NC Nutrient Criteria Development Plan – Scientific Advisory Council (meeting #4) 10/14/2015

Attendees

SAC members in attendance:

- Marcelo Ardon
- Bill Hall
- Lauren Petter
- David Kimmel
- Martin Lebo
- Linda Ehrlich
- Clifton Bell
- Deanna Osmond
- Michael O'Driscoll
- Hans Pearl (and alternate Nathan Hall)
- James Bowen
- Rich McLaughlin

SAC meeting facilitator:

- Andy Sachs

NCDENR NCDP Team members in attendance:

- Steve Kroeger
- Carrie Ruhlman
- Tammy Hill
- Mike Templeton
- Connie Brower
- Pam Behm
- Jing Lin
- Christopher Ventaloro
- Jeff Manning
- Jucilene Hoffman
- Jim Hawhee
- Cyndi Karoly
- Jennifer Schmitz

CIC members in attendance:

- Andy McDaniel
- Anne Coan

Others - Online:

- Tim Spruill
- Trish D'Arconte

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Meeting notes

All questions, comments and answers are paraphrased

Contents

1. **Convene** (Andy Sachs)
    a. SAC members, DWR staff and audience attendees provide names and affiliations.
    b. Facilitator asks for approval on meeting notes from 3rd SAC meeting.
    c. Facilitator reminds SAC that current ground rules allow members to invite audience members to speak if they desire and, that SAC members should decide as a group to allow audience members to participate in discussions.
2. **High Rock Lake Review from August 18th SAC meeting** (Steve Kroeger & Carrie Ruhlman)
    a. Briefly reviewed the following topics discussed during the August 18th meeting:
        i. HRL Watershed Model
        ii. HRL Nutrient Response Model
        iii. HRL Classifications, Designated Uses & Impairments

iv. Discussion/Brainstorming session

b. Developing a Water Quality Goal – Questions & Thoughts
   i. How do we get to a goal?
   ii. Is the existing condition in HRL actually a problem?
   iii. Show us the impairment to the designated uses!
   iv. Is there an actual impairment to aquatic life?
      1. Chlorophyll-a indicates "yes"
      2. High pH indicates "yes"
   v. Need to list all uses for a water quality goal.
   vi. Need to understand what is appropriate for the system.

c. Review the HRL Water Quality Goal as established by the SAC
   i. Goal:

      "To provide for the protection of designated uses in the HRL reservoir by defining and proposing the appropriate level of algal related indicators for each of the following:
      - *Aquatic Life*
      - *Fishing*
      - *Fish Consumption*
      - *Wildlife*
      - *Secondary Recreation (e.g. wading, boating)*
      - *Agricultural Uses (e.g. irrigation)*
      - *Water Supply*
      - *Lower Lake: Primary Recreation – full human body contact (i.e. swimming, water skiing)"*

   ii. Indicators & Criteria
      1. Use monitoring to provide info on current conditions.
         - Acknowledge that we may need to consider altering our monitoring based on the recommendations that the SAC proposes.
      2. Establish a baseline for current conditions.
      3. What information do we have for HRL that can link:
         - Toxins
         - Excessive biomass
         - Impacts to indigenous populations
   iii. Potential indicators (as decided on by the SAC):
      1. Aquatic Life
         - pH, DO, Algal toxins, biovolume
      2. Fishing
         - Quality of fishery
      3. Recreational
         - Algal toxins, cyanobacteria density, reported incidents of adverse impacts
      4. Water Supply

- Algal toxins, taste & odor

iv. Review of Chesapeake Bay presentation given by Rich Batiuk (US EPA) at the September 25th CIC meeting.
    1. Approach focused on public buy-in to garner support for multi-state rulemaking.
    2. Played segment focused on designated uses (starting at 1:18).
        - Reviewed the designated uses.
        - Discussed DO, clarity and algal biomass as indicators.
        - Discussed the Chesapeake Technical Support Document (TSD).
        - *SAC+DWR - develop a TSD for HRL!!!*
    3. Played segment on criteria (starting at 2:34).
        - Interesting that there is no mention of developing criteria for either N or P.

v. Reviewed the causal and response variables as discussed in the NCDP (June 2014) document.
    1. Stress that we view these as relational and not as separate from one another.

vi. Questions/comments:
    1. Is the portion of the Yadkin River entering HRL monitored monthly?
        - Answer: Yes
    2. How does river/stream monitoring frequency differ from lake/reservoir monitoring?
        - Answer: Rivers/streams are monitored monthly while lakes/reservoirs are monitored every 5-years during basinwide assessments.
    3. It is complicated trying to incorporate load versus response variables along a watershed.
    4. Chesapeake Bay program started with an overview of the resource.
    5. The effort in the Chesapeake has the advantage of having a great deal of money, time and data that have made it possible for them to support the regulatory decisions that they have made.
    6. The Chesapeake used a simple model that laypeople could understand and support. How could we explain the HRL system to the general population to garner this same support?
    7. What needs to be managed in the different zones of HRL?
        - Answer: Much of this has already been discussed in past presentations by Pam B. and Jing L.

