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Meeting minutes

The first meeting of the Scientific Advisory Council (SAC) was held on May 6, 2015 from 9:00am – 3:00pm at the Rural Center, 4021 Cary Drive, Raleigh, NC 27610.

1. Introductions
 - a. [SAC members](#) and audience attendees provided names and affiliations.
2. Agenda review (Andy Sachs, SAC facilitator)
 - a. [Agenda](#)
3. Welcome (Jay Zimmerman, NC Division of Water Resources (DWR) director)
 - a. SAC members were thanked for their participation. The importance of the nutrient criteria development process was highlighted.
4. Overview (Steve Kroeger, DWR Water Sciences Section supervisor)
 - a. [The Nutrient Criteria Development Plan \(NCDP\)](#) provides a 10-year timeframe with goals for water body types and specific water bodies within each type, toward the ultimate development of numeric nutrient criteria for all bodies of surface water in NC by 2025.
 - i. Reservoirs and Lakes – High Rock Lake
 - ii. Estuaries – Albemarle Sound
 - iii. Rivers and Streams – Central Cape Fear River
 - b. Steve Kroeger is the NCDP Project Manager. Partners within DWR include staff working on water quality standards (Jeff Manning, Connie Brower and Chris Ventaloro), modeling (Pam Behm), NPDES permitting (Mike Templeton), nonpoint source issues (Rich Gannon and John Huisman) and water sciences (Carrie Ruhlman and Tammy Hill). The Albemarle-Pamlico National Estuary Partnership is also a partner (Jim Hawhee).
 - c. What DWR needs from the SAC:
 - i. Recommend scientifically defensible and economically feasible numeric nutrient criteria that
 1. Protect designated uses
 2. Protect uses before adverse conditions occur
 3. Protect downstream uses
 - ii. The SAC should focus on science. Another committee, the Criteria Implementation Committee (CIC) is being formed to focus on implementation of nutrient criteria. Regular communication between the two committees is expected to ensure that resulting criteria are both scientifically valid and implementable.
 - d. DWR information
 - i. The DWR includes regulatory (e.g. permitting) and non-regulatory (e.g. monitoring) activities. An overview of monitoring programs and available data will be presented at the next SAC meeting.
 - ii. DWR staff will provide as much support as possible to the SAC, including providing chemical, physical and biological monitoring data and explanations, coordination of meeting venues, a website with records and links to information, and a system for tracking publications of interest (based on input from SAC members).

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- e. Several resources were highlighted.
 - i. NC Nutrient Criteria Development [webpage](#)
 - ii. EPA [N-STEPS Program](#)
- 5. Tracking and Sharing Relevant Publications
 - a. MS EndNote, Zotero and Mendeley were discussed as examples of reference management software programs that could be utilized to catalog relevant published documents. Documents may be made available to SAC members and the public, depending upon copyright considerations.
- 6. Break
- 7. Housekeeping (Andy Sachs, SAC facilitator)
 - a. SAC members discussed how their work might contribute to the SAC's mission.
 - b. Discussion and expansion of Ground Rules ([Draft](#))
 - i. In-person meeting attendance will maximize SAC efficiency and productivity. If a member is unable to attend in person, s/he may participate via conference call, webinar or Skype. SAC members may designate an alternate with similar expertise. This should be arranged in advance with Steve Kroeger, and it is recommended that the alternate begin attending meetings ahead of acting as a member in order to become familiar with SAC processes.
 - ii. Relevant speakers can be invited by SAC members to address the SAC as needed.
 - iii. There should be no sidebar discussions among SAC members or the audience. These can distract others from the process.
 - iv. Speak up in order to be heard by all SAC members, as well as audience and webinar attendees.
 - v. DWR staff will keep meeting minutes and circulate to SAC members prior to posting online.
 - c. Review and discussion of [Draft Charter](#)
 - i. Clarify numbers of SAC members denoted on pages 1 (9-12 members) and 2 (8-10 members, a subset of the 9-12).
 - ii. The Charter should reflect the ongoing communication between the SAC and the CIC.
 - d. Meeting schedule
 - i. In-person meetings will occur approximately every other month, with shorter conversations in between via conference call and/or email to maintain momentum. Meetings should generally be held in the Raleigh area due to its central location. The length of meetings will vary as needed to cover topics currently being discussed by the SAC. DWR will establish an online poll to determine a standard meeting time that works for SAC members.
 - ii. Upcoming meeting topics
 - 1. Approaches to numeric nutrient criteria development
 - 2. What other states have done (successful processes are more important to note than the actual criteria outcomes)

