Water Quality Criteria for Nutrients:
Overview of Status and Activities in Texas and U.S.
Nutrient Criteria Development Advisory Workgroup June 20, 2011
Texas Commission on Environmental Quality Water Quality Standards

National Developments

- Environmental Protection Agency (EPA) memo (Ben Grumbles) urged states to speed up nutrient criteria (May 2007).
- Florida Wildlife Federation sued EPA for lack of nutrient criteria in Florida (July 2008).
- EPA Inspector General criticized slow adoption of nutrient criteria by states (August 2009).
- Coalition filed intent to sue EPA for lack of nutrient criteria in Wisconsin (November 2009).
- Friends of the Kaw filed intent to sue EPA for lack of nutrient criteria in Kansas (June 2010).
- EPA promulgated numerical nutrient criteria for Florida rivers & lakes (November 2010).
- Florida Attorney General and Agriculture Commissioner sued EPA for promulgating nutrient criteria for Florida (December 2010).
- EPA letter (Tinka Hyde, Region 5) required Illinois to evaluate individual wastewater permits to implement the state's narrative nutrient water quality standard (January 2011).
- EPA response letter (Nancy Stoner) to New England states affirmed that numerical nutrient criteria are to include both phosphorus and nitrogen (March 2011).
- EPA memo (Nancy Stoner) suggested a framework for states to reduce nutrient loadings while numerical nutrient criteria continue to be developed (March 2011).

Status of TCEQ Nutrient Criteria for Reservoirs

Initial Steps

- TCEQ's nutrient development plan was established in 2001 and revised in 2004 and in 2006.
- The 2006 plan is still current and has been "agreed upon" by EPA.
- A nutrient advisory workgroup started in 2002 and has met for numerous work sessions.

General Approach for Reservoir Criteria

- TCEQ's development plan: criteria first for reservoirs, then streams and estuaries.
- Reservoir criteria were based on the long-term historical database for each reservoir, plus an allowance for statistical variability.
- Criteria are intended to establish baseline conditions for numerous reservoirs.
- Eventually, other approaches, such as grouping similar reference reservoirs, or identifying "use-based" conditions, may be needed for potentially impacted reservoirs.

Assumptions and Characteristics of Criteria for Individual Reservoirs

- Primary parameter was chlorophyll a (Chl *a*), as the "response" variable of concern.
- Optional screening values for total phosphorus and transparency (Secchi depth) were also calculated.
- Minimum data set was 30 or more sampling dates.
- Data were used from 1990 to 2008, older data were used if needed to get minimum sample size.
- Criteria were based on data taken in the main pool of the reservoir.
- Data less than the quantification limit were assumed to be one half.
- Criteria was equal to the upper prediction interval of data set for each reservoir.
- If a calculated criterion less than 5 micrograms per liter Chl *a*, it was set at 5 micrograms per liter (historical quantification limit).
- Compliance is assessed using median of at least 10 samples taken in the main pool.

Proposal/Adoption

- Proposed option 1: Impairment would be defined as an exceedance of a Chl *a* criterion plus an exceedance of either total phosphorus (TP) or transparency screening value.
- Proposed option 2: Stand-alone Chl *a* criteria for 93 reservoirs.
- In response to comments, stand-alone Chl *a* criteria were adopted on June 30, 2010.
- Criteria were adopted for 75 reservoirs (because of data anomalies 18 reservoirs were not adopted).

EPA Review of Reservoir Nutrient Criteria (in progress)

- EPA expressed the following concerns and suggested additional needed documentation:
  - Criteria for 21 reservoirs are greater than 20 Chl *a*, and EPA considers this relatively high.
  - Some criteria calculations might incorporate increased nutrient loading over time.
  - TCEQ should demonstrate that criteria are protective of attainable uses.
  - There needs to be a demonstrated relationship of Chl *a* criteria with TP and total Nitrogen (TN).
- TCEQ provided responses and documentation to EPA on August 4, 2010 that included:
  - Excerpts of revised standards implementation procedures that relate TP and Chl a.
  - Time graphs and trend analyses of TP, Chl a, and transparency for each reservoir.
  - Land-use patterns, wastewater discharge locations for selected reservoirs.
  - Use-support information: TPWD reservoir surveys, TCEQ water supply testing, 2010 impaired list for nutrient related parameters.

