Results of Online Survey

Nutrient Criteria Development Advisory Workgroup, October 1, 2014
Texas Commission on Environmental Quality (TCEQ)
Texas Surface Water Quality Standards (WQS)

Summary: A total of eight respondents provided input on the survey questions. Responses to each of the five questions are provided below, and are presented exactly as submitted by each of the respondents. None of the responses were edited by TCEQ, including corrections for spelling and grammar.

Question 1: **The EPA has expressed an interest in states creating total nitrogen (TN) and total phosphorus (TP) criteria and has also suggested developing a weight of evidence approach for assessing water quality. Do you have any thoughts or recommendations on how to incorporate TN and TP and other parameters into criteria development and for use in a weight of evidence approach?**

Responses to Question 1:

Responder #1 - i think that simple regression analysis of TN and TP on Chl'a' for main lake sites that are not influenced heavily by turbidity is the most appropriate way to relate these parameters. TN and TP should be used a ancillary criteria to Chl'a' to better understand and address the Chl'a' problem. Texas waters appear to be a bit unique in their Chl'a':TP and Chl'a':TN ratios to use literature values for any of these parameters. Empirical estimation seems best.

Responder #2 - It would be interesting see how the environmental criteria and the decision framework is set up.

Responder #3 - TCEQ needs to continue to address, on a site-specific basis, whether or not designated uses that can be effected by nutrient enrichment (i.e., aquatic life protection, recreation, public water supply, agriculture, etc.) are being achieved. Weight of evidence for setting TP and TN criteria should not be divorced from the attainment of uses, although that appears to be exactly what EPA would like the state do do. The weight of evidence approach is appropriate and should focus on the evidence supporting correlations between TP and TN concentrations, effects on water quality constituents that directly affect uses such as pH and DO and transparency and color for recreation, public water supply limitations such as taste, odor and algae-related toxicants and similar characteristics that effect the designated uses.

Responder #4 - TN and TP criteria should be incorporated into criteria along with assessment of current phytoplankton (reservoir) or periphytic algae (stream) trophic state. Criteria should be developed that ensure that nutrients from wastewater and stormwater discharges do not result in changes in algal trophic status from current conditions in less-disturbed watersheds or achieve a desired trophic status in already developed watersheds. Continuous water quality simulation modeling should be used to evaluate proposed discharge permits to set adequate quantitative TN and TP limits that preserve existing or achieve desired algal trophic status. For evaluating thresholds based on ecological community responses, Smith and Tran 2010 (Journal of the North American Benthological Society 29(3) provides a method for establishing quantitative nutrient limits. Baker and King 2010 (Methods in

Ecology and Evolution 2010(1), also provide a excellent analytical framework with the TITAN tool for assessing ecological community thresholds that would be ideal for incorporating into this process, and the source code in R is freely available from Dr. King. Holistic weight-of-evidence approaches should incorporate benthic macroinvertebrate community composition, algal abundance (eg, percent cover in streams), algal community composition (eg, blue-green algal dominance), and algal cell nutrient ratios relative to biomass. Using a weight-of-evidence approach including biological community composition with an appropriate analytical method (eg, changepoint analysis) can result in nutrient criteria that are quantitative and ecologically protective.

Responder #5 -Bayesian statistics can be used for the statistical analysis of nutrient data. Advantages for this are that large data sets are not required, data from different studies can be combined, and model selection is striaghtforward.

Responder #6 - Not sure i understand the weight of evidence approach enough to know if it would be beneficial in Texas streams

Responder #7 - No comment

Responder #8 - I think some form of biological verification as part of the NNC or weight of evidence approach is important to include. This can provide a mechanism for avoiding nutrient impairment listings when a water body is considered healthy by some accepted biological metric. That is, use TN/TP as assessment targets and then use nutrient response variables (chl-a, DO, transparency, biological metrics, etc) to assess health/integrity of the water body.

