

Nutrient Criteria Development Work Group
February 24, 2003
Meeting Summary

Welcome & Introductions - Barbara Henry

Specific Work Group Purpose & Plan for the Day - Jim Davenport

- Spend time on approaches to reservoirs
- Uses & criteria for historical data
- Feedback

Nutrient Criteria/Plans - Philip Crocker

- Purpose
 - To convey a sense of Regional priorities
 - To briefly discuss state activity
 - To provide insight on EPA's review proposed standards
- EPA has requested that the states prepare Nutrient Criteria Development Plan - which is a key national and regional priority (serves as a framework for how standards are developed)
- Policy Memo For Nutrient Criteria Development & Adoption (November 14, 2001)
 - Purpose of memo - to provide additional guidance to states on nutrient criteria plans, the role of the plans, flexibility available, and expectations on time frames for both developing a plan and adopting criteria
 - Plans are encouraged rather than required
 - Serve as an agreement between Region and states (not approved/disapproved)
 - Nutrient Criteria Development Plans should include:
 - Mutually agreed upon approach, schedule, milestones
 - Description of data analysis and identification of data gaps
 - Strategy for quantifiable endpoints
 - Coordination of efforts and public involvement
 - Prioritization of water body types
 - Classification and grouping of waters
 - Sources of data
 - How data will be analyzed
 - Which parameters for which criteria will be set
 - How criteria would protect uses, including downstream uses
 - All water body classes should have a schedule outlined in the plan
 - EPA flexible on approach
- Timeline
 - By end of 2004, EPA will evaluate state/tribe progress compared to their plan
 - If no plan developed, EPA expects state/tribe to have begun administrative process to adopt EPA's criteria by end of 2004

- The time to implement a plan should ensure nutrient problems are addressed in a timely fashion
- Schedule will be evaluated based on the need for original sampling, scale of the problem, time to analyze data, available resources and the breadth of geographic water body coverage
- Variables
 - EPA recommends 2 causal and 2 response variables for freshwaters: TN, TP, water clarity, and chlorophyll *a*
 - For estuaries, dissolved oxygen (DO) and macro algal biomass (e.g., also include DO. Others may be added.
- Region 6 Submittals by States
 - All states have been engaged in addressing nutrients
 - Four of the five of our states have submitted plans: LA, NM, OK, TX
 - States lack details on some elements: we will request additional information
 - OK draft is fairly detailed and targeted
 - EPA has draft template checklist to standardize reviews
- State Plan Submittals
 - Arkansas: No plan yet - Scenic streams have been a recent focus
 - Series of meetings with the state of Oklahoma
- State Plan Submittals
 - Louisiana - Plan dated December 27, 2001
 - 1st priority is lakes/reservoirs and rivers/streams
 - Extensive analyses based on level III ecoregions
 - Interested in effects based approach
 - Working with academic community
- Region 6 Submittals by States
 - New Mexico - Submittal dated January 18, 2002
 - Consists of tiered assessment protocol
 - Also included methodology for developing TMDLs
 - Did not include a plan/milestones related to nutrient criteria
 - Emphasis to date has been on streams
- State Plan Submittals
 - Oklahoma - Informally submitted July 17, 2002
 - Detailed and targeted
 - 1st priority - scenic streams
 - 2nd priority - lakes and reservoirs
 - 3rd priority other streams
 - Have already proposed numeric criterion of scenic streams
 - Propose Trophic State Index for lakes
- State Plan Submittals
 - Texas - Plan dated November 30, 2001
 - 1st priority is reservoirs
 - Formed an extensive technical work group
 - May set statistical or effects based criteria