Nutrient implementation procedures – wastewater permits.

- Revisions to the Standards Implementation Procedures were approved by TCEQ on June 30, 2010.
- New screening procedures were added to assess need for effluent phosphorus limits.
- Screening incorporates a variety of site-specific factors to assess potential nutrient impacts.
- Factor examples: size of discharge, water clarity, shading, dilution, identified "concerns".
- Potential impact from phosphorus is ranked high, medium, or low for each factor.
- Results for all factors are weighted and combined to obtain overall recommendation.
- EPA commented on the procedures on Dec 2, 2010; and nutrient comments included:
  - Consider applying the same screening to renewals as to new/ amended permits.
  - Consider potential for TP limits less than 0.5 mg/L.

Overall Next Steps

- Reconvene nutrient advisory committee (June 20, 2011).
- Improve monitoring data – lower TP quantification; more data on TN and attached algae.
- Evaluate available monitoring data in Texas & review criteria development in other states
- Develop criteria options for streams and rivers, and for estuaries.
- Consider "weight-of-evidence" of multiple parameters for developing and assessing criteria.
- Consider selected new nutrient criteria for next standards revisions (targeted for 2013).

Prognosis for Streams and Rivers

Data and studies available for developing nutrient criteria for streams and rivers.

- 30 to 40 years of data at hundreds of stations, for TP, some TN, Chl *a*, Transparency, dissolved oxygen (D.O.), etc.
- Substantial data for fish, invertebrates, with established indices of biotic integrity.
- Recent/ongoing stream nutrient studies, including sampling for attached algae, such as:
  - 33 East Texas streams (USGS), 2003-2005
  - 15 Central Texas streams (USGS), 2005-2006
  - 64 North Central Texas streams (Baylor University), 2006-2008
  - 6 streams in the Brazos basin (TPWD), 2007-2008
  - 30 South Central Texas streams (AgriLife with others), 2010-2011
  - ~ 60" least-impacted" streams around Texas (TCEQ and others), 2010-2011

Potential Approaches for Streams and Rivers

- Categorize and group streams based on geographic, hydrologic, & chemical similarities.
- Option 1: Base criteria on historical levels of Chl *a* (in rivers), TP, TN (as available), and Transparency in reference groups of streams and rivers.
- Option 2: "Stressor/response analyses," relating TP & TN (as available) to observed effects on biological indices, D.O., Chl *a* (in rivers), attached algae abundance (in streams), D.O., biological indices for fish and macroinvertebrates; 2011 University of Arkansas project.

Challenges for Streams and Rivers

- Limited data for TN and relative abundance of attached algae.
- Extensive geographic, hydrologic, chemical variability.
- Numerous effluent dominated streams & rivers , difficult to reasonably address.

Prognosis for Estuaries

Data and studies for estuaries.

- Long-term monitoring stations with decades of data for TP, (TN), Chl *a*, Transparency, D.O., & salinity (~ 72 active stations in 2010)
- Numerous research studies:
- - Marine institutes, national estuary programs, TPWD, USGS, TWDB, others
- - E.g., nutrient assessment of Mission-Aransas Estuary, UT (Ed Buskey, ongoing)
- - E.g., nutrient sources/inputs for Galveston Bay, TAMU (Antonietta Quigg, ongoing)

Potential approaches for nutrient criteria for estuaries.

- Option 1: Base criteria on historical levels of Chl *a*, TP, TN, Transparency at reference sites.
- Option 2: Relate TP, TN to observed responses of Chl *a*, Transparency.
- Option 3: Incorporate models of nutrient loading/responses (Florida DEP, Chesapeake Bay).
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Challenges for estuaries.

- Lack of consensus in defining normal, healthy nutrient loads & water quality for estuaries.
- Establishing comparable groupings of reference stations will be difficult.
- Examples of criteria development elsewhere are very limited.
- High spatial and temporal variability of salinity and other parameters within a single estuary.
- Biological indices are not as developed as for freshwater streams.
- Limited data is available for TN.