Nutrient Criteria Update

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Nutrient Criteria: National

- EPA and numerical nutrient criteria:
  - 1998 mandate: numerical criteria by 2004
  - Allows state development plans and schedules
  - Established national guidance criteria
    - Separate for lakes, streams, reservoirs
    - Pooled for large, aggregate ecoregions
    - Based on historical data for TP, TN
    - 25th percentile, or 75th for unimpacted sites
  - "Go faster": EPA Inspector General, Aug 2009
  - Lawsuits: Florida (Wisconsin, Kansas)

EPA Nutrient Criteria: Florida

- Lawsuit from Florida Wildlife Fed. & others in 2008
- Consent decree with EPA in 2009
- EPA promulgated criteria for Florida lakes & streams in Nov 2010 – in effect Mar 2012
- Recent countersuits:
  - Florida municipalities and utility districts
  - Florida Fertilizer and Agrichemical Assoc.
  - Florida Agriculture Commissioner
- EPA estuary criteria: propose in Nov 2011; final Aug 2012

Nutrient Criteria: Florida Lakes & Streams

- Promulgated for lakes in each of 3 regions:
  - TP (0.01-0.05 mg/L); TN (0.51-1.27 mg/L)
  - Chlorophyll *a* (0.006-0.020 mg/L)
  - Based on Chl *a* for oligotrophic, mesotrophic
- Promulgated for streams in each of 5 regions:
  - TP (0.06-0.49 mg/L); TN (0.67-1.87 mg/L)
  - Based on reference streams (90^{th} percentile)
- Stream criteria must protect downstream lakes
- EPA allows site-specific adjustments of criteria

Why Are Nutrient Criteria Difficult?

- Lack of clear “use-based” thresholds, for uses such as recreation & aesthetics, aquatic life propagation, drinking water sources
- Responses to nutrients are highly variable – e.g., effect of TN,TP on Chl *a*
- No consensus on how to derive criteria
- Independent criteria, or “weight-of evidence”?
- Insufficiencies in historical monitoring data
- Initial EPA guidance criteria were problematic
- High concern about regulatory impacts

Nutrient Criteria: State/National Efforts

- Many states have criteria for some streams, rivers, lakes, and reservoirs
- Monitoring & research is increasing
- Potential approaches are becoming defined:
  - Stressor-response evaluations of what levels of TP, TN cause a significant response in Chl *a*, algal cover, dissolved oxygen swings, fish & invertebrate communities.
  - Defining reference conditions – basing criteria on historical ambient concentrations of nutrients in relatively unimpacted water bodies.

TCEQ Nutrient Criteria: Development

- Submitted plans to EPA in 2001, 2006
- Reservoirs, then streams & estuaries
- Convened advisory workgroup
- Separately for each reservoir
- Set on historical conditions
- Proposed for 93 reservoirs
  - Stand-alone Chl *a* criteria
  - Chl *a* criteria, + screening levels:
    TP, transparency
- New permitting procedures for nutrients

Reservoir Nutrient Criteria - Assumptions

- Included reservoirs with ≥ 30 sampling dates
- Data from 1990-2008, older data if needed
- Criteria = upper prediction interval
- Outliers = > 1.5 interquartile range (boxplot)
- Values < detection limit = ½ detection limit
- Assumes normality of untransformed data
- Minimum criterion = 5 µg/L Chl *a*

Reservoir Nutrient Criteria - Options

- Assessed as median Chl *a*, ≥10 sampling dates
- Assessed at main pool station or comparable
- Option 1: Confirm with TP, Transparency values
  - Calculated same as Chl *a* criteria
  - Impaired if chl a criterion plus one of the screening criteria are exceeded
- Option 2: Stand-alone Chl *a* criteria
- Adopted: Option 2 for 75 reservoirs
- Documentation sent to EPA for review, Aug 2010

Nutrient Criteria: Examples

Reservoir	Chl *a* (µg/L) Stand-alone	Chl *a* (µg/L)	TP (mg/L)	Transparency (meters)
Eagle Mtn	25.4	23.0	0.07	0.80
Cedar Creek	30.4	27.8	0.07	0.80
Livingston	23.0	20.6	0.16	0.67
Lewisville	18.5	16.4	0.06	0.60
Houston	12.4	10.8	0.18	0.28
Travis	3.7	3.3	0.03	3.13