3. **High Rock Lake Criteria Brainstorming Session** (SAC members, Andy Sachs, Carrie Ruhlman, Connie Brower)
    a. Possible criteria and selected indicators from brainstorming session:
        i. Chlorophyll-a
            1. Responds to a system's existing nutrients levels.
            2. Represents the trophic state/productivity/health of a system.
                - Represents the overall phytoplankton population
                - Represents the food web associated with the system.
                - Related to overall health of fishery.
            3. Can possibly be used as a surrogate for toxicity if we understand the relationship between chlorophyll-a levels and toxicity occurrence/concentration.
            4. Can correlate to other events such as:
                - Predicting the likelihood of blooms and/or occurrence of high cyanobacteria concentrations.
                - Seasonality - Exceedances often occur in winter.
                - Aesthetics – How green is the water and is it too green?
            5. Is well suited for long-term monitoring.
                - It's easy to monitor.
                - Can be measured year round in North Carolina.
                - Remote sensing can be used to supplement monitoring.
                - Has standardized laboratory methodology.
            6. Relates to other criteria.
                - Is associated with and influences other response variables such as turbidity, pH and DO.
                - Can use modeling to establish boundaries for other criteria (ex: maximum pH or DO levels) that may predict high chlorophyll-a events.
            7. Can be used to develope more flexible criteria:
                - Have numeric criteria defined by additional narrative language.
                - Incorporate range (Magnitude, Frequency, Duration)
                - Establish criteria that incorporate an average and maximum (not to exceed) value.
                - Incorporate other criteria into chlorophyll-a criteria (pH, DO)
                - Multiple ways to analyze data – µg/L vs. weight/volume.
            8. Further questions/to-do list:
                - What correlations can we make?
                - Use modeling to suggest bounds.
                - Use NSTEPS/TetraTech lakes report as information source.
                - Look at other lakes for comparison.

ii. Algal Assemblages
    1. Need to become more familiar with the algal community in HRL to be better able to make correlations between chlorophyll-a and food web value and cyanotoxins.
        - SAC members should review past SAC presentations for information on algal species in HRL.
        - Relate chlorophyll-a and assemblage relationships to existing seasonal data related to species composition and chlorophyll-a levels.
        - Biovolume is a good predictor of primary production.
        - What about other chlorophyll types?
    2. Food web value
        - Can we identify "good" and problematic assemblages in advance?
        - Blooms may shift assemblage populations and impact food web value.
        - Can we perform an assessment of zooplankton in HRL?
    3. A narrative criteria would be well supported by knowledge of HRL algal assemblages.
        - Possible establish an assemblage threshold, based on chlorophyll-a, above which we would expect to see a negative impact on the availability of food species.
            i. Any threshold value would need to be critically examined.
            ii. Would also need to account for the duration of any shift that occurs.

iii. pH
    1. pH is affected by the concentration of chlorophyll-a in the middle to lower part of the lake.
    2. May need to change the existing pH standard range to be specific to HRL
    3. What would be required to change the existing pH standard?
        - Would need to be able to demonstrate that the existing uses could still be maintained.
        - Would need the approval of EPA.
    4. To do:
        - Further examine the correlation between chlorophyll-a and pH.

iv. Dissolved Oxygen
    1. Some factors relevant to HRL:
        - Bottom DO and other physical factors are important in HRL.
        - Look into Lake Erie as a source of information.
        - Could we effectively manage DO at HRL?
        - There exists a diurnal range due to man-made sources.