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3. Current scientific literature
4. A primer for each water body type and example
 - a. System dynamics, drivers and biological effects
 - i. Characteristics (e.g. turbidity, color, light) influencing behavior of nutrients; interactions between physical drivers and nutrients
 - b. History of research and management actions
 - c. Synthetic analysis, available data and gaps (e.g. loading), available literature
 - d. Designated uses, rationale for impairment and management endpoints
 - e. The domain for expression of criteria
8. Lunch Break
9. History of Nutrient Criteria Development in NC (Connie Brower, DWR)
 - a. EPA's recommendations for [ecoregional nutrient criteria](#) developed during 2000-2003. Based on this approach, the recommended chlorophyll-*a* criterion for the North Carolina Piedmont was 4.93 µg/L, while NC's standard is 40 µg/L.
 - b. **Water Quality Standards** define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollutants. A Standard includes four components:
 - i. The designated uses of the water: public water supply, recreation, propagation of aquatic life/wildlife, irrigation
 - ii. The water quality criteria: specifies the amounts of various pollutants that may be present in those waters without impairing the designated uses. Criteria include one or more of three components: magnitude, duration and frequency. Criteria may be numeric and/or narrative.
 - iii. Antidegradation: requirements to maintain and protect uses and high quality waters
 - iv. General policies: address implementation issues (e.g. low flows, variances, mixing zones)
 - c. NC water quality standards related to the NCDP response variables
 - i. Chlorophyll-*a*
 1. 40 µg/L in Class C waters (all NC waters)
 2. 15 µg/L in Trout waters
 3. These standards may or may not be protective of all waters. Studies were conducted with [WRRRI](#) and others. See [March 2001 write-up](#).
 - ii. Dissolved oxygen
 1. 5.0 mg/L in Class C waters
 2. 6.0 mg/L in Trout waters
 - iii. pH
 1. 6.0 -9.0 in all fresh waters
 - iv. Turbidity

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1. 50 NTUs/25 NTUs (narrative standard)
 - d. Current goal for SAC: Science-based criteria for any parameters that the SAC determines will be helpful for controlling nutrient-related issues in NC waters.
 - i. Magnitude, duration and/or frequency may be applied in this process. EPA encourages states to define all three in new standards.
 - e. Determination of impairment of a designated use depends on parameter. Generally, NC applies an assessment of the last five years of data, determining impairment with greater than 10% exceedance of a standard with at least 90% statistical confidence. *{Post-meeting information item: The [2016 303\(d\) listing methodology](#) was approved by the Environmental Management Commission (EMC) on May 14, 2015.}*
10. Nutrient Criteria Development Process (Carrie Ruhlman, DWR)
 - a. Please see [flowchart](#) for an overview of a process to achieve the goal of scientifically sound, defensible, economically feasible nutrient criteria.
 - b. DWR needs the SAC to develop and evaluate potential criteria to protect designated uses and achieve management goals for NC water. Criteria may be numeric and/or narrative and must be measurable.
 - c. Several approaches may be applied during criteria development. These approaches, and the data needs related to each, will be explored in more depth during a future SAC meeting.
 - i. Reference condition
 - ii. Stressor-response
 - iii. Mechanistic modeling
 - iv. Weight-of evidence
 - v. Best professional judgment
 - vi. Others
 - d. DWR needs the CIC to consider options for implementation of criteria developed by the SAC. This will be a cooperative, iterative process to discuss pros and cons, feasibility, costs and benefits of proposed criteria.
 - e. At the end of the process, the most scientifically defensible, economically feasible criteria will be selected. The DWR will work with the NC Environmental Management Commission (EMC) toward water quality standards rule adoption.
11. Break
12. High Rock Lake: [Background and Existing Information](#) (Pam Behm, DWR)
 - a. High Rock Lake differs from other NC waters in the development of nutrient-related criteria in that models have already been developed and evaluated.
 - b. The High Rock Lake watershed is ~4000 square miles, lake surface area is ~24 square miles, the Yadkin River dominates its flow, and retention time is ~15-30 days. Dam construction was completed in 1928, and is owned and operated by Alcoa Power Generating, Inc.
 - c. Water quality classifications: Please see [classification explanations](#) and [current water quality standards](#) .
 - i. High Rock Lake is classified as a Water Supply. Various sections of the lake are classified WS-IV B CA, WS-IV B, WS-V B, and WS-V.