- May utilize ecoregion or watershed size groupings
- Still in data analysis mode
- Plan updated December 31, 2002
- Included additional data consolidation and analysis
- Various approaches to criteria being considered
- Technical work group meetings
- Starting to evaluate rivers, streams (sampling planned)
- Future Actions Related to Plans
 - Would like to arrive at mutually agreeable plans
 - Would like to see substantial progress by end of 2004
 - Encourage work group involvement and peer review of products (e.g. RTAG)
 - Coordinate with neighboring states
 - Encourage states to prioritize funding and apply for grants to dedicate personnel to nutrient criteria development
- How will EPA review proposed Nutrient Water Quality Standards (WQS)?
 - EPA will consider its criteria/technical guidance
 - States should include both causal and response criteria
 - State can propose numeric criteria or translator
 - Criteria should have sound technical basis
 - State should be consider downstream uses
- Summary
 - Very encouraged with the state's efforts to develop nutrient criteria to date
 - The key to solidifying the process is the written plan
 - Training, further guidance planned
 - Plans will help convey activity and can be used to solicit input from scientific community and the public
 - EPA intends to take action where states have not made substantial progress - If a Nutrient Criteria plan has not been developed by the end of 2004, EPA will promulgate standards
 - Do want to see inclusion of EPA standards

History of Work Accomplished for Texas to Date - Sidne Tiemann & Jim Davenport

- EPA Documents & National Guidance completed on -
 - Reservoirs & lakes
 - Streams & rivers
 - Estuaries
 - Wetlands - none
 - Wetland Modules
- Ecoregion Criteria Documents for all Texas Ecoregions
 - Reservoirs & lakes
 - Streams & rivers
- TCEQ/USGS Work
 - Data
 - TCEQ Texas Regulatory Auditing & Compliance System (TRACS) -

- Surface Water Quality Monitoring (SWQM) database
 - USGS
 - 1970-2002
- EPA Methodology - Texas Ecoregions
 - 25th percentile - May 2002 meeting
 - Reservoirs
 - Streams & rivers
- Eagle Mountain Lake - current Chlorophyll *a* screening value is 21.4 on chart - median is 13.1 & mean is 13.7
- Since May 2002 - Reservoirs
 - Reduced reservoirs to 110
 - Near dam sites
 - Total phosphorus & chlorophyll *a*
 - Winter - October to April
 - Summer - May to Sept.
 - 15 data points - Station had to have to be included in the list of reservoirs to review
 - Planned future work
- The Future Estuaries
 - Processing raw data
 - Historical data - will be looking at historical trends in Nitrogen, Phosphorus, & chlorophyll *a*
 - EPA Protocols 25 percentile
 - Categories
 - Pooled 2-sample t-test
- The Future Rivers and Stream
 - Same data analysis as estuaries
 - Additional data collection
 - SWQM 24-hour dissolved oxygen
 - Water column nutrients & chlorophyll *a*
 - Benthic chlorophyll *a*
 - Algal assessments
 - Data analysis
- TCEQ is looking at ambient criteria as a starting point for looking at reservoir, however, need to look at other uses
- USGS under EPA contract
- Expand database
- Delineate “Impacted” vs “Less Impacted” Reservoirs - I prefer to use reference vs. nonreference reservoirs
- Permit discharge
- Land use in watershed
- For each “Less Impacted” Reservoir use main pool data
- Option 1 - ambient data
- Impacted reservoirs

- Establish reference groups- determine groups
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A Proposed Method for Nutrient Criteria Development Using the Pooled Two-sample *t* Procedure - Charles Bayer

- A possible method to Develop Nutrient Criteria
 - Criteria are derived by utilizing the pooled two-sample *t* procedure formula (**See Handout #2**)
 - Formula utilizes the arithmetic mean, standard deviation and Student's *t* value for the number of data values used for each calculation
 - Water quality standards attainment is evaluated as an assessment period mean of at least ten samples taken on different dates not to exceed the derived criterion
 - The assessment period should be the same as the 305(b) assessment
 - Calculation is based on the minimum value for the assessment period mean nutrient parameter
 - To increase probability - number has to increase
 - More samples - more probability that it will decrease - closer to the mean
 - Test Sample $n = 155$, $\bar{x} = 13.7$, $S = 9.16$, $t = 1.655$
 - Upper 95% probability $\bar{x}_1 + t_{(1)(0.05)}(s_{\bar{x}1} - \bar{x}_2)$ - Upper 95% confidence - Interval of Mean $\bar{x} + t_n (s/\sqrt{N})$

