

NCDP Criteria Implementation Committee Agenda

9:00 am – 11:00 pm

January 23, 2019

Triangle J Council of Governments

Executive Conference Room

4307 Emperor Blvd., Suite 110

Durham, NC 27703

Desired Outcomes:

- Shared understanding of SAC's draft Chla proposal.
- Shared understanding of the SAC's next steps.
- Shared understanding and finalization of the CIC's pH proposal comment document.

Time	Topic	Lead
9:00 am	Convene Introductions, review desired outcomes, agenda, and ground rules. Adopt notes from previous meeting.	Jenny Halsey (facilitator)
9:15 am	SAC Update – Chla Proposal and basis	Brian Wrenn, DWR
10:00 am	Next steps and schedule for SAC	Brian Wrenn, DWR
10:15 am	Discussion on CIC's pH proposal comment document	Bill Kreutzberger
10:45 am	Closing Comments	
11:00 am	Adjourn	



SAC's Draft Chlorophyll *a* Criteria

January 23, 2019

Department of Environmental Quality



Talking Points

- Chlorophyll *a* proposal
- Scientific basis
- Next Steps



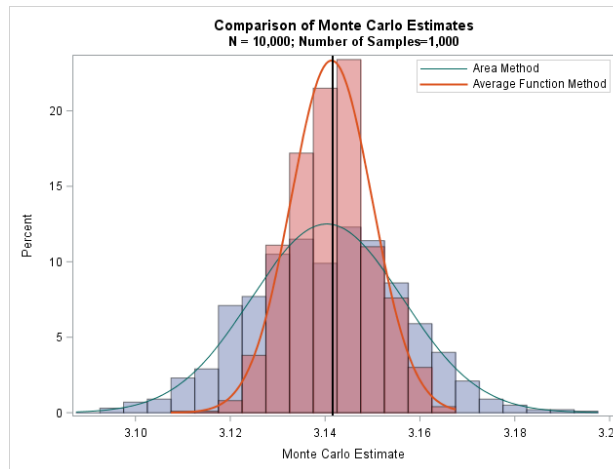
Magnitude, Duration, Frequency

- Magnitude – 35 $\mu\text{g/L}$
- Duration – Geometric Mean for growing season
(April 1-October 30)
- Frequency – Not to exceed. Expression of confidence for exceedance is recommended.
- Sample as a photic zone (2X secchi depth) composite grab sample.
- Criteria should be applied by assessment unit.
- This magnitude is within a CHLa range of 25-40 $\mu\text{g/L}$ that is protective all uses (recreation, aquatic life, drinking water).
 - Magnitude to be driven by narrative standards (to be determined).



