in asmnt Methods

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27-43-15-(1)b2	Middle Creek	From ut on west isde of creek 3.0 miles downstream to backwaters of Sunset Lake	Neuse	Turbidity	Change in asmnt Methods
27-43-15-(1)but3	UT to Middle Creek	source to Middle Creek	Neuse	Turbidity	Change in asmnt Methods
27-43-15-(4)a1	Middle Creek	From dam at Sunset Lake to small impoundment upstream of US 401	Neuse	Turbidity	More Recent/New Data
27-45-(2)a	Black Creek	From dam at Panther Lake to 1 mile upstream of Reedy Creek	Neuse	Dissolved Oxygen	Change in asmnt Methods
27-45-(2)b	Black Creek	From 1 mile upstream of Reedy Creek to mouth of Sassarixa Creek	Neuse	Dissolved Oxygen	Change in asmnt Methods
27-5-(2)	Ellerbe Creek	From a point 0.2 mile upstream of Durham County SR 1636 to Falls Lake, Neuse River	Neuse	Zinc	Change in asmnt Methods (however, available data indicates only 1 or fewer exceedances in 3 years)
27-86-2	Moccasin Creek (Bunn Lake)	From source to Contentnea Creek	Neuse	Dissolved Oxygen	Change in asmnt Methods
30-1-6a	Coinjock Bay	Entire Bay	Pasquotank	Enterrococcus	Flaws
22-(1)b	DAN RIVER (North Carolina portion)	From Little Dan River to Peters Creek	Roanoke	Turbidity	Change in asmnt Methods
22-(38.5)	DAN RIVER	From a point 0.8 mile downstream of Matrimony Creek to Mill Branch (Town of Eden water supply intake)	Roanoke	Turbidity	Change in asmnt Methods
22-(39)a	DAN RIVER (North Carolina portion)	From Mill Branch to NC/VA crossing downstream of Wolf Island Creek	Roanoke	Turbidity	Change in asmnt Methods
22-(55.5)	DAN RIVER (North Carolina portion)	From a point approximately 0.5 mile upstream of the City of Roxboro's intake to the City of Roxboro's intake	Roanoke	Turbidity	Change in asmnt Methods
22-(55.75)	DAN RIVER (North Carolina portion)	From the City of Roxboro's intake to the last crossing of North Carolina-Virginia State Line	Roanoke	Turbidity	Change in asmnt Methods
22-27-(1.5)	Belews Creek (Kernersville Lake)	From a point 0.5 mile upstream of backwaters of Kernersville Lake to Town of Kernersville Water Supply Dam	Roanoke	Chlorophyll a	Change in asmnt Methods
22-40-(1)	Smith River	From North Carolina-Virginia State Line to a point 0.8 mile downstream of Rockingham County SR 1714 (Aiken Road)	Roanoke	Copper*	Change in asmnt Methods
22-40-(2.5)	Smith River	From a point 0.8 mile downstream of Rockingham County SR 1714 (Aiken Road) to Fieldcrest Mills Water Supply Intake	Roanoke	Copper ***	Change in asmnt Methods