Responder #9 - Site specific criteria should be used for TP and TN limits, based on ambient background concentrations in the receiving stream. These concentrations vary widely in Texas, and are exceptionally low in hill country/limestone streams, especially in contributing and recharge streams for the Edwards Aquifer. A statewide limit will not be protective of these nutrient-sensitive areas, therefore the need for site-specific criteria.

Responder #10 - TN AND TP should be important wt of evidence factors particularly where point sources generate loads not assimilated. The concentrations need not be numeric criteria.

Responder #11 - No

Responder #12 - The importance of TN and TP concentrations are relative. Some systems are able to assimilate more nutrients than others without exhibiting any environmental impacts. Others systems are much more sensitive. Any nutrient standard should be site specific, based on environmental response.

Responder #13 - Yes--criteria for TN and TP may well be needed at the end of a process of building understanding and consensus on the sensitivity and the desired future condition of the key or primary response variables in each system. In short, if TN and TP are having a significant effect on plant community type and growth, we need a consensus on what is desired before we can spend public money on achieving a particular TN or TP level. A concern I have with the "weight of evidence" term is that it is so subjective. In other regulatory situations, what passes for evidence is at times just opinion. If WoE is to be used, we need to make a concerted effort to ensure that it is quantitative and reflects inputs from all involved parties.

Responder #14 - While I know it is the trend to assess TN and TP, nitrate and orthophosphate are the most bioavailable and are the compounds most likely to be driving aquatic primary productivity. I would propose a plan where TN and TP are used as the first level of nutrient assessment. If a water body fails

to meet one or both of the TP and TN levels, then it gets assessed for the response variables. If it also fails the response variable assessment, the waterbody is impaired.

Responder #15 - We remain convinced that measurements of TN and TP are not good predictors of use impacts. It is true that an absence of nutrient inputs to a system limits growths of algae and vegetation. Also, it is possible to have nutrient concentrations so high that they exceed the uptake capacity of the plants and aquatic vegetation, and these systems have dense stands of algae and/or aquatic vegetation. However, in the range of responses to nutrient loads that are of most interest from the standpoint of water quality protection in an environment with some nutrient inputs, the relationship between water column concentrations and use impacts is extremely weak. For example, the changepoint models develop by the University of Arkansas for the relationship between chlorophyll-a and TP in streams have r2 values of less than 0.1. That means that 90% of what drives chlorophyll-a concentrations is not explained by TP concentrations. This is not unexpected since many other factors (turbidity, sunlight intensity, temperature, velocity, etc.) can have significant effects. In addition, as stated in previous comments (and as demonstrated in Dr. McClelland's presentation), nutrient responses are driven by system load inputs (which often occur in association with high flow events), and these inputs are typically not detected by subsequent measurements of water column concentrations of nutrients. If EPA remains adamant on the inclusion of TP and TN standards, an approach similar to New Mexico's can be developed, perhaps. However, the agency appears to be beginning to recognize the limitations of TN and TP standards; so, there may be less emphasis to this as time goes on The New Mexico approach results in a reservoir being found to be non-compliant with water quality standards for nutrients in either of the following cases: (1) there are exceedances of the criterion for either TN or TP and the criterion for one response variable, or (2) there are no exceedances of TN or TP criteria, but there are exceedances of two response variables. Any criterion that is adopted as a standard that can result in a water body being found to be non-compliant should be site-specific. It may be possible after sufficient experience is gained with site-specific standards to adopt ecoregion standards, but such standards should be based on experience at the site-specific level.

Responder #16 - N/A

Question 2: **In July 2013, the EPA approved site-specific chlorophyll a criteria for 39 reservoirs and disapproved criteria for 36 reservoirs. The EPA requested the TCEQ state its plans and timeline for revising the disapproved chlorophyll a criteria. The TCEQ is working on reconsidering these criteria for future submissions of the Texas Surface Water Quality Standards. Do you have any suggestions for addressing the disapproved criteria? What do you feel are the pros or cons of using site specific vs. broad based criteria? Is there another criteria development method you would suggest?**

Responses to Question 2:

Responder #1 - a case could be made that Texas waters are different than many of those EPA cited in their review. Comparing Chl'a' vs TP models developed here to those from northern lakes shows that we have alot of TP that is not used by the algae. There also may be evidence that our average concentrations of Chl'a' do not suggest bloom concentrations at the rate more northern areas do. i suggest TCEQ build a case for how we are different and stay with the proposed criteria. Site specific criteria require alot of data but there is definitely regional differences. I think there might be a grouping

of reservoirs somewhere in between that would be the best of both worlds. I like the t stat. Think it is a good starting point and works great with the IP evaluation of evaluating a point source load.