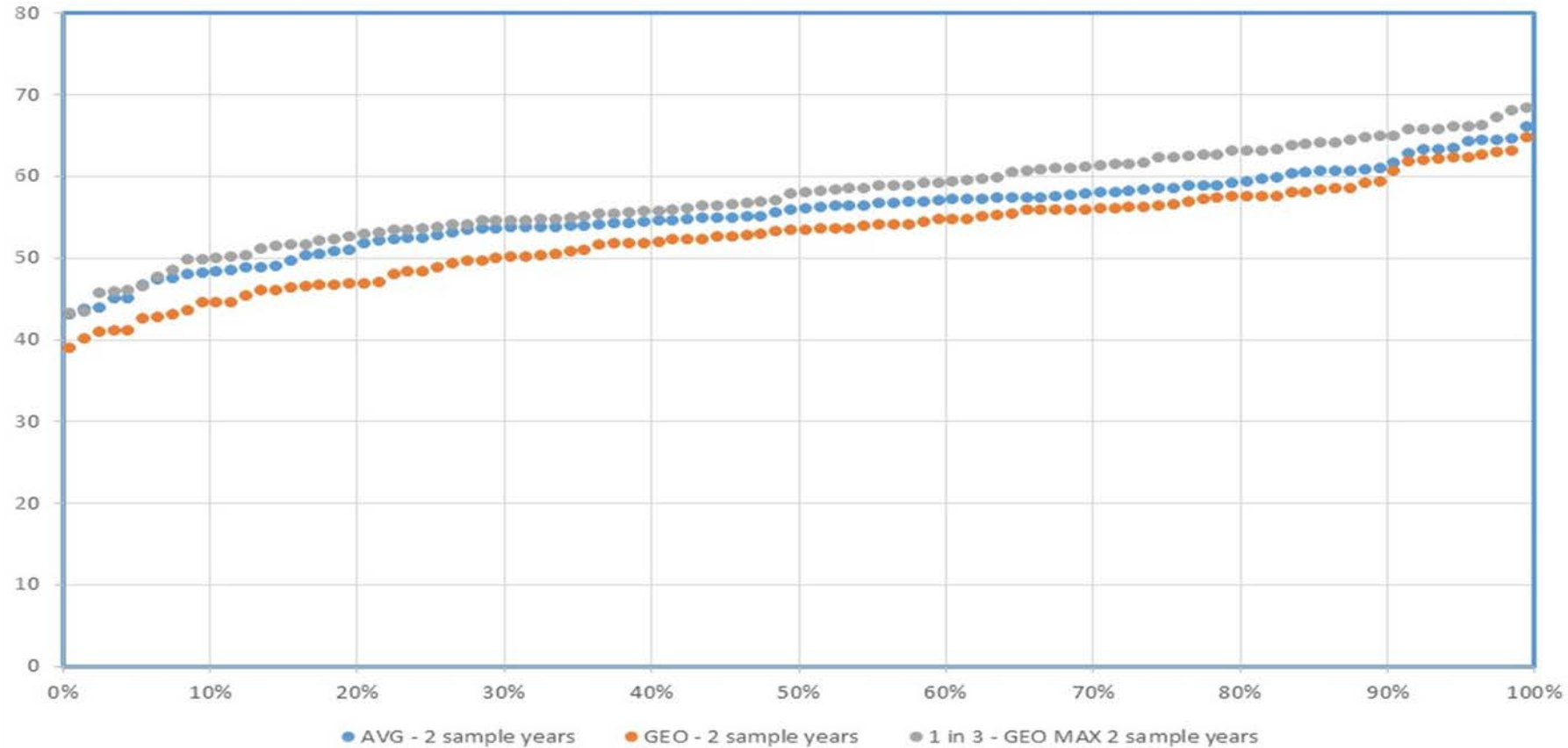
Monte Carlo Analysis

- Monte Carlo is a computer simulation provides a series of probable results based on a range of values for a particular variable – in this case CHLa.
- Using the probability distribution, decisions can be made on the likely outcomes based on a particular variable value, essentially a risk assessment.
- 100 independent runs simulated using data for HRL from 2006-2016.
- HRL051, YAD152C,
YAD169A, YAD169B



Monte Carlo Simulations at YAD152C

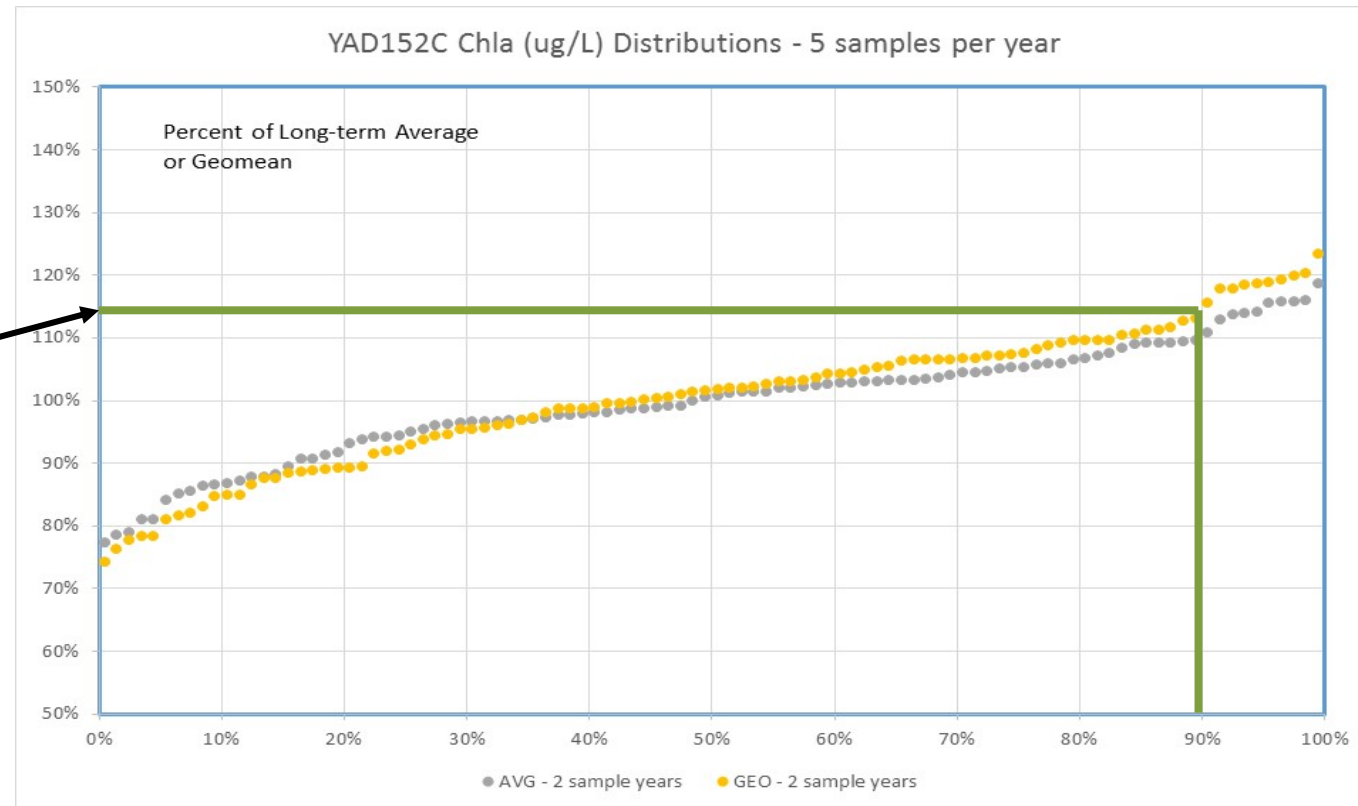
YAD152C Chla (ug/L) Distributions - 5 samples per year