Latest Results from USGS Work with Reservoir Information - Evan Horning

- A. Reservoirs**
 - 1. Pool two-sample *t***
 - 2. Criteria used to select reference reservoirs**
 - B. Trends**
- Developing Criteria for Reference Texas Reservoirs - The TCEQ proposed criteria for reference lakes is the value that the average nutrient concentration would have to attain to exceed the 95% confidence intervals of the historical data (5% probability criteria). (**See list of Reservoirs - Handout #3**)
 - Retrieve TCEQ (TRACS database) and USGS nutrient data from the main pool site of each of the 110 Texas designated reservoirs from 1/1970 to 6/2002
 - Separate each reservoir's data by constituent (TP, Chl *a*, TN) and by season: Winter (October - April) and Summer (May-September)
 - For each dataset (lake/constituent/season) exclude outliers using a statistical approach based on distribution of log-normal transformations of data (EPA's "Grubbs" method).
 - For datasets with under 20 measures, inspect graphically and remove obvious outliers
 - For each lake/constituent/season dataset with at least 15 measures, calculate mean, standard deviation and probability-based criteria (using TCEQ method for TDS and sulfates)
 - Based on reservoir and upstream segment land uses, select reference reservoirs

- for initial application of the criteria
- Half a dozen or so sites do not have measures
- At least 15 measurements for each of the seasons
- It is land use that we base reference to not the results
- Using single reservoir approach
- Medians are calculated annually
- Focus on major reservoirs - easier to assess data
- Trends are hard to see in reservoirs, example Lake Waco. Dairies moved into the area in the 80's. In 1997 and 98 they had the 2nd largest run-off in history. Evan Hornig's graphs showed a noticeable increase in TP and Chlorophyll *a* in 97 and 98 over previous years.
- Buffalo Springs - variability over time in the data set
- Will be adding data sets from additional stations included in 305(b) assessment
- Values are medians of annual medians

Discussion

- How do we group - look at unimpacted and impacted reservoirs (**See Handout #4**)
- Problem with putting on list is just based on land use
- Set up qualitative & quantitative criteria to make determinations on reservoirs
- Referenced reservoirs use ambient criteria
- Flag bodies of water & type of uses
- Impacted reservoirs & non-referenced reservoirs are synonymous
- Some referenced reservoirs are on the 303(d) lists
- Use qualitative data & criteria to make determination
- Determine where uses are met
- Use 305(b) & 303(d) lists to compare & make assessments
- Look at TPWL's fish kill list & see if they need to be on reference list
- Riparian Corridor
- Concerns of Septic System's Density
- Water supply
- Flag bodies of water & type of uses
- Data gap - look at Texas Park & Wildlife's collected data
- Start with use - include other criteria
- Build reservoirs with land use data list
- Pull ecoregion group - run data and set criteria
- Referenced list needs to be looked at - criteria may be set directly on those reservoirs
- Processed based approach
- Use ecoregions to set criteria
- Use-based criteria would be much higher if used
- Ambient based approach
- Set standards as use-based through levels of degradation
- Take most stringent uses
- Should be use-based versus ambient based
- Need to set criteria now - can make them more stringent later
- Set the bar low for high quality reservoirs

- Process based approach - reservoir by reservoir basis - would take too much time
- Develop specific uses for each reservoir
- Uses have to be analyzed for each reservoir to develop criteria - there are advantages
- Next meeting - discuss process based
- Ambient Water Reporting Level (AWRL) - highest low number according to Clean Rivers Act
- Total phosphorus is above AWRL
- Do not report above AWRL - Really it is the lowest value that they have to report if they get a value lower. They can have higher values, it 's just that if the AWRL is .06 and they only have a method that goes down to .08, they can't use that method. They have to use a method that will give them a value of at least .06. They can report lower than .06, but assume the true value is .001, they can either report .001 or .06
- May be cross of ambient data & use criteria
- Discharge will be along edge of reservoir - higher levels of chlorophyll *a*
- Set standards low enough, it would avoid a lot of problems
- Change summer span of months to be April to September instead of May to September
- Total numbers on Canyon reservoir that Evan Horning presented are different than those found by Dr. Groeger
- Lake Summerville is getting artificial ground water from Alcoa and there are fish kills there every year
- Lake Fork has a lot of CAFOs in the watershed
- Question if Buchanan is affecting Inks Reservoir
- For Canyon Reservoir, bar should be set low considering the high quality
- Morphometry and residence time should be considered in categorizing reservoirs