Responder #2 - No comment

Responder #3 - If I recall correctly, one of EPA's problems for the reservoirs with unapproved criteria was that there was a disconnect between SWQM's screening criteria and the site-specific chlorophyll a criteria. SWQM would indicate that there was a "concern" based on TP, TN, chlorophyll and the criteria were set based on the same site-specific data. The remedy to this is to make sure that when repurposing site-specific criteria, the screening levels and previous water quality assessments are consistent and any anomalies are described.

Responder #4 - Current TCEQ chlorophyll-a criteria on based long-term water quality data that incorporates existing degradation, is limited by arbitrarily restrictive quality control requirements, and does not help to achieve standards that can be implemented in permitting to protect all designated uses. Utilize receiving water body continuous simulation water quality models to identify discharge nutrient thresholds that maintain or achieve a desired algal trophic status. These could be implemented in a TMDL-type approach. Broad criteria would not be protective of sensitive, less-disturbed water bodies. Site-specific quantitative criteria that can easily be implemented thru permitting are needed.

Responder #5 - A site specific criteria is more appropriate because there should be less variability than broad based criteria. Additional minimization of variability can be obtained by partitioning site specific data into seasonal data

Responder #6 - I would always lean toward site-specific criteria over the broad-based approach (no one shoe fits all), but the site specific criteria requires a very extensive and comprehensive data set

Responder#7 - Respondent skipped this question

Responder #8 - Not familiar w/ the reservoir criteria developed.

Responder #9 - Ambient background conditions vary widely and site specific criteria must be utilized to be protective of reservoirs with very low nutrient concentrations.

Responder #10 - Respondent skipped this question

Responder #11 - Site specific criteria are appropriate for determining the true impact to a water body taking into account other water quality parameters that might influence nutrient availability.

Responder #12 - I believe that a lot of time and thought was put into lake standards that was submitted to EPA in 2010. It appeared as if EPA cherry picked data sets in order to disapprove of the as many reservoirs as it could. In many instances using 1 site out of 5 in a reservoir to make a determination. EPA also failed to acknowledge any sort of natural succession in a number of the disapproved lakes. Decoupling chlorophyll a with secondary criteria is a mistake. If we allow to EPA to dictate this process I would prefer we start from scratch and come up with a new methodology.

Responder #13 - The basic method of developing criteria form site-specific data needs to be maintained. Going to a general number--say 30 ug/L--has no technical or use support basis. Where there is an apparent trend of increasing chl a that is potentially caused by human activity, a numerical modeling effort could be used to derive an estimate of a chl a criterion. That estimate should include building a consensus on the appropriate seasonal distribution of samples, inflow conditions, etc. that should be considered for setting a criterion. Ultimately a model used to support building a consensus on a criterion could also be used to set reasonable targets to get the reservoir back to a pre-human impact level.

Responder # 14 - There needs to be one process by which nutrient standards will be determined and assessed. Two different methods will lead to a PR disaster when it comes to remediation and/or enforcement efforts. Unfortunately, this may mean a total re-do for both the approved and disapproved. I think site specific standards are a must. We have seen the failure of assumed criteria for other parameters and broad based screening levels for nutrients that have led us to this current state. I think you are already pursuing our preferred method of using an integrated system of response variables and causal variables. However, we do not support the use of algal composition as a potential response variable. While algal composition may be a good indicator of nutrient-related concerns, it is too expensive, time-consuming and cumbersome to be something that can reasonably be routinely assessed on a basin-wide basis. Additionally, we do not support the use of turbidity or transparency as a response variable as these can be impacted by the geology of a water body. I would hate to see a water body listed because it is naturally muddy.
Responder #15 - Site-specific criteria are desirable to achieve the most appropriate use-protection level for each reservoir. This approach also benefits permittees in that it eliminates the uncertainty that a future, much more stringent site-specific criterion will be imposed.
Responder #16 - Due to the variation of waterbodies in Texas a site specific approach is best