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22-40-(3)	Smith River	From Fieldcrest Mills Water Supply Intake to Dan River	Roanoke	Copper ***	Change in asmnt Methods
22-58-12-6b	Marlowe Creek	From Mithcell Creek to Storys Creek	Roanoke	Copper*	Change in asmnt Methods
22-58-4-(1.4)b	South Hyco Creek (Lake Roxboro)	From 1.6 miles downstream of backwaters to dam at Lake Roxboro	Roanoke	Chlorophyll a	More Recent/New Data
23-(26)b3	ROANOKE RIVER	From Hwy 17 bridge at Williamston to the 18 mile marker at Jamesville	Roanoke	Dissolved Oxygen	More Recent/New Data
23-10c	Smith Creek	From SR1208 to North Carolina-Virginia State Line	Roanoke	Turbidity	Change in asmnt Methods
23-30b	Quankey Creek	From Little Quankey Creek to Roanoke River	Roanoke	Benthos	More Recent/New Data
28-(15.5)	TAR RIVER	From a point 0.6 mile upstream of Taylors Creek to a point 0.3 mile downstream of Coole Creek	Tar	Turbidity	More Recent/New Data
28-(64.5)	TAR RIVER	From dam at City of Rocky Mount Reservoir to Maple Creek	Tar	Dissolved Oxygen	More Recent/New Data
28-11-2	Foundry Branch	From source to Fishing Creek	Tar	Dissolved Oxygen	More Recent/New Data
28-11e	Fishing Creek	From Coon Creek to Tar River	Tar	Turbidity	Change in asmnt Methods
28-29-(2)b	Cedar Creek	From Franklinton Branch to Tar River	Tar	Turbidity	More Recent/New Data
28-79-(1)a2	Fishing Creek	From Horse Creek to Possumquarter Creek	Tar	Dissolved Oxygen	Change in asmnt Methods
28-79-(1)a3	Fishing Creek	From Possumquarter Creek to Shocco Creek	Tar	Dissolved Oxygen	More Recent/New Data
28-79-(1)b	Fishing Creek	From Wolfpit Branch Shocco Creek	Tar	Dissolved Oxygen	Change in asmnt Methods
28-87-1.2	Ballahack Canal	From source to Conetoe Creek	Tar	Turbidity	More Recent/New Data
29-(27)	PAMLICO RIVER	From a line across Pamlico River from Cousin Point to Hickory Point to a line across Pamlico River from Roos Point to Persimmon Tree Point	Tar	Copper*	Change in asmnt Methods
29-19-(5.5)	Bath Creek	From a line across Bath Creek from Long Point to Pamlico River	Tar	Chlorophyll a	More Recent/New Data
29-6-(5)	Chocowinity Bay	From a line across the Bay from the upstream mouth of Cedar Creek to the upstream mouth of Silas Creek to Pamlico River	Tar	Copper*	Change in asmnt Methods
29-9	Blounts Bay (inside a line from Hill Point to Mauls Point) (Pamlico Blounts Bay Segment)	From source to Pamlico River	Tar	Chlorophyll a	Change in asmnt Methods
18-87-22b	Pages Creek	From 0.5 miles inland of ICWW to Intracoastal Waterway	White Oak	Conditionally Approved Closed Shellfish Growing Area	More Recent/New Data

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19-(10.5)	New River	From U. S.Hwy. 17 bridge to Atlantic Coast Line Railroad Trestle	White Oak	pH	More Recent/New Data
19-(11)	New River	From Atlantic Coast Line Railroad Trestle to Mumford Point	White Oak	pH	More Recent/New Data
19-14	Wilson Bay	Entire Bay	White Oak	Copper*	Change in asmnt Methods
21-32a	Calico Creek	From source to Ut on south side of creek 0.35 miles west of SR1176 bridge.	White Oak	Fecal Coliform	Inconsistent with Methods
21-32b	Calico Creek	From Ut on south side of creek 0.35 miles west of SR1176 bridge to Newport River	White Oak	Copper*	Change in asmnt Methods
21-32b	Calico Creek	From Ut on south side of creek 0.35 miles west of SR1176 bridge to Newport River	White Oak	Dissolved Oxygen	More Recent/New Data
21-32b	Calico Creek	From Ut on south side of creek 0.35 miles west of SR1176 bridge to Newport River	White Oak	Fecal Coliform	Inconsistent with Methods
21-32b	Calico Creek	From Ut on south side of creek 0.35 miles west of SR1176 bridge to Newport River	White Oak	Turbidity	Change in asmnt Methods
21-35-7-10-4	Broad Creek (Nelson Bay)	From source to Nelson Bay	White Oak	Copper*	Change in asmnt Methods
12-(108.5)b1	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	From mouth of Grants Creek to Buck Steam Statio	Yadkin	Chlorophyll a	More Recent/New Data
12-(108.5)b1	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	From mouth of Grants Creek to Buck Steam Statio	Yadkin	Copper*	Change in asmnt Methods
12-(108.5)b1	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	From mouth of Grants Creek to Buck Steam Statio	Yadkin	Turbidity	Change in asmnt Methods
12-(108.5)b3	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	From downstream side Swearing Creek Arm to downstream side of Crane Creek Arm	Yadkin	pH	More Recent/New Data
12-(108.5)b4	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	Crane Creek Arm of High Rock Lake	Yadkin	Turbidity	Change in asmnt Methods
12-(114)b2	YADKIN RIVER (including lower portion of High Rock Lake)	Lower Abbots Creek Arm Above NC 8	Yadkin	pH	More Recent/New Data