2010 Nutrient Implementation Procedures

- In 2010 Standards Implementation Procedures
- Applied to increases in domestic discharges
- Sets framework for nutrient (TP) effluent limits
- Reservoirs – predict effects on “main pool”
- Reservoirs – assess local impacts:
  - Apply site-specific screening factors
  - Level of concern – low, moderate, or high
  - Assess “weight-of-evidence”
- Streams – assess local impacts: (as for reservoirs)

Nutrient Screening: Local Factors for Reservoirs

- Size of discharge (quantitative)
- Distance from reservoir (quantitative)
- Sensitivity: water clarity (quantitative or qualitative)
- Sensitivity: observed vegetation responses
- Sensitivity: shading by brush and trees
- Consistency with similar permits (qualitative)
- Local dispersion, mixing (quantitative or qualitative)
- Impact on main pool (quantitative)
- Listed as a nutrient concern in WQ inventory?

Local factors for streams are similar

Nutrient Screening: Local Factors for Streams

- Size of discharge
- Instream dilution
- Sensitivity to attached vegetation – type of bottom
- Sensitivity to attached vegetation – depth
- Sensitivity to nutrient enrichment – clarity
- Sensitivity to aquatic vegetation – observations
- Sensitivity to aquatic vegetation – sunlight, tree shading
- Streamflow sustainability
- Impoundments and pools
- Consistency with other permits
- Listed as a nutrient concern in WQ inventory?

2010 Nutrient Implementation Procedures: Example

- Factor for local impacts - water clarity in reservoirs:

Concern level	Qualitative	Quantitative Secchi (m)
Low	Turbid …	< 0.75
Moderate	… not murky	0.76 to 1.27
High	… high transparency	> 1.28

Nutrient Criteria: The Road Ahead

- Reconvene nutrient advisory committee
- Develop criteria options for streams, estuaries, & revisit selected reservoir criteria
- Address additional long-term data needs
- Evaluate available monitoring data in Texas & review criteria development in other states
  - ongoing project with U. of Houston Clear Lake
- Consider in part for next standards revisions

The Road Ahead: Streams & Rivers

- 30-40 years of data at 100's of stations, for TP, ~TN, Chl *a*, Transparency, D.O., etc.

  plus frequent fish, invertebrate sampling
- Recent/ongoing stream nutrient studies, with low-level nutrients and measures of attached algae, for over 100 streams
- Option 1: Base criteria on historical levels in reference streams and rivers
- Option 2: Stressor/response analyses, relating TN,TP to biological indices, D.O., Chl a (in rivers), attached algae (smaller streams)
- Challenge: Many effluent-dominated streams

The Road Ahead: 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
  - Nutrient criteria for Mission-Aransas Estuary, UT Marine Science Institute (Dr. Ed Buskey)
  - Nutrient sources/inputs for Galveston Bay, TAMU Galveston (Dr. Antonietta Quigg)
  - Loading calculations (USGS) – Topic 2 today

The Road Ahead: Estuaries (2)

- Data/research needs:
  - More TN data, lower TP,TN detection limits
  - Relationship of TP,TN to Chl *a*, productivity
  - Biological indices for fish, invertebrates
  - Biological responses to nutrient loading
  - Addressing effects of variations in salinity
- Option 1: Base criteria on historical levels at reference sites
- Option 2: Relate TN, TP to response parameters such as D.O., Chl *a*
- [Option 3: Incorporate models of loading and nutrient responses (Florida DEP)]

Summary

- National interest in nutrient criteria is increasing, partly in response to new EPA criteria for Florida
- TCEQ adopted criteria (Chl *a*) for 75 reservoirs, but EPA has not yet approved them
- Texas & other states are increasing efforts & resources to develop state nutrient criteria
- TCEQ staff are developing draft criteria based on multiple options for streams and rivers, and for estuaries

- **Questions?**