Linking Nutrients to Uses: a Clean Rivers Program Study - Paul Jensen, Glenn Clingenpeel, Trinity River Authority

- Quantification of Nutrient Effects on Designated Uses in the Trinity River Basin - **(See Handout #5)**
- Project Objectives
 - Gather data on levels of nutrients and uses
 - Identify specific uses
 - Determine if there are direct relations between nutrient levels & use support
- Project Tasks
 - Selection of study reservoirs (completed)
 - Acquiring data (near completion)
 - Seeking relationships (ongoing)
 - Generalize relationships
 - Reporting
- Study Reservoirs
 - Central OK/TX Plains: Eagle Mountain, Benbrook, Bridgeport, Ray Roberts
 - Texas Blackland Prairies: Ray Hubbard, Richland-Chambers
 - East Central Texas Plains: Cedar Creek
 - South Central Plains: Livingston (Upper and Lower), Houston County

- Western Gulf Coastal Plains: none
- Lake Uses
 - Recreation - swimming (full body contact-bacteria), boating, aesthetic appreciation, sportfishing
 - Aquatic life support (High-DO, ph, etc), desirable fishery support, other biological criteria
 - Water supply (solids, MCLs), Municipal, Industrial & Agricultural
- Reservoir Recreation Uses
 - Sport fishing - boat & bank
 - Waterfowl management (Duck hunting)
 - Boating
 - Water skiing
 - Swimming and Diving
 - Park activities with water view
- Parameters Possibly Related to Nutrients
 - Water clarity - Chl *a*, tannic staining & suspended sediments
 - Water color
 - Odor
 - % Vegetation coverage
- See handout # 5 for charts & information for the following:
 - Recreation Uses & Possible Data Sources
 - Aquatic Life Use Support Sportfishing
 - TPWD Prism Data
- Need for Uniform Measure of Habitat Quality
- Aquatic Life Support Other Biological Criteria
- Fish Data Reviewed
- Water Supply Data
- Preliminary Results
- Nutrient criteria needs to be use based
- Doing a global criterion is tough
- Doing a specific criterion on specific reservoir is possible
- There is a significant statistical relation between nitrate & odor
- Status
 - Project is roughly half complete
 - Preliminary findings in the areas of:
 - Overall conditions
 - Uses
 - Criteria
 - Relations between nutrients & possible uses
 - Potential for general application to many reservoirs
- Overall Conditions
 - Reservoirs in Trinity basin serve many functions: water supply, flood control, recreation, electric cooling
 - No indication in PRISM data of fish kills or problems relating to nutrients in

- study reservoirs
 - Popular fishing attractions
 - Over half popular tournament lakes
- Uses & Criteria
 - Existing uses in standards very loose
 - They do not include many functions important to the public
 - To develop numerical nutrient criteria that relate to uses, more specificity will be needed
 - With tentative specific use selections, some relations exist for recreation, aquatic life & water supply
 - More work needed to refine
- General Relations & Criteria Development
 - But data are limited and very noisy
 - Every reservoir is unique & general relations may be limited
 - Data provide a strong basis for criteria development for each reservoir
- Chemical data is from 1993 to present
- Fishery data began in 1996 to present

Evaluation of Potential Nutrient Criteria Parameters - Peggy Glass, Glenn Clingenpeel, & Mark Ernst