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12-(114)b3	YADKIN RIVER (including lower portion of High Rock Lake)	Lower Flat Swamp Creek Arm above railroad bridge	Yadkin	pH	More Recent/New Data
12-(124.5)a	YADKIN RIVER (including lower portion of High Rock Lake)	From a point 0.6 mile upstream of dam of High Rock Lake to High Rock Dam	Yadkin	pH	More Recent/New Data
12-(124.5)b	YADKIN RIVER (including upper portion of Tucktertown Lake)	From High Rock Dam to mouth of Cabin Creek	Yadkin	Chlorophyll a	Change in asmnt Methods
12-(124.5)b	YADKIN RIVER (including upper portion of Tucktertown Lake)	From High Rock Dam to mouth of Cabin Creek	Yadkin	Dissolved Oxygen	More Recent/New Data
12-(38)b	YADKIN RIVER	From Reddies River to Mulberry Creek	Yadkin	Copper*	Change in asmnt Methods
12-(53)	YADKIN RIVER	From a point 0.3 mile upstream of the mouth to Elkin Creek (River) to a point 0.3 mile upstream of Ararat River	Yadkin	Turbidity	Change in asmnt Methods
12-108-16-(0.5)b1	Hunting Creek	From Little Hunting Creek to North Little Hunting Creek	Yadkin	pH	Change in asmnt Methods
12-108-16-(0.5)b2	Hunting Creek	From North Little Hunting Creek to a point 1.1 miles upstream of Davie County SR 1147	Yadkin	pH	Change in asmnt Methods
12-108-18-(3)	Bear Creek	From a point 0.2 mile downstream of U.S. Hwy. 64 to South Yadkin River	Yadkin	Copper*	Change in asmnt Methods
12-108-18-(3)	Bear Creek	From a point 0.2 mile downstream of U.S. Hwy. 64 to South Yadkin River	Yadkin	Fish Community	More Recent/New Data
12-108-20-4a1	Third Creek	From source to I77	Yadkin	Turbidity	Change in asmnt Methods
12-108-20-4a2	Third Creek	From I77 to SR 2359	Yadkin	Turbidity	Change in asmnt Methods
12-108-21a	Second Creek (North Second Creek)	From source to Withrow Creek	Yadkin	Turbidity	Change in asmnt Methods
12-108-21c	Second Creek (North Second Creek)	From Beaverdam Creek to South Yadkin River	Yadkin	Turbidity	Change in asmnt Methods
12-117-(3)a	Second Creek Arm of High Rock Lake	From a point 1.7 miles downstream of Rowan County SR 1004 to SR1002	Yadkin	pH	More Recent/New Data
12-118.5b	Abbotts Creek Arm of High Rock Lake	From NC 47 to Davidson County SR 2294	Yadkin	Turbidity	More Recent/New Data
12-119-(4.5)	Abbotts Creek (including Lexington-Thomasville Water Supply Reservoir at normal reservoir elevation, Tom-A-Lex Lake)	From a point 0.5 mile upstream of Davidson County SR 1810 to the upstream side of culvert at U.S. Hwys. 29 & 70	Yadkin	Chlorophyll a	More Recent/New Data
12-119-(6)b	Abbotts Creek	From SR1243 toI85	Yadkin	Turbidity	More Recent/New Data
12-119-7a	Rich Fork	From source to Payne Creek	Yadkin	Turbidity	Change in asmnt Methods