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- ii. Class C standards also apply in all NC waters to protect uses such as secondary recreation, fishing, wildlife, fish propagation, survival and maintenance of biological integrity. Current impairments in High Rock Lake are based on Class C standards and include turbidity, high pH and chlorophyll-*a*.
- d. Maintenance of biological integrity will likely be discussed repeatedly during the criteria development process. Biological integrity is defined in NC administrative code 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.
 - i. High Rock Lake is known for sport fishing.
- e. Impairments
 - i. Eutrophication issues on High Rock Lake have been documented since the 1970s.
 - ii. Algal blooms on the lake are almost always dominated by blue-green algae. Algal data for High Rock Lake, as well as the statewide NC algal monitoring program, will be presented at a future SAC meeting.
 - iii. Most of High Rock Lake is impaired for chlorophyll-*a*. Sections along the main stem are additionally impaired for turbidity and/or high pH.
- f. Models have been developed for High Rock Lake, and will be presented in greater depth at a future SAC meeting.
 - i. Watershed model (nutrient inputs, landscape considerations, loading by source)
 - ii. Nutrient Response Model (chlorophyll-*a* prediction; what reductions in nitrogen and/or phosphorus loading are necessary to achieve water quality standards in the lake?)
 - iii. Models were developed by Tetra Tech. A voluntary Technical Advisory Committee (TAC) of stakeholders, EPA and DWR were involved with model selection, review and revision processes.
 - iv. An intensive monitoring study during 2008-2010 produced over 80,000 data points. Forty-five sampling events occurred at 10 in-lake stations: 5 on the main stem, 5 on arms of the lake. Data collection included chlorophyll-*a*, algal assemblage composition, nutrients, suspended sediment and physical parameters such as temperature. The intensive monitoring data report is located [here](#).
 - v. Limiting nutrients – in general:
 - 1. Upper Lake – light
 - 2. Middle Lake – co-limitation by nitrogen and phosphorus
 - 3. Forebay – phosphorus, with brief periods of nitrogen limitation
 - vi. SAC discussion about the models
 - 1. The watershed model used was Hydrological Simulation Program – FORTRAN (HSPF).
 - 2. The hydrodynamic model used was the 3-dimensional Environmental Fluid Dynamics Code (EFDC), time series based. It was coupled with the water quality model Water Quality Analysis Simulation Program (WASP).

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3. High Rock Lake stratifies in the summer and is more mixed in the winter.
- vii. Questions for the SAC, given that High Rock Lake nutrient management strategy development began in 2005 and models have been developed to address existing chlorophyll-*a* impairment.
 1. What concentration, frequency and/or duration of chlorophyll-*a* is right to protect aquatic life? How to determine the appropriate N & P?
 2. Is a response indicator of chlorophyll-*a* standard enough? Are other causal or response indicators appropriate?
 3. Are the resulting criteria translatable to other lakes?
- g. High Rock Lake information and reports are available [here](#).
- h. SAC discussion and questions
 - i. Where in the water column is water released from the dam?
 - ii. Are there data from the time of lake impoundment? Are there maps of land use changes over time?
 - iii. What are the human health impacts of algal populations (e.g. potential exposure to algal toxins)? Are algal toxin data available?
 1. DWR response: In general, we haven't seen high concentrations of algal toxins in Piedmont lakes, even with high concentrations of blue-green algae, but it's important to note that DWR does not usually monitor for toxicity.
 2. SAC follow-up question: Why not? What mechanism is limiting production of toxins?
 - iv. Has there been any use of remote sensing to map contours of impairment?
 1. DWR response: not yet, but this is being discussed for the future.
 - v. Additional things to consider:
 1. Bioaccumulation of toxins in fish
 2. All levels of the food web
 3. Frequency of contact dermatitis
 4. Dissolved oxygen and its effects on the ecosystem
 5. What kind(s) of N and P are we discussing, and how does the model handle these?
 6. Do we need to consider a gradient of impairment, especially in relation to reference condition based criteria development approaches?

13. Next steps

- a. Next 2 meetings and topics
 - i. DWR will circulate dates in June, July and August. SAC hopes to find 2 dates that work for all to meet.
 - ii. Topics to be discussed at subsequent meetings include:
 1. High Rock Lake data (including algae) and modeling
 2. Other state's nutrient criteria development
 3. DWR data and monitoring programs
 4. Nutrient criteria development approaches