- Report of TWCA Nutrient Criteria Committee Investigation of Potential Parameters for Nutrient Water Quality Standards (**See Handout #6**)
- Objective - Determine which parameter(s) is most representative of the extent of algal growth in reservoirs that meets the following criteria:
 - A reasonably representative database currently exists.
 - Needs to be economically & technically practical to continue to gather the data so that updated assessments of standards compliance can be performed routinely
 - Use professional judgement on their reservoirs
 - Focus on the main body
 - Chlorophyll *a* - Have the data and it is reliable
 - Base parameters on uses process
- Scope
 - Major Reservoirs only: 22 evaluated
 - Data from two Basins and three Agencies
 - Trinity & Lower Colorado Basins
 - Trinity River Authority, Tarrant Regional Water District, and Lower Colorado River Authority
 - Planktonic algae assumed to be most significant algal form in reservoirs
 - Parameters Considered: Dissolved Oxygen, pH, Chlorophyll *a*, Total Nitrogen, Total Phosphorus
 - Used 5 years of data - mimic clean rivers program
 - Segregated data for the main body of the lake from data for coves & headwaters
- Dissolved Oxygen (DO) Evaluations
 - Only samples within first meter of depth considered

- DO deficit (mg/L) evaluated for samples collected before 10:00 a.m.
- DO supersaturation (mg/L) evaluated for samples collected after 2:00 p.m.
- Data for total period evaluated
- Only data for April through September of each year evaluated
- Chlorophyll *a* Evaluation
 - Only samples within first meter of depth considered
 - Only data for April through September evaluated
 - Values below detection limit treated as zero
- Total Phosphorus & Total Nitrogen Evaluations
 - Only samples within first meter of depth considered
 - Data for total period evaluated
 - Only data for April through September of each year evaluated
- Parameters Considered & Rejected
 - Variation in DO over 24-hour period - insufficient data
 - DO in hypolimnion & depth to hypolimnion - previous experience suggests algal -
 - concentrations in surface waters are not the principal controlling factor
 - Turbidity - Values frequently lower in summer; difficult to differentiate between biological and inorganic contributions
- Chlorophyll *a* in the Colorado River Highland Lakes
 - Nutrient Criteria -
 - Total N - 79% of dataset was censored (calculated)
 - Total P - 58% of dataset was censored
 - pH - Highland Lakes are well buffered
 - Oxygen deficit/saturation - only meaningful near dawn - reservoir dynamics
 - Chlorophyll *a*
 - One of the most reliable datasets
 - Comes closest to measuring a direct impact
 - Data exist
 - Highland Lake Chlorophyll *a*
 - Mean/ 5-7,
 - Max = 77.9 in Austin
 - Peggy Glass's Opinion
 - Segment-specific criteria seem to be the way to go - reservoir morphology, dynamics, geography
 - Chlorophyll is not the best answer, but it is the only avenue to pursue given time constraints - 1% productivity - nutrient limitation
- Evaluation of Alternative Nutrient Criteria - Glenn Clingenpeel
 - Objectives
 - Examine Potential Alternative Numeric Criteria to TP & TN
 - Examine Data *Spatially* Within Selected Trinity Basin Reservoirs During Growing Season