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12-63-(9)a	Fisher River	From Town of Dobson water supply intake to Little Fisher Creek	Yadkin	Turbidity	Change in asmnt Methods
12-63-(9)b	Fisher River	From Little Fisher Creek to Yadkin River	Yadkin	Turbidity	Change in asmnt Methods
12-67a	East Double Creek	From source to upstream of SR2235	Yadkin	Fecal Coliform	More Recent/New Data
12-72-14-5b	Heatherly Creek	From NC 268 to Toms Creek	Yadkin	Benthos	More Recent/New Data
12-72-8-(3)	Lovills Creek (Lovell Creek)	From Town of Mount Airy Water Supply Dam to Ararat River	Yadkin	Benthos	More Recent/New Data
12-84-1-(0.5)a	North Deep Creek	From source to Haw Branch	Yadkin	Turbidity	More Recent/New Data
12-94-(0.5)a	Muddy Creek	From source to Mill Creek #3	Yadkin	Benthos	More Recent/New Data
12-94-(0.5)b2a	Muddy Creek	From Mill Creek to Silas Creek	Yadkin	Copper	Flaws
12-94-(0.5)b2a	Muddy Creek	From Mill Creek to Silas Creek	Yadkin	Zinc	Flaws
12-94-(0.5)b2b	Muddy Creek	From Silas Creek to SR 2995	Yadkin	Copper*	Change in asmnt Methods
12-94-12-(1)a	Salem Creek (Middle Fork Muddy Creek, Salem Lake)	Kerners Mill Creek Arm	Yadkin	Chlorophyll a	More Recent/New Data
12-94-12-(4)a	Salem Creek (Middle Fork Muddy Creek)	From Winston-Salem Water Supply Dam (Salem Lake) to Burke Creek.	Yadkin	Copper	Flaws
12-94-12-(4)a	Salem Creek (Middle Fork Muddy Creek)	From Winston-Salem Water Supply Dam (Salem Lake) to Burke Creek.	Yadkin	Zinc	Flaws
12-94-12-(4)b	Salem Creek (Middle Fork Muddy Creek)	From Burke Creek to SR1120	Yadkin	Copper*	Change in asmnt Methods
12-94-12-(4)b	Salem Creek (Middle Fork Muddy Creek)	From Burke Creek to SR1120	Yadkin	Zinc *	Change in asmnt Methods
12-94-12-(4)c	Salem Creek (Middle Fork Muddy Creek)	From SR1120 to Muddy Creek	Yadkin	Copper*	Change in asmnt Methods
13-(34)a	PEE DEE RIVER	From Blewett Falls Dam to mouth of Hitchcock Creek	Yadkin	Dissolved Oxygen	More Recent/New Data
13-17-17	Clear Creek	From source to Rocky River	Yadkin	Turbidity	Change in asmnt Methods
13-17-18a	Goose Creek	From source to SR 1524	Yadkin	Turbidity	More Recent/New Data
13-17-20	Crooked Creek	From source to Rocky River	Yadkin	Turbidity	Change in asmnt Methods
13-17-20-1	North Fork Crooked Creek	From source to Crooked Creek	Yadkin	Turbidity	Change in asmnt Methods
13-17-31-1	Little Long Creek	From source to Long Creek	Yadkin	Benthos	More Recent/New Data
13-17-36-(3.5)b	Richardson Creek (Lake Lee)	Entire Reservoir	Yadkin	pH	Change in asmnt Methods
13-17-36-(5)a1b	Richardson Creek	From Stewarts Creek to Watson Creek	Yadkin	Copper ***	Change in asmnt Methods
13-17-36-(5)a2	Richardson Creek	From Watson Creek to Salem Creek	Yadkin	Copper*	Change in asmnt Methods
13-17-36-9-(4.5)	Stewarts Creek [Lake Twitty (Lake Stewart)]	From a point 0.4 mile downstream of mouth of Stumplick Branch to Union County SR 1681 (City of Monroe water supply intake)	Yadkin	Copper ***	Flaws

