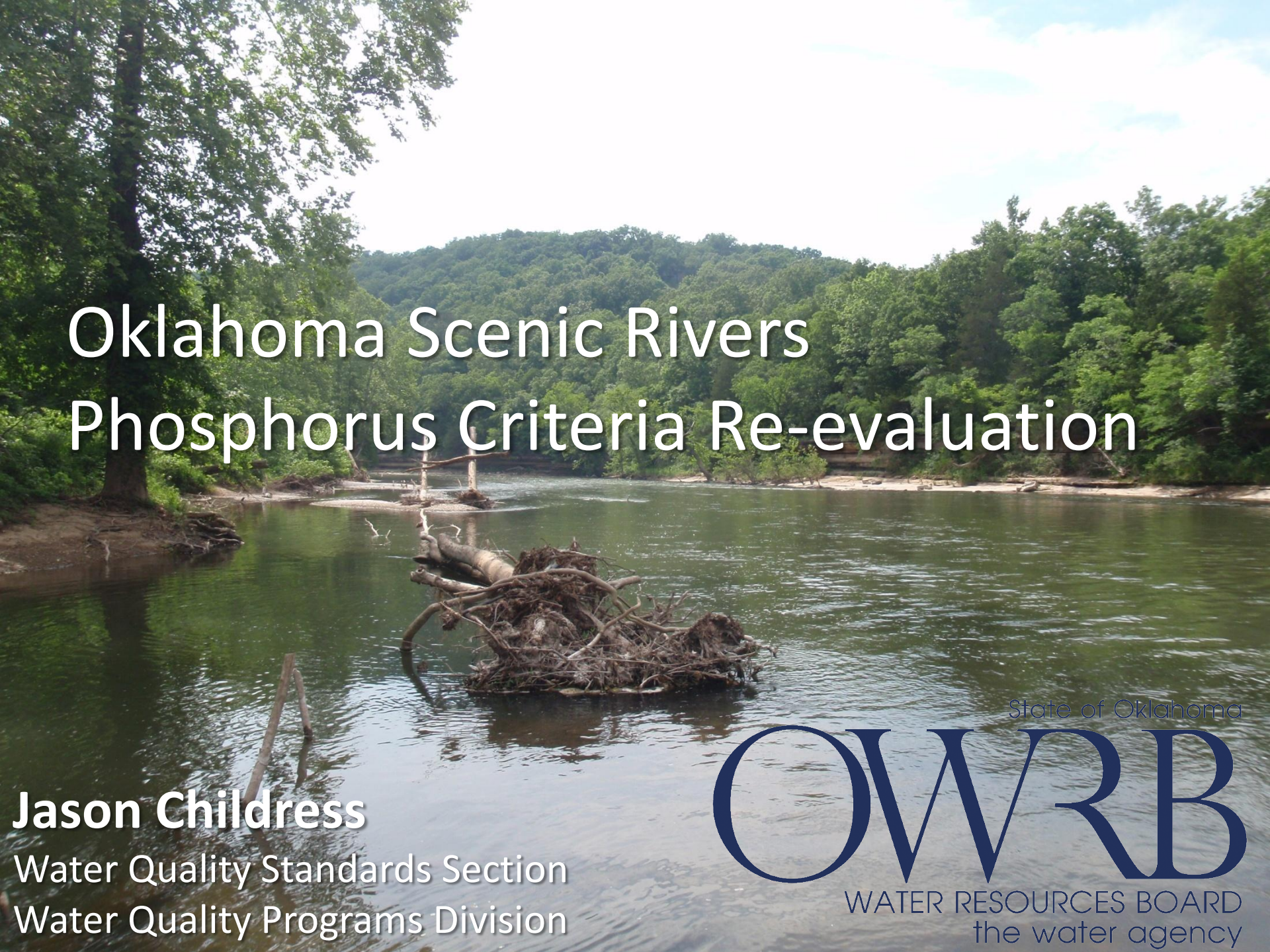
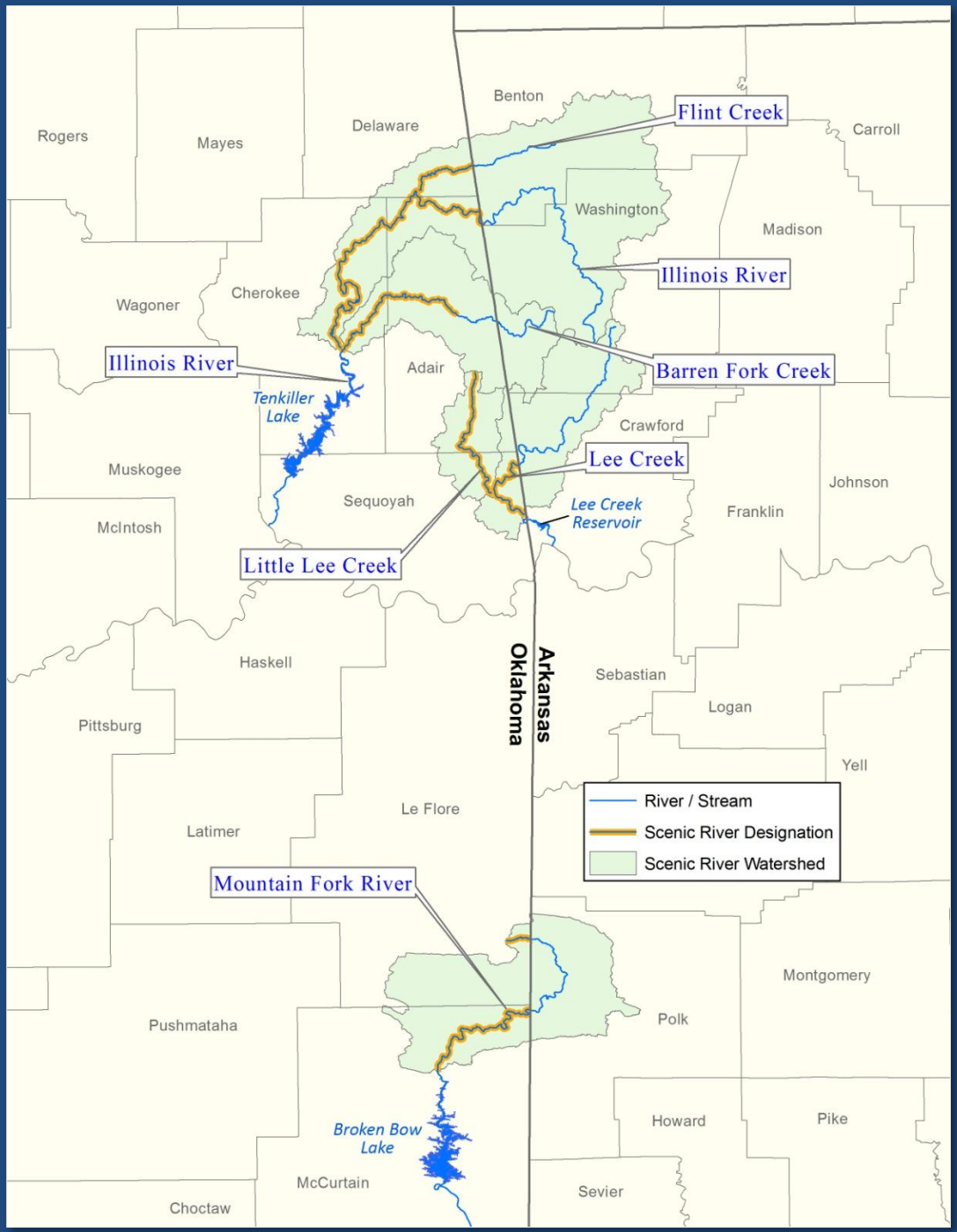


Oklahoma Scenic Rivers Phosphorus Criteria Re-evaluation

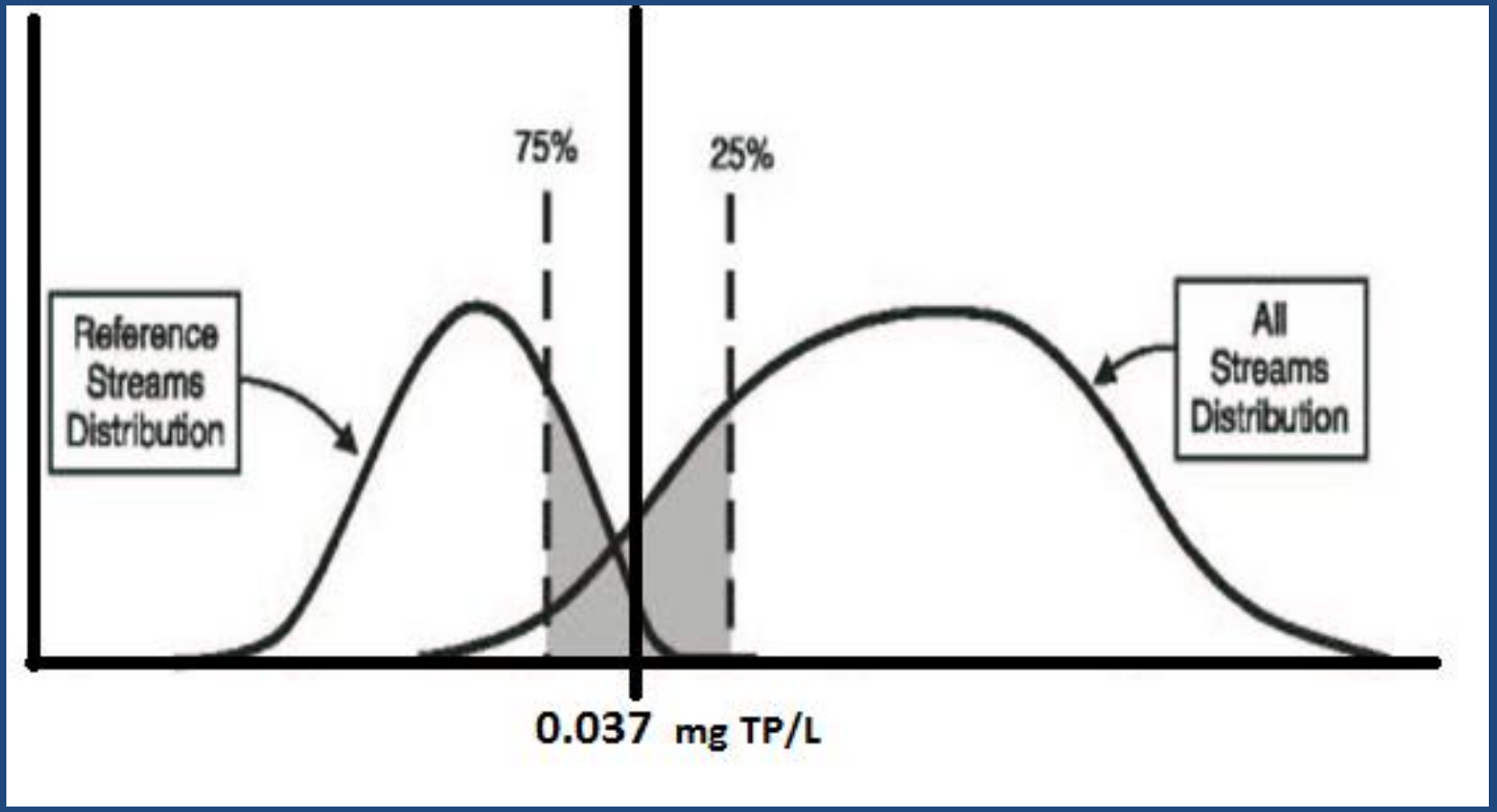
Jason Childress
Water Quality Standards Section
Water Quality Programs Division

State of Oklahoma
OWRB
WATER RESOURCES BOARD
the water agency


Flint Creek
Illinois River
Barren Fork Creek
Illinois River
Tenkiller Lake
Lee Creek
Lee Creek Reservoir
Little Lee Creek
Mountain Fork River
Broken Bow Lake
Arkansas
Oklahoma
Benton
Delaware
Rogers
Mayes
Carroll
Washington
Madison
Wagoner
Cherokee
Adair
Crawford
Muskogee
Sequoyah
Johnson
Franklin
McIntosh
Haskell
Sebastian
Logan
Pittsburg
Yell
Le Flore
Latimer
Montgomery
Polk
Pushmataha
Howard
Pike
McCurtain
Sevier
Choctaw
River / Stream
Scenic River Designation
Scenic River Watershed

Original Criteria

- Empirical and Anecdotal evidence for over two decades indicated that the Illinois River was seriously threatened by excess nutrients
- These nutrients-primarily phosphorus-were resulting in significant growths of algae. River clarity and substrate quality were being adversely affected
- Similar problems with ecological and recreational integrity were also present in the other five Scenic Rivers


75%
25%
Reference Streams Distribution
All Streams Distribution
0.037 mg TP/L

Rule Language

785:45-5-19. Aesthetics

(2) Nutrients; numerical criterion applicable to waters designated Scenic Rivers. *The thirty (30) day geometric mean total phosphorus concentration in waters designated "Scenic River" in Appendix A of this Chapter shall not exceed 0.037 mg/L. The criterion stated in this subparagraph applies in addition to, and shall be construed so as to be consistent with, any other provision of this Chapter which may be applicable to such waters. Such criterion became effective July 1, 2002 and shall be implemented as authorized by state law through Water Quality Standards Implementation Plans and other rules, permits, settlement agreements, consent orders, compliance orders, compliance schedules or voluntary measures designed to achieve full compliance with the criterion in the stream by June 30, 2012*

EPA Approval

- Approved by EPA – Dec 29, 2003
- In it's review of the criteria, EPA considered multiple other sources of data and information
- EPA concluded that these reported values corroborate that Oklahoma's adopted criteria is scientifically defensible and protective

“Statement of Joint Principles and Actions”

“Oklahoma periodically reevaluates all of its water quality standards. In particular, Oklahoma will reevaluate Oklahoma’s 0.037 mg/L criterion for total phosphorus in Oklahoma’s Scenic Rivers by 2012, based on the best scientific information available at that time, and with the full, timely inclusion of officials from the State of Arkansas representing both point and nonpoint source dischargers.”

Following this agreement EPA approved the Oklahoma criterion on December 29, 2003.

Criteria Re-evaluation

- EPA Grant – Project Tasks
  I. Establish Technical Advisory Group (TAG)
  II. Prepare a Secondary Data QAPP
  III. Solicit Best Scientific Information Available
  IV. Information Review
  V. Criteria Reevaluation – with “full, timely inclusion of officials from the State of Arkansas”

Technical Advisory Group (TAG)

Derek Smithee, Chief of the Water Quality Programs Division of the OWRB (Facilitator)

Shannon Phillips, Director of the Water Quality Division of the OCC

Shellie Chard-McClary, Director of the Water Quality Division of the ODEQ

Quang Pham of the ODAFF

Cara Cowan-Watts of the Cherokee Nation

Melinda McCoy with Region VI of the U.S. Environmental Protection Agency

Ed Swaim, Chief of the Water Resources Management Division of the ANRC

Steve Drown, Chief of the Water Division of the ADEQ

OWRB Water Quality Standards Staff - Phil Moershel, Jason Childress, and Lynda Williamson

Timeline

August 2010	Workplan Approved	
January 2011	TAG Initial Meeting	Oklahoma City, OK
April 2011	TAG Conference Call	
May 2011	QAPP Finalized	
May 2011	TAG Meeting	Rogers, AR
August 2011	Public Input Meeting	Tahlequah, OK
October 2011	TAG Conference Call	
November 2011	TAG Meeting	Sallisaw, OK
February 2012	TAG Conference Call	

Information Solicitation

- Solicited “Best Available Scientific Information”
  - Public notices (newspapers)
  - Email lists
  - Stakeholders and Interested Parties
  - Tribal Contacts

Information Review

- Regular review of relevant journals for the past 10 years
- Over 100 specific technical research articles were reviewed – 10 were deemed most relevant and received the most attention
- Submitted information and comments from N.W. Arkansas cities, USGS, and Univ. of Ark.
- EPA N-steps Review

Current TP Values and Trends

- 2003 study by Haggard, Masoner and Becker
  - Statistical analysis shows that the 75th percentile of TP concentrations in the watershed were greater than the criterion.

- 2005 study by Haggard
  - Dissolved P concentrations throughout the Illinois River watershed were generally several orders of magnitude greater than concentrations which typically limit periphyton growth in streams or that are observed in relatively undeveloped basins.

- 2010 study by Haggard
  - Evaluated P loads in the Illinois River from 1997-2008
  - Flow-adjusted loads significantly increased from 1997 through 2002 and significantly decreased from 2002 through 2008.

Nutrient Thresholds & Distributions

- 2006 study by Stevenson, et. al.
  - Looked at two regions (Kentucky and Michigan)
  - Found that most responses in benthic algae occurred in the range of 0.010-0.030 mg TP/L

- 2008 study by Stevenson, et al.
  - Found thresholds in algae responses between 0.010-0.020 mg TP/L in the Mid-Atlantic Highlands
  - They recommended a P criterion in the range of 0.010-0.012 mg TP/L to protect high quality biological conditions in streams of the Mid-Atlantic Highlands
  - Cladophora (unaesthetic and problematic for fishing and recreation) can be prevented by maintaining an average of 0.030 mg TP/L

Nutrient Thresholds & Distributions

- 2009 study by Justus, et. al.
  - Compared algal, macroinvertebrate, and fish assemblage Indices for low-level nutrient enrichment in wadeable Ozark streams
  - At <0.018 mg TP/L biotic metric scores were highest

- 2010 study by Smith and Tran.
  - Used a weight-of-evidence approach to define nutrient criteria for large rivers in New York State
  - EPA's Percentile analysis = 0.023 mg TP/L
  - Cumulative probability distributions = 0.009-0.07 mg TP/L
  - Macroinvertebrates = 0.037 mg TP/L
  - Diatoms = 0.037 mg TP/L
  - Weight-of-evidence approach, proposed criterion = 0.03 mg TP/L

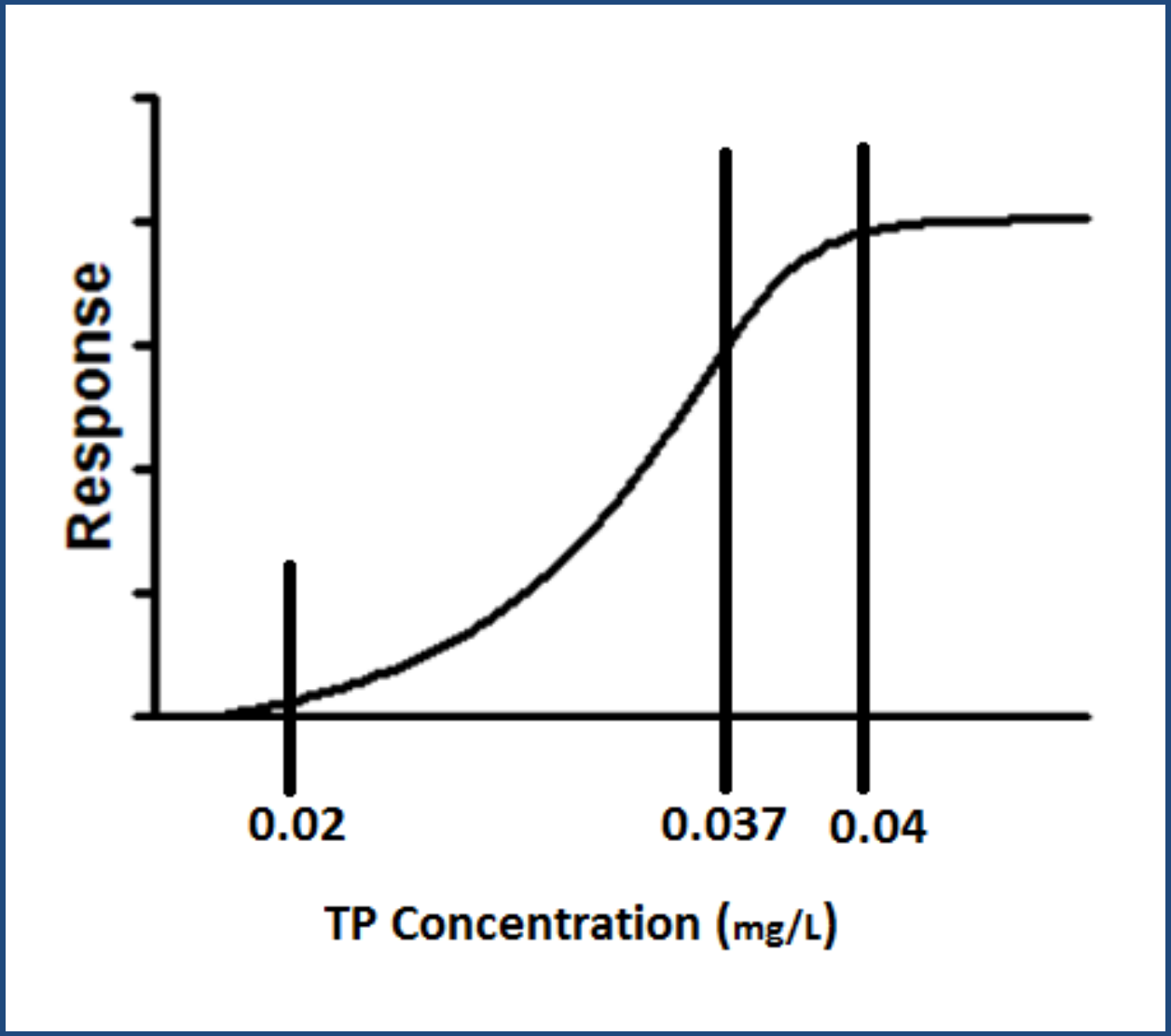
Stressor Response Studies

- 2009 study by King, et al.
  - Wadeable streams in cross timbers region of Texas
  - Found shifts in periphyton communities at concentrations above 0.020 mg TP/L
  - Aquatic macrophyte cover declined in streams with >0.025-0.050 mg TP/L
  - The study suggests that TP levels >0.020-0.030 mg/L, with low flows, will cause declines in dissolved oxygen

- 2010 study by Miltner
  - Focus on small rivers and streams in Ohio (watersheds <1300 km^2)
  - 0.038 a change point in benthic chlorophyll a

Stressor Response Studies

- 2011 Study by Stevenson, et. al.
  - Illinois River Watershed
  - 0.027 mg TP/L a threshold response in cover of stream bottoms by filamentous green algae
  - Authors note that thresholds in algal biomass response to nutrients have often been obsverved close to this concentration. Refers to Dodds (1997) where he found that accrual of benthic algae from streams throughout the world , measured as chlorophyll a, was saturated at approximately 30 µg TP/L


Response
0.02
0.037
0.04
TP Concentration (mg/L)

Frequency and Duration

- Paucity of Information in the literature related to frequency and duration
- No information submitted
- While there is not specific literature, the 30 day geo-mean seems to be supported
    - Accrual periods
    - Growth rates
    - Etc.

Majority TAG Finding