Simulations v. Actual Long-term

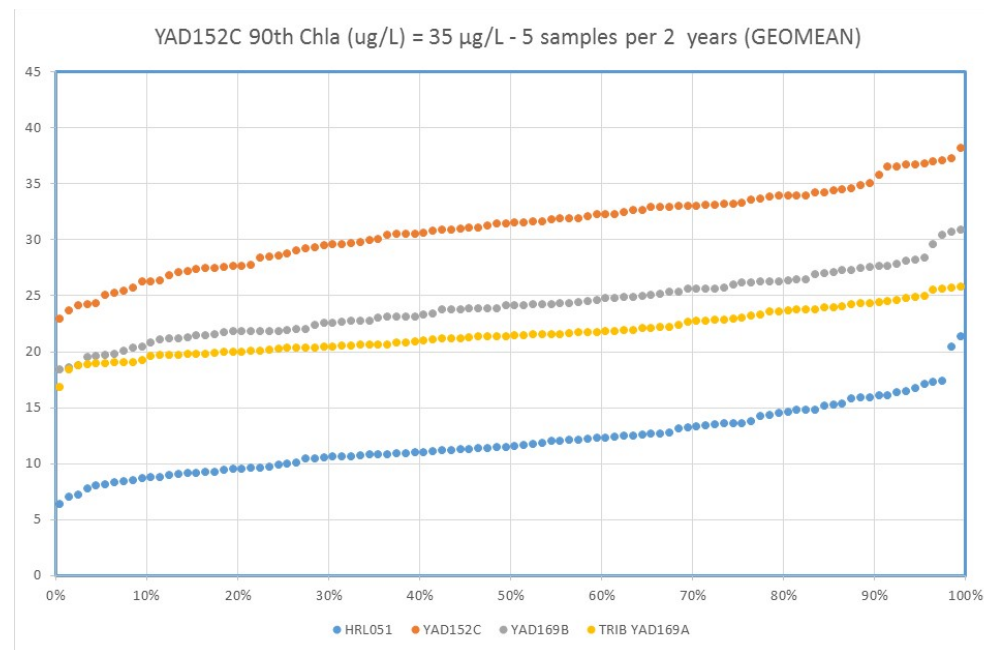
- Using 2006-2016 data, long-term avg. and geomean was determined.
- The percentages of the long-term avgs. were compared to the Monte Carlo simulations – the 90th percentile was chosen.