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13-17-36-9-(4.5)	Stewarts Creek [Lake Twitty (Lake Stewart)]	From a point 0.4 mile downstream of mouth of Stumplick Branch to Union County SR 1681 (City of Monroe water supply intake)	Yadkin	Dissolved Oxygen	More Recent/New Data
13-17-40-(1)	Lanes Creek	From source to Marshville Water Supply Dam (located 0.1 mile downstream of Beaverdam Creek)	Yadkin	Turbidity	More Recent/New Data
13-17-40-11	Beaverdam Creek	From source to Lanes Creek	Yadkin	Copper*	Change in asmnt Methods
13-17-5b	Mallard Creek	From 0.2 miles downstream of Stoney Creek to Rocky River	Yadkin	Turbidity	More Recent/New Data
13-17-6-(5.5)	Coddle Creek	From a point 0.2 mile upstream of N.C. Hwy. 73 to Rocky River	Yadkin	Turbidity	More Recent/New Data
13-17-8a	Reedy Creek	From source to McKee Creek	Yadkin	Fish Community	More Recent/New Data
13-17-9-(2)	Irish Buffalo Creek	From Kannapolis Water Supply Dam to Rocky River	Yadkin	Copper*	Change in asmnt Methods
13-17-9-(2)	Irish Buffalo Creek	From Kannapolis Water Supply Dam to Rocky River	Yadkin	Turbidity	Change in asmnt Methods
13-17-9-4-(1.5)	Cold Water Creek	From dam at Lake Fisher to Irish Buffalo Creek	Yadkin	Benthos	More Recent/New Data
13-17-9-4-(1.5)	Cold Water Creek	From dam at Lake Fisher to Irish Buffalo Creek	Yadkin	Fish Community	More Recent/New Data
13-17-9-4-(1.5)	Cold Water Creek	From dam at Lake Fisher to Irish Buffalo Creek	Yadkin	Turbidity	More Recent/New Data
13-17a	Rocky River	From source to Clarke Creek	Yadkin	Turbidity	Change in asmnt Methods
13-17b1	Rocky River	From Clarke Creek to Mallard Creek	Yadkin	Copper ***	Flaws
13-17b3	Rocky River	From Reedy Creek to Irish Buffalo Creek	Yadkin	Copper ***	Flaws
13-17b3	Rocky River	From Reedy Creek to Irish Buffalo Creek	Yadkin	Turbidity	More Recent/New Data
13-17c1	Rocky River	From the Irish Buffalo Creek to Hamby Branch	Yadkin	Turbidity	Change in asmnt Methods
13-17c1	Rocky River	From the Irish Buffalo Creek to Hamby Branch	Yadkin	Zinc	Flaws
13-17c2	Rocky River	From Hamby Branch to Anderson Creek	Yadkin	Copper*	Change in asmnt Methods
13-17c2	Rocky River	From Hamby Branch to Anderson Creek	Yadkin	Zinc	Change in asmnt Methods (however, available data indicates only 1 or fewer exceedances in 3 years)
13-17c3	Rocky River	From Anderson Creek to Lanes Creek	Yadkin	Copper*	Change in asmnt Methods
13-17c3	Rocky River	From Anderson Creek to Lanes Creek	Yadkin	Turbidity	Change in asmnt Methods
13-17c3	Rocky River	From Anderson Creek to Lanes Creek	Yadkin	Zinc *	Change in asmnt Methods
13-17d	Rocky River	From the Lanes Creek to the Pee Dee River	Yadkin	Copper*	Change in asmnt Methods

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13-2-3-3-(0.7)	Back Creek (Back Creek Lake)	From a point 1.0 mile downstream of Randolph County SR 1504 to dam at Back Creek Lake (City of Asheboro water supply intake)	Yadkin	Chlorophyll a	Change in asmnt Methods
13-2-3-3-2-2-(2)	Unnamed Tributary to Cedar Fork Creek (Lake Bunch)	From a point 1.1 miles upstream of mouth to Cedar Fork Creek (City of Asheboro water supply intake)	Yadkin	Chlorophyll a	Change in asmnt Methods

* Failure to demonstrate good cause: added to the 2014 Section 303(d) List by the EPA
** These waterbody/ pollutant combinations were in Category 4t already (TMDL approved 2002)
*** These waterbody/pollutant combinations have been placed on a list for high priority followup monitoring (see Appendices E and F)

Delisting Justifications	
Change in asmnt Methods	Change in Assessement Methods per NC Environmental Management Commission in 2013.
More Recent/New Data	The assessment and interpretation of more recent or more accurate data in the record demonstrate the parameter of interest is meeting criteria
Pollutant Identified	Moved to Category 4s. Pollutant causing impairment identified. TMDL implementation will result in attainment of water quality standards
Flaws	Flaws in the original analysis of data and information led to assessment being incorrectly listed in Category 5
TMDL Complete	TMDL completed and approved by EPA
Inconsistent with Methods	Previous listing in Category 5 was inconsistent with the assessment methodology. Available data insufficient to determine attainment status
Not Required	Moved to Category 4c - A use is impaired, but the impairment is not caused by a pollutant.
Natural Conditions	Determination that exceedances of the parameter of interest are due to natural conditions