2. How to measure:
    - Look at other water body projects for guidance (Lake Erie; Lake Erie is not being recommended as a model for HRL).
    - Identify what organisms are affected by DO (fish are mobile and can travel to areas with better DO).
3. Is there information on effects of DO on macroinvertebrates?
4. What about zonation?
    - Establish worst-case scenarios across contours and spatial variations.
    - Examine the tributaries.

v. Toxins

1. Focus only on biological toxins.
    - Species that can produce toxins don't necessarily do so.
        i. Establish a relationship between toxin production and nutrient and/or photic levels.
        ii. Screening methods are becoming less expensive.
        iii. Utilizing screening tools may be the best approach in HRL given DWR and DHHS limitations.
2. Examine potential for various impacts:
    - Impact to human health.
    - Impact to wildlife and agricultural animal health.
    - Impact to plankton community.
    - Ripple effects up through food chain.
3. Role in criteria development:
    - There is not enough data to establish a numeric standard.
    - Would be better to include as part of a narrative standard.
        i. Note the many different types of toxins in the narrative standard.

vi. Aesthetics

1. Can be related to designated uses such as primary and secondary recreation and water supply.
    - Keep in mind that HRL is a potential water supply.
    - Taste and odor must be accounted for.
    - Also, account for subjective "funkiness".
    - Violation of aesthetics is subjective and may be complaint-driven.
2. Monitoring:
    - Look at frequency, duration and magnitude of scum and floating mats.
    - Develop a visual/ordinal scale.

vii. Quality of HRL fishery
    1. Important existing use.
    2. How do we measure to figure out if the use is being met?
    3. Must consider the health of both individual fish as well as the community as a whole.
        - Occurrence of disease (Red Sore Disease, others?)
    4. To-do:
        - Request Lawrence Dorsey (Fisheries Biologist, Wildlife Resources Commission) provide information related to the state of the fishery in HRL.

viii. Water Clarity
    1. Role in developing criteria:
        - Is related to sediment type, chlorophyll levels, water color, plankton communities, and presence of macrophytes.
        - Plays a fundamental role in the overall health of the aquatic community by controlling the light available in the water column for primary production.
        - Also directly effects higher trophic level species by potentially interfering with feeding and reproduction bahaviors.
        - Correlated to chlorophyll, total suspended solids, and algal production.
        - Important consideration for water supplies and recreation.
        - Is a key component in aesthetics.
    2. Easy to measure:
        - Use citizen scientist observations
        - Use remote sensing.
    3. Other considerations:
        - There are time lags between the occurrence of a storm event and the subsequent clarifying of the waters back to base levels.

ix. Action items & data needs
    1. SAC members should review past SAC presentations for information on algal species in HRL.
    2. What will be the next step if the state does not have available resources to adopt or implement any recommendations, based on the best available science, that are proposed by the SAC?
    3. What data do we have available and what data does the SAC require to make decisions?
    4. What can we accomplish with existing data?
    5. Need more data on the health of fisheries in HRL.
        - ALCOA reports are available on the NCDP website.

- The Busk Stream Station report (2011) is available on the NCDP website.
- Request Lawrence Dorsey (Fisheries Biologist, Wildlife Resources Commission) provide information related to the state of the fishery in HRL.

6. Need more data on macroinvertebrate populations related to HRL.
7. Data gathering for the future:
    - Toxicity
        i. Basic measurements of toxicity.
        ii. Establish routine monitoring.
        iii. Make use of inexpensive cyanotoxin test kits.
        iv. Develop a record of toxin occurrence and concentrations in HRL.
    - Fishery and macroinvertebrate data.
    - Algal assemblage data.

4. **Albemarle Sound: Nutrient Criteria Development Progress** (Jim Hawhee)
    a. The Albemarle Sound presentation and audio recording can be found on the NCDP website.
    b. Provided a geographic and hydrologic overview of the Albemarle Sound estuary.
        i. Part of the Albemarle-Pamlico estuary system.
        ii. Consists of shallow and highly turbid waters of varying salinity.
        iii. Has no direct connection to the Atlantic Ocean.
        iv. 45-day residence time.
    c. Discussed the need for nutrient criteria in the estuary.
        i. Algae/phytoplankton blooms
        ii. Toxins, hypoxia, fish kills, real estate, tourism.
        iii. Impacts to submerged aquatic vegetation (SAV).
        iv. Increased turbidity, habitat limitation, loss of fisheries production.
    d. Informs the SAC of the efforts made thus far towards the creation of nutrient criteria.
        i. Discussed the Albemarle Sound NCDP Workgroup & APNEP Nutrients Workgroup.
        ii. See the APNEP website, for more detailed information and to see timelines and a list of participants.
        iii. APNEP offering support for development of estuarine nutrient criteria/standards.
        iv. Albemarle estuary was chosen as a pilot site due to local expertise and existing support work.
        v. APNEP worked with DWR and EPA in developing timelines for Albemarle nutrient criteria development.
        vi. NCDP aligns with APNEP's management plan and workgroup development process.
    e. Discussed the NCDP timeline for Albemarle Sound.
        i. Phase I – APNEP lead. Final product is the Phase I Report targeted for a summer 2016 release.