Question 3: **The TCEQ may consider estuary criteria development next. Provided there is adequate data for estuary criteria development, do you have any thoughts or comments on how to prioritize estuaries? Should we use estuary characteristics (salinity, depth, etc.) or estuary inflow values to classify estuaries into groups? If so, which variables should be utilized?**

Responses to Question 3:

Responder #1 - No comment
Responder #2 - No comment
Responder #3 - I suggest that TCEQ use the same priorities that it used for reservoirs - set criteria first for those estuaries that fully comply with all their designated uses. Then work on estuaries that may have one or more uses impacted. Particular attention should be paid to estuaries where there are healthy and significant seagrass populations because we know that they can be adversely affected by increase turbidities due to phytoplankton.
Responder #4 - No response
Responder #5 - Respondent skipped this question
Responder #6 - My main comment is that standards for estuaries is going to be a challenge because these waterbodies need the nutrients that would come from inflows and we are working to reduce those sources because rivers are the opposite in need
Responder #7 - Respondent skipped this question
Responder #8 - There should be some form of estuary classification used (salinity, depth, residence time, surrounding land use, freshwater inflow) because all of these variable affect the nutrient assimilation capacity of the estuary. Estuaries are complex water bodies which tend to drive NNC development to being more site-specific.

Responder #9 - Not sure - but if there is not sufficient data, we must work on obtaining it; and in the meantime, move forward with establishing protective limits for the streams and tributaries we do have adequate data for.
Responder #10 - Respondent skipped this question
Responder #11 - no input
Responder #12 - I believe that any criteria that we come up with should be as site specific as possible.
Responder #13 - Adequate data do not now exist to select chl a criteria, at least for estuaries like Galveston and Nueces where an apparent decline has been noted. For those we have to first understand the reasons for the changes and with that understanding, build a consensus on what chl a level we want to maintain. This will require a modeling effort and several years, but it is doable. For estuaries that have seen less alteration, developing criteria in a fashion similar to that followed for reservoirs would seem reasonable.
Responder #14 - I would prioritize based on estuaries with large commercial/sport fisheries and/or current concerns for significant declines in estuary health (i.e. declining levels of seagrass or declining catch rates for sensitive commercial species).
Responder #15- As with all water bodies, the criteria developed should be site-specific. The criteria should be site-specific not only to the estuary system, but also to the specific embayments within the larger system. For example, the same standards would not be appropriate for Corpus Christi Bay and Oso Bay, even though these bays are adjacent to each other. It is unlikely that estuaries can be grouped. Salinity regimes, clarity, depth, temperature, etc. vary significantly between the upper Texas coast and the southernmost Texas coast. Furthermore, variations within the boundary of the estuary, such as variations in depth and substrate, variations in the absence or presence of vegetation, variation of the type of vegetation, and variation in the impact from freshwater inflows, will require consideration and may require segmentation of the estuaries. When developing criteria, salinity and depth will be major factors. However, as individual water bodies are assessed, other factors will also be determined to be significant. Data from Oso Bay has demonstrated that the presence of rooted vegetation can drive diurnal DO swings from very high to near zero even without significant nutrient input from POTW effluent. This has been confirmed using a WASP modeling of Oso Bay.
Responder #16 - Respondent skipped this question

Question 4: **Many states have used a modeling approach to develop load- based criteria for estuaries (e.g., FL). Which model would you suggest for Texas estuary criteria development? Why?**

Responses to Question 4:

Responder #1 - No comment
Responder #2 - No comment
Responder #3 - I don't have enough experience with the models to suggest which approach is most practical. I would start with looking closely at what Florida is doing for its Gulf Coast estuaries because they are most likely to have somewhat similar characteristics to Texas estuaries. However, I expect that as one moves further south on the Texas coast the higher salinity-estuaries will likely require significant changes in any models being developed by states such as Florida.

Responder #4 - WASP, based on flexibility in calibration, broad use, available documentation, and measurable input coefficients.
Responder #5 - Respondent skipped this question
Responder #6 - Don't know enough to suggest one
Responder #7 - Respondent skipped this question
Responder #8 - There are a number of potential models for modeling estuaries but at a minimum should include a hydrodynamic model for water circulation and a water quality model for nutrient-algae-DO-transparency (eutrophication). In some instances, consideration of SAV (available light) may be important because of importance in estuary health and diversity. Two potential models to use based on FDEP efforts are ECOMSED/RCA and EFDC/WASP. A linked watershed model (e.g., LSPC or HSPF) may also be helpful for providing watershed inputs to the estuary. A recent WERF nutrient model selection tool was recently developed and can also provide some guidance on appropriate model selection in estuaries.
Responder # 9 - Respondent skipped this question
Respondent #10 - Respondent skipped this question
Responder #11 - no input
Responder #12 - Any model used should take into account environmental response and not just total load.
Responder #13 - I would suggest using a combination of Tx-BLEND and WASP. Dr. Quigg and I submitted a proposal to GBEP for this that provides more detail. The key point is that it uses models that have a lot of use experience.
Responder #14 - The estuaries are all so different based on needs and responses, this may be one situation where consistency in methodology is not as important as getting the standard right. Given that the estuary standard will then dictate what happens to river standards upstream, the estuary criteria must be right. This may be a situation where the individual estuary's characteristics, dictate the model that needs to be used for developing it's individual criteria.
Responder #15 - For linear estuaries where lateral averaging is appropriate, the two-dimensional CE-QUAL-W2 may be the best choice. For estuaries where a three-dimensional model is required, WASP or CE-QUAL-ICM, combined with an appropriate hydrodynamic model, is an appropriate choice. A WASP model of Oso Bay has already been developed, which is coupled with the FREHD hydrodynamic model.
Responder #16 - Respondent skipped this question

Question 5: **In the past, stakeholder input for nutrient criteria development has primarily come from this advisory group. Please identify any additional stakeholders that should be included in the NCDAWG.**

Responses to Question 5:

Responder #1 - Respondent skipped this question
Responder #2 - No comment
Responder #3 - I think you have everyone that has a real interest and wants to contribute on the WG already.

Responder #4 - Seek and incorporate input from independent academic experts in environmental engineering and biological sciences that (not being permittees or advocates) could provide much needed technical input on current state of the science

Responder #5 - Respondent skipped this question

Responder #6 - Is will there be someone that could represent environmental flows, both the SB2 and SB3 processes? I believe there is very strong connection between these two issues.

Responder #7 - Daren Harmel, USDA-ARS

Responder #8 - None at this time.

Responder #9 - Respondent skipped this question

Responder #10 - Respondent skipped this question

Responder #11 - Texas Water Utilities, Texas section of American Water Works Association, Water Environment Association of Texas

Responder #12 - Respondent skipped this question

Responder #13 - The parties that do not appear to be well represented at this time are the sport and commercial fishery folks. it seems that it is mainly agencies and consultants that are at the table.

Responder #14 - I think the group is pretty well rounded. I can't think of a major stakeholder category that is missing.

Responder #15 - Given that the TCEQ is shifting its focus to estuaries, we recommend approaching coastal dischargers for their input. These may include: • City of Corpus Christi • City of Houston • City of Beaumont • City of San Patricio • Gulf Coast Waste Disposal Authority Coordination with the Basin and Bay Stakeholder Committees and Expert Science Teams may be good place to start in identifying appropriate stakeholders to include in the NCDAWG.

Responder #16 - no