- Examine Trinity Basin's Population, land use & chlorophyll *a*
 - Grapevine Lake- Total phosphorus concentrations vs. chlorophyll *a* - a direct correlation
 - Lake Livingston - TP concentrations vs. chlorophyll *a* - no direct correlation
 - Lake Ray Hubbard - TP concentrations vs. chlorophyll *a* - no relationship
 - Cedar Creek - a lot of point source pollution
- Conclusions
 - No clear relationship between TP & chlorophyll *a*
 - Coves & headwaters are different than main body
 - Most reservoirs are under-sampled both *spatially* and *temporally* - not enough data out there
 - Chlorophyll *a* appears to be best measure HOWEVER any parameter used as a numeric criterion *must address uses*
- Can DO DO it? - Mark R. Ernst
 - Diurnal DO seems more meaningful of a measurement than instantaneous DO
 - Daily DO variation is not related well to Chl *a* levels
 - Water quality models such as Streeter Phelps and Qualtex utilize daily average DO - Diurnal variation makes this a moving target
- Bloom-Frequency Approach
 - William Walker, 1985 NALMS Proceedings - proposed this approach and applied it to S. African, Vermont and 258 COE Reservoirs
 - Steven A. Heiskary, 1990 NALMS Pub. - User perception surveys to hone in on 30 ug/L Chl *a* as "severe nuisance level" and regional perception uniqueness
 - R. L. Raschke, 1994 NALMS Pub. - Approach applied to 17 reservoirs in SE United States - Suggested mean growing season Chl *a* of 25 ug/L
- Conclusions
 - Chl *a* appears to be the best measure of reservoir eutrophication
 - Minimal day to day variability of Chl *a* may make it a better modeling parameter
 - The "bloom-frequency approach" shows widespread applicability & suggests a mean Chl *a* growing season average of 25.8 ug/L will limit "nuisance" levels of 30 ug/L to 25% of the summer growing season
 - User preference has regional aspects
 - TP is probably the means to the end
- Conclusions
 - Characteristics of coves & headwaters can be very different from characteristics of the main body of the lake - Different criteria may be needed
 - Only April - September data should be used - Timing of sampling can skew results, otherwise
- Conclusions
 - The parameter that seems to rank reservoirs in the most appropriate order, based on general knowledge of the state of the reservoirs, is chlorophyll *a* - However, it

may be necessary to select a higher criteria value than that proposed by EPA

Discussion

- Continue building use data and water supply
- Coordinate with ambient data approach
- Look at subset of reservoirs that we have data first
- Structure to get focus on the best data to make decisions

What's next? - Sidne Tiemann

Rivers, Streams & Estuaries

- Use same data analysis as estuaries
- Additional data collection & data analysis
- SWQM 24-hour DO
- Process raw data & look at historical data
- EPA protocols 25 percentile
- Look at categories
- Pooled 2-sample *t* test
- Water column nutrients & chlorophyll *a*
- Algal assessments
- Benthic chlorophyll *a*
- Need to keep looking at ambient concentration

Discussion

- Will look into scientific data related to uses
- Agency's position on use based approach - individual reservoir basis - long term-averages
- Not getting much feedback from EPA on use base
- Ambient based 25%
- Address nutrient criteria - subset of reservoirs - 110 reservoirs
- Plan by 2004 - philosophy of data to base decision
- Water Quality Division should present reasonable alternatives to upper management & the public
- Group would like the staff to let upper-management know about both approaches
- Use based vs. ambient based
- Need to build data to go beyond reasonable doubt
- Would like to see different alternatives
- Concerns regarding impacted reservoirs
- Ambient focused is quite useful
- Recommend both approaches use base & ambient base
- Present reasonable alternatives to upper management and the public
- Group would like the staff to let upper management know about both approaches - ambient data & uses approach

**Nutrient Criteria Development Work Group
Attendee List
February 24, 2003**

Evan Hornig	USGS
Philip Crocker	EPA
Paul Jensen	PBS&J
Pat Radloff	TPWD
Larry Hauck	TIAER
Mel Vargas	Parsons
Tom Weber	TCEQ
Charles Bayer	TCEQ
Alicia Reininund	LCRA
Mark Ernst	TRWD
Woody Frossard	TRWD
Al Groeger	SWTSU
Dania Drogolewicz	TCEQ - TMDL
Cory Horan	TCEQ
Gayle B. Haecker	Brazos River Authority
Jill Cselcitz	TCEQ
Glenn Clingenpeel	TRA
Peggy Glass	APAI
Jim Mathews	TML
Robert Adams	CHZM HILL
Gail Rothe	TCEQ
Jim Davenport	TCEQ
Larry Koenig	TCEQ
Eric Reese	TCEQ
Sara Burgin	Brown McCarroll
Raika Hammond	Texas Municipal League
Myron Hess	NWF
Allison Woodall	TCEQ
Brenda Smith	TCEQ - SWQM
Donna Long	TSSWCB
Jason Leifester	TCEQ - TMDL
Patrick Roques	TCEQ - SWQM
Mark Cochran	TSSWCB - Temple
Lial Tischler	Tischler/Kocurek
Chris Pasch	Pasch Consultants