1. Review and synthesize information.
    - Ecological pathways, criteria thresholds and/or ranges, reference conditions, spatial considerations.
2. Determine range of scientifically defensible criteria.
    - Examine all criteria that have available information, examine complimentary criteria, link criteria to designated uses, examine causal and response indicators.
3. Incorporate policy.
    - Feasibility, assessment methodology, permitting, enforceability, existing conditions, impacts to stakeholders

ii. Phase II – APNEP lead. Final product is the adoption of nutrient criteria for Albemarle Sound scheduled for December 2020.

f. Discusses the role of the SAC as the NCDP moves forward.
   i. Reviewed the NCDP timeline to develop nutrient criteria for estuaries.
   ii. Detailed on page 15 of the NCDP
   iii. DWR lead. Scheduled to adopt nutrient criteria for estuaries by June 2023.

g. Discussed the current status for the Albemarle Sound project.
   i. NASA DEVELOP Project - COMPLETE
      1. Analysis of satellite color imagery to evaluate its accuracy for detecting chlorophyll-a.
      2. Results: inconclusive.
   ii. Literature Review – COMPLETE
      1. NSTEPS proposal funded and conducted by Tetra Tech
      2. Summary of ~4,000 estuarine literature citations including abstracts and tags.
      3. Results: sortable EndNote database.
   iii. DWR Data Review and Analysis – UNDERWAY
      1. NSTEPS proposal for data analysis funded. Review underway by Tetra Tech.
      2. Results: Report due December 2015.
   iv. Nutrient Criteria Law and Policy Review – NEARLY COMPLETE
      1. Evaluation of case law regarding numeric nutrient criteria. Conducted a legal fellow associated with Sea Grant and the NC Coastal Resources Law, Planning and Policy Center.
      2. Results: Pending.

h. Albemarle Sound – What's Next?
   i. November phone call to reacquaint workgroup, discuss progress to date, and plan through conclusion of Phase I.
   ii. Monthly meeting through spring 2016 to discuss project results and their implications.
   iii. Phase I report targeted for summer 2016.
   iv. Discuss the role of the SAC & CIC?

i. Questions/comments
    i. What will be in the Phase I report?
        1. Answer: Would expect to see preliminary recommendations for indicators, criteria and thresholds/ranges.
    ii. Has there been any collaboration with Virginia?
        1. Answer: Yes, we have been in contact with Virginia DEQ and keeping them in the loop.
    iii. Is there a plan to develop a model?
        1. Answer: There are no immediate plans to develop a model, nor has it been determined that a model is needed.
    iv. Comments:
        1. Important to get a handle on the trends in nutrient loading into the estuary.
        2. Important to understand what data is available and how it can be used to identify indicators that will help with criteria development.
        3. The lower salinity portions of the estuary have been experiencing problems with algal blooms/cyanobacteria that are typical in freshwater systems.
        4. Do we need to deal with both N & P at the same time or can would focusing on just one be more appropriate for this system?
        5. Also need to consider hydrologic inputs. For example, large rain events which seem to be occurring more frequently.
        6. Might be useful to have a better understanding the relationship between water concentrations and nutrient loading into the estuary. A historical perspective would also be useful.
        7. The cyanobacteria blooms that have been occurring in the Chowan River have been composed primarily of non-nitrogen fixing species (species that do not need to fix nitrogen from the atmosphere). This is a trend that is being seen in many low salinity estuarine environments. This is important because it suggests that there are plentiful nitrogen sources in the water and, as such, it may be appropriate to employ N-limiting measures in this system.
        8. Important to remember that the Chowan River system is a separate entity from the Albemarle Sound estuary system and that we can't necessarily draw conclusion for the Albemarle from Chowan data.
    v. Has APNEP gone through the process of related indicators to designated uses?
        1. Answer: Not really. Hoping to go in that direction.

5. **Wrap-up** (Andy Sachs, Steve Kroeger)
    a. Next meeting scheduled for December 4th, 2015.
    b. DWR plans to communicate with SAC members prior to next meeting.