90th percentile CHLa concentration is 115% of long-term average/geomean



Simulations v. Actual Long-term

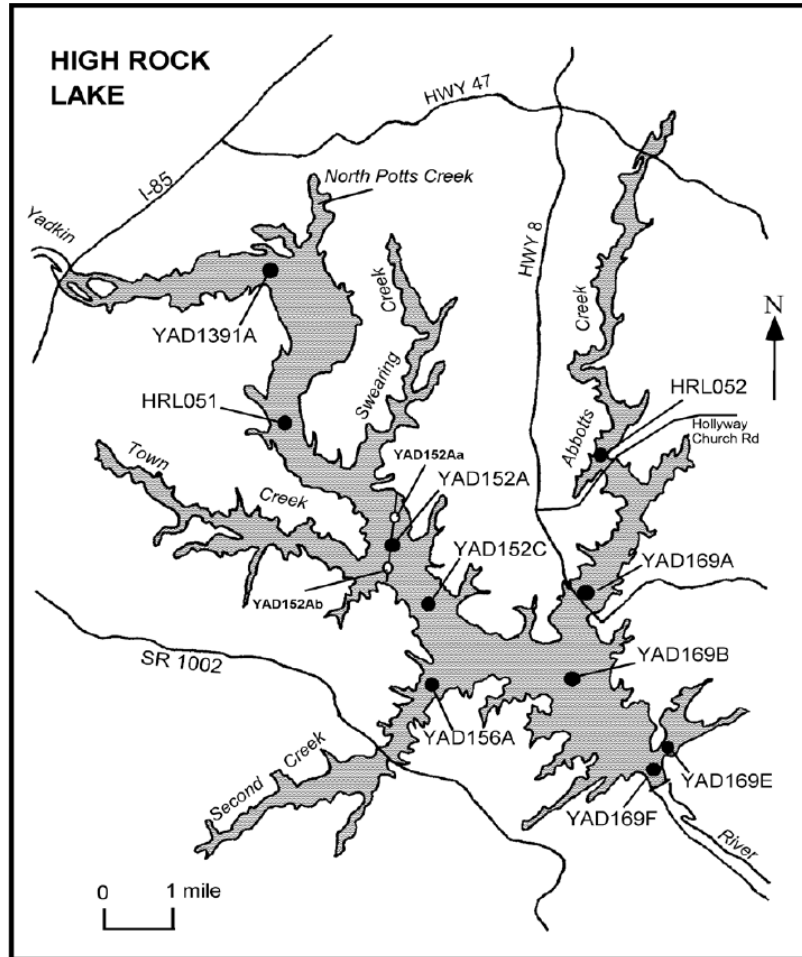
- Using this relationship, the magnitude was scaled down to 35 $\mu\text{g/L}$ (BPJ).
 - Value is within the 25-40 $\mu\text{g/L}$ and is protective of all uses.
 - Results in long-term average of 26 $\mu\text{g/L}$ (all stations).



Scientific Basis

- Magnitude is based on maintaining a viable fishery throughout the lake.

- Literature suggests that a productive fishery requires CHLa concentrations of 20-25 $\mu\text{g/L}$.
- Long-term average of 26 $\mu\text{g/L}$ at all stations maintains productive fishery.



Next Steps

- Begin development of CHLa proposal document.
- Using document template.
- Each section has a leader with support from various SAC members
- Outlines due in February 2019, final document by April 2019.
- Begin looking at N and/or P numeric criteria.
- Revisit response variables to revise as appropriate.



Questions?



High Rock Lake Nutrient Criteria Schedule		
Task	Date	Comment
Complete development of Chla criteria	December 3, 2018	Draft criteria for Chla agreed to by SAC
Complete development of N criteria	February 2019	Draft concentration/loading rate as criteria or "action level" for bioconfirmation process agreed to by SAC
Complete development of P criteria	February/April 2019	Draft concentration/loading rate as criteria or "action level" for bioconfirmation process agreed to by SAC
Complete development of any bioconfirmation criteria	April/June 2019	Draft bioconfirmation methodology agreed to by SAC
Complete revisits of other response variables previously discussed	June 2019	Draft criteria for any response variables previously discussed agreed to by SAC
Draft criteria proposal documents	August 2019	Completion of draft documents for review by SAC
Submit final documents to CIC	October 2019	Final HRL criteria package submitted to the CIC

**Nutrient Criteria Development Plan
Criteria Implementation Committee
Evaluation of SAC Recommendations for pH Criteria for
High Rock Lake
December 18, 2018 DRAFT**

Summary

[To be added after review]

Purpose

The purpose of this document is to review alternatives for the pH criterion for High Rock Lake (HRL) that were developed by the Science Advisory ~~Committee~~ Council (SAC) and present an evaluation and recommendation for input back to the SAC. This evaluation and review will primarily focus on implementation issues related to the criteria and will not attempt, for the most part, to re-evaluate ~~“the science”~~ the scientific data reviewed by the SAC.

Commented [AC1]: The name of the SAC is the Scientific Advisory Council. Please revise wherever this appears.

Commented [AC2]: Suggest removing quote marks. Could be misinterpreted as disparaging. Perhaps there is a better way to say this?

Science Advisory Committee Recommendations

The SAC developed a majority report that included two options for adjusting the upper range of the pH criterion applicable to HRL (see Attachment 1). These were as follows:

Option #1—Short-duration criterion of 9.5: Under this option, the criteria could be applied in a similar manner as the existing instantaneous criteria typically measured at 0.15 meters below the surface, with the exception of the change in magnitude in the maximum value from 9.0 to 9.5. This value is considered protective with a margin of safety because: (1) literature-based thresholds of pH effects on warmwater (non-salmonid) fish taxa are primarily in the 10.1 – 10.8 range with 4+ day exposure; and (2) additional margin of safety would be provided when the existing practice of only using the photic zone measurement for assessment is applied. This option would be similar to pH criteria approved by the USEPA for six artificial reservoirs in Georgia that support warmwater fisheries.

Option #2—Short-duration criterion of 9.0, vertically averaged: Under this option, monitoring data collected at multiple depths over a short (1-hour) timeframe would be used to evaluate compliance with the pH criterion and availability of habitat for warmwater (non-salmonid) fish taxa. The magnitude of the pH criterion would be unchanged from the existing standard of 6.0 to 9.0 but would be applied as a depth-averaged value for the portion of the water column with a dissolved oxygen concentration greater than 4 mg/L. By incorporating data from multiple depths, the criterion would be protective of warmwater fish taxa even when the surface pH value is above 9.0 and approaches literature-based thresholds of potential pH stress on fish growth by providing habitat with pH below 9.0 in waters below the surface layer. Because the magnitude of the criterion is unchanged, this option could be implemented through a change in assessment methodology.

The SAC~~this~~ report was recommended by an 8 to 2 vote of SAC members with the members generally split between the two options. A minority report from two SAC members (see Attachment 2) was also provided to the CIC for consideration. The minority~~this~~ report recommended maintaining the current upper range of the pH criterion at a pH of 9.0.

This ~~this~~-evaluation by the CIC considers the two options recommended in the majority report as well as the current maximum criterion recommended in the minority report.

Clarification Request

In discussing the pH proposals at a June 2018 CIC meeting, several questions were posed for DWR and for the SAC. Responses to these questions were provided in a memorandum dated August 27, 2018 (see Attachment 1). A few of these are included below to support the discussion and recommendations in this report.

How would a change to the pH criterion impact the pH limits in permits for regulated discharges?

In regard to the range of areas where a revised pH standard would be applied to regulated entities, there are very few areas of DWR programs that would be impacted by a revised pH standard for HRL. Application of the standard through development of the integrated report and impaired waters list could (but not likely) result in a TMDL or nutrient management strategy. However, regulated entities under the NPDES program would not be impacted. NPDES dischargers must meet technology-based effluent limitations (TBELS) which require pH of 6.0-9.0. These limits are included in the effluent limitations of a NPDES permit. NPDES or state stormwater permits include benchmark ranges for pH. However, they are not limitations, but pollutant levels that potentially trigger additional monitoring or best management practices. The benchmarks included in these permits would likely not be impacted by a standard change. Furthermore, 401 Water Quality Certifications and non-discharge permits for spray irrigation or land application do not include pH requirements for surface waters.

If 1-hour median is scientifically defensible, why allow instantaneous reading? Should proposal read median or instantaneous?

The proposal is correct stating a 1-hour median. The 1-hour hour median would be calculated from multiple instantaneous measurements over an hour if they were available. If only a single measurement was available, it could be taken as representative of the 1-hour median for the purposes of ~~determine~~-determining individual exceedances. This is directly analogous to acute criteria for toxics, which are technically 1-hour averages but are usually evaluated with grab samples that represent a single point in time.

Commented [KB3]: We can decide whether we want to correct grammar on DWR repsonse

Could Option #2 be implemented under existing pH criteria?

The proposal already includes the statement, "Since the magnitude of the criterion is unchanged, this option could be implemented through a change in assessment methodology."

What is criteria for water column where DO <4.0 mg/L?

The criteria of 6 – 9 for pH would be unchanged and apply throughout the water column. Evaluation of attainment of the criteria would be limited to waters where DO is greater than or equal to 4.0 mg/L.

Why did proposals use different metrics for determining general tendency (median v. arithmetic mean)?

The two measures of central tendency originated from the two original proposals considered by the SAC. The SAC briefly discussed the concept of making them consistent, but ultimately chose to leave them as formulated.

Option #1 proposed the median for reasons stated in section 4.1.1:

... pH values are inherently logarithms, and the arithmetic mean of log-transformed values has somewhat different properties than the arithmetic mean as it is commonly used for non-log-transformed data. Although this does not invalidate the arithmetic mean as a measure of central tendency for pH, the median value is proposed as a more straightforward measure of central tendency for pH.

Option #2 used the arithmetic mean to retain information about the magnitude of pH above and below the criterion of 9.0 since the intent was to represent whether habitat was present with a lower chance of pH stress to organisms.

The SAC did not make a formal determination as to whether the median or arithmetic mean was preferred.

Evaluation Approach

As stated previously, the CIC is tasked with evaluating implementation issues associated with nutrient related criteria proposed by the SAC. A number of implementation issues were considered, and the CIC decided to evaluate the three pH alternatives based on the following criteria:

- Monitoring methodology
- Monitoring level of effort
- Impairment assessment methods
- Regulatory impact including cost
- Perception to the public
- EMC/EPA approval likelihood

In using these criteria, the CIC chose to evaluate each of these criteria qualitatively using varying descriptors by criterion but consistent across the alternatives. The [details detailed](#) assumptions made in evaluating the Alternatives, a table summarizing the evaluation, and ~~a with~~ a brief discussion of the evaluation for each criterion [is included](#).

Assumptions

The CIC made the following assumptions as a basis for the evaluations:

1. DWR’s response to the CIC’s clarification request addressing how a change in pH criteria would be implemented on regulated dischargers (refer to p. 2) is assumed to be true and comprehensive.
2. The CIC acknowledges that DWR has prepared EPA approved TMDLs for exceedances of the existing pH criteria. The CIC is also aware that there are a number of new pH listings in the draft 2018 303(d) List and that these listings could result in additional pH TMDLs being developed and approved in the future. However, for the purposes of this evaluation the CIC assumes that DWR will continue the practice of not including explicit wasteload allocations related to pH for NPDES permitted dischargers in these TMDLs.
3. The CIC acknowledges that exceedances of pH criteria can be associated with nutrient driven eutrophication. However, for this evaluation the CIC assumes that new or “expanded” nutrient management strategy rules will not be adopted solely on the basis of pH criteria exceedances in the absence of exceedances of other nutrient related water quality standards such as chlorophyll-a.

Qualitative Evaluation of pH Criteria Alternatives Relative to Existing pH Criteria

Evaluation Measure	pH Criteria Alternative		
	6.0 to 9.0 (current criteria)	6.0 to 9.0* (SAC Option #2)	6.0 to 9.5 (SAC Option #1)
Monitoring Methodology/Level of Effort	No change	No change	No change
Assessment Methodology	No change	Minor**	No change
Regulatory Impact including cost	No change	No change***	No change***
Perception to public	No change	Minor	Negative
Approval difficulty (State/EPA)	N/A	Low	Medium-High

* Measured based upon central tendency of water column where DO ≥ 4.0
 ** Somewhat more involved data analysis to examine multiple pH and DO levels in water column
 *** In the long run, options 1 and 2 could reduce some regulatory costs for the agency in that they better align with chlorophyll a and avoid the need for a TMDL solely based on pH, where ~~this~~ there is no impairment due to chlorophyll a

Monitoring Methodology/Level of Effort. This evaluation measure focuses on whether the proposed criteria would force a substantive change in monitoring methodologies which in turn could also negatively impact comparisons with historical data. In lakes/reservoirs, DWR collects field parameters as a surface measurement (generally 0.15 m depth) and at 1-meter intervals to bottom. Generally speaking, significant changes in the level of monitoring effort are not expected with any of the alternatives for the pH criteria.

Assessment Methodology. DWR currently uses only the 0.15 m depth data for pH in making assessments used for the Integrated 303d/305b report. This would not change for the existing criteria or for SAC Option #1 of changing the maximum value to 9.5. However, SAC Option #2 would require adjustments to the assessment method to examine vertical pH and DO data, and calculate the central

Commented [AC4]: Regarding note 3, I would like to hear DWR’s reaction to this statement.

Commented [AC5]: At the meeting I hope there will be a discussion as to why we are including “perception to public” as an evaluation measure. Not sure I agree that it should be included. Or perhaps you mean something else, such as likelihood of being litigated. I note that later in the document this is described as how changes will be perceived by “a portion of the public.” There are a lot of “publics” – some may perceive changes 180 degrees differently than others – some may perceive the same change as negative and some as positive.

Commented [KB6R5]: I am certainly open to changing the description. However, the issue here is there is always a strong negative reaction to relaxing a water quality standard or changing a use classification to removing a use – regardless of the technical justification. I have seen this often – first hand – in NC as well as almost universally across the US. There are multiple publics – but typically those supporting the change are not as vocal as those opposing anything considered to be a relaxation of a standard. Probably a good discussion topic

Commented [KB7]: Please look at note 3 (***). I added this based on a comment from Doug. We might consider this too speculative to add. I would like other opinions

Commented [KB8R7]: TJ Lynch Comment - Certainly understand what you mean in terms of being considered speculative. Speculative or not, it’s true. I don’t think I would change it unless there is some pushback.

tendency based on the approach (average or median) recommended by the SAC and adopted by the EMC as rule. The CIC considers this a minor change in the assessment methodology that could be easily incorporated into their data evaluation procedures/tools.

Regulatory Impact including cost. According to the staff response to questions posed by the CIC and the assumptions outlined above, there are no significant regulatory impacts to NPDES dischargers or other permit holders from a change in pH criteria. Furthermore, DWR does not address eutrophication related pH impairment directly but assumes that management strategies for nutrients based on managing chlorophyll *a* will also address pH impairment. To date, modeling tools developed for HRL have not been calibrated to simulate pH and thus cannot be used directly to develop regulatory approaches based on pH. The CIC concludes that in lake/reservoir systems pH criteria should be considered as a compliment to chlorophyll *a* in regard to nutrient related management strategies. Therefore, there is no change in regulatory impact in the foreseeable future to any of these alternatives. However, there is a higher probability that there could be impairment based on pH alone, without chlorophyll *a* exceedances, with the current water quality criterion for pH and associated assessment methodology.

Public Perception. The majority of the SAC considered either alternative to the current pH criterion as technically justified. In addition, DWR staff have suggested that assessing pH based on a measure of central tendency in the water column where $DO \geq 4.0$ could be accomplished without a change to the standard (a conclusion that the CIC is not convinced about as mentioned in the Discussion section below; thus, alternative language is suggested in the Recommendation section below). Even if a pH change to a maximum of 9.5 is accompanied by changes and potential lowering of the chlorophyll *a* criterion, it will be perceived by a portion of the public as a relaxation of the water quality standard. Changing the assessment methodology (with or without a change to the water quality standards language) may also be perceived as a minor relaxation of the standard. This assessment is independent of any technical justification and should be acknowledged as an implementation consideration.

Approval Difficulty (EPA/State). Any final recommendation from the SAC will require detailed technical justification. In some respects, the minority report contains a preview of some of the comments that might be posed both in the state adoption process and the EPA approval process. Our assessment is that the change in assessment methodology with or without a corresponding change in the water quality standard language would have minor resistance while a change to maximum pH value could encounter a moderate level of scrutiny-resistance in both the state and EPA approval process. In the event DWR elects to support a criterion change that is considered by some to be a relaxation of the current criterion, there could be administrative or legal objections raised. This may result in delays and/or legal costs to address such challenges.

Discussion

In many respects, the pH criterion as considered in the context of lake eutrophication and HRL specifically, is not critical since it is not directly regulated as a load. Modeling tools are not set up to link nutrient inputs to pH and for the foreseeable future pH excursions in a lake will be managed complimentary-complementary to chlorophyll *a*. It is currently assessed based on a measurement as an instantaneous value at a depth of 0.15 m. Based on science reviewed by the SAC which considered both acute and chronic effects of pH on aquatic organisms, this is an extremely conservative assessment

Commented [DD9]: So what happens if a new chl a criterion is adopted and then somehow implemented and attained, but there are still pH exceedances? I realize it seems unlikely, but any time you logically link a "response factor" (pH) to causal factors (nutrients), it opens a door for future regulation of the causal factors. This scenario felt a bit more likely when we heard that there are recent pH exceedances in reservoirs below HRL, in the absence of chl a exceedances.

Commented [AC10R9]: Does DWR know the cause of these pH exceedances where there is not a chlorophyll-a impairment?

Commented [KB11R9]: The likelihood you mention is higher with the current criterion. See my suggested addition highlighted in yellow

Commented [KB12R9]: I have never seen a high pH exceedance other than due to eutrophication - except as a result of spills of caustic material - will be interesting to see DWR reaction

Commented [KB13]: TJ Lynch Comment - I agree with this statement but have some concern about how it might be perceived. The statement could lead to the question - are we implementing a new assessment methodology that is "less protective"? I personally see it as "more representative" but I think we may have to defend that without a statement here that references the new methodology being more representative of actual conditions than current assessment methodology. Overall, document looks very good!

Commented [AC14]: If this sentence is retained it needs a bit more explanation as to why this is the case.

Commented [KB15R14]: It is because the current methodology is very conservative - regarding a single depth - near the surface and one point - versus chl a and nutrient measurements based on depth integrated composites

Commented [AC16]: I commented on "public perception" being used as an evaluation measure earlier. If something about this is to be included in the document, rather than as an evaluation measure, perhaps a discussion of the possible perception of some "publics" could be in a section of "additional information for consideration." Again, is this really about a discussion of the likelihood of litigation, which is also discussed in the next section and possibly best addressed as such there?

Commented [AC17]: These last two sentences mention possible legal challenges because the change is considered by "some" to be a relaxation. This is also discussed in the "Public Perception" section - see my comments on that section.

approach both temporally and spatially because it likely measures pH at the level in the water where it would be at its maximum. In contrast, both chlorophyll *a* and nutrient related parameters are measured in depth integrated composite samples in the photic zone of the water column (measured as 2 times the secchi depth).

Although the CIC is not tasked with examining the science as is the SAC, some commentary on the issues raised in the majority and minority reports seems appropriate:

- The pH literature does seem to indicate that somewhat higher levels of pH could be tolerated for short durations in HRL especially since it is a warm water fishery.
- The concern about ammonia toxicity seems over-stated given the comparison of data using criteria using developed to protect sensitive mussel genera typically found in small stream systems and that most excursions were from the older data. The fact that data collected during the most rigorous data collection periods in the last 15 years did not indicate major excursions of the ammonia criteria seem compelling that this is not a major issue. The brief mention that using a measure of pH central tendency in the water column might allow ammonia toxicity is not well developed or measures seemingly justified by the recent data.

It seems that assessing pH in a way that is more ecologically based (using the portion of the habitat available for mobile aquatic species) than the current conservative approach is justified technically and is readily accomplished using the implementation criteria considered. However, the CIC is not convinced that this change can be accomplished solely by changing the assessment method and requests that DWR staff explore the need for some narrative addition to the standard for HRL and if supported in the future by the SAC, other lakes to include in the water quality standards regulations.

Recommendation

Based on this analysis, the CIC recommends that the SAC consider adoption of the following pH criterion for High Rock Lake based on implementation considerations:

Option #2—Short-duration criterion of 9.0, vertically averaged: Under this option, monitoring data collected at multiple depths over a short (1-hour) timeframe would be used to evaluate compliance with the pH criterion and availability of habitat for warmwater (non-salmonid) fish taxa.

The CIC also recommends that the following underlined language be considered for incorporation into the water quality standards regulations contained in 15A NCAC 2B .0211(14):

pH: shall be normal for the waters in the area, which 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. For lake/reservoir systems pH may/shall be assessed based on a measure of central tendency within the portion of the water column generally available for habitat for aquatic life with a dissolved oxygen concentration greater than or equal to 4 mg/L if normal for those waters;

While this document is specifically addressing a pH criteria for HRL, we believe this same recommendation may be appropriate for other lake/reservoir systems, assuming the SAC does not bring forward additional scientific information to the contrary.

Commented [AC18]: Not sure what this last clause beginning “or measures...” means. Are there words missing? What “measures” are being described here?

Commented [KB19R18]: We mention earlier that SAC did not strongly recommend what measure of central tendency to use – mean or median – geomean isn’t really appropriate since pH is already log-transformed and a mean of pH is an approximation of a geomean

Commented [AC20]: Should this be made stronger by deleting “requests that DWR staff explore” and instead say “believes that there is the need for some narrative addition...”

Commented [KB21R20]: A point to discuss among the group. I feel like given past changes to interpretation of criteria – a narrative is needed but am willing to listen to staff rationale

Commented [AC22]: “May” or “shall” will need to be discussed in the CIC if regulatory language is proposed. (Also see next comment.)

Commented [KB23R22]: Yep – that is why it was highlighted

Commented [AC24]: Are we supposed to be addressing other than HRL at this time? This .0211(14) regulation change would affect all lake and reservoir systems, not just HRL. The CIC needs to discuss whether we are ready to recommend this for all lakes and reservoirs in the state at this time..

Commented [AC25]: Same comment as above regarding all lake/reservoir systems.

Commented [KB26R25]: Points of discussions for CIC on last two items. John Fear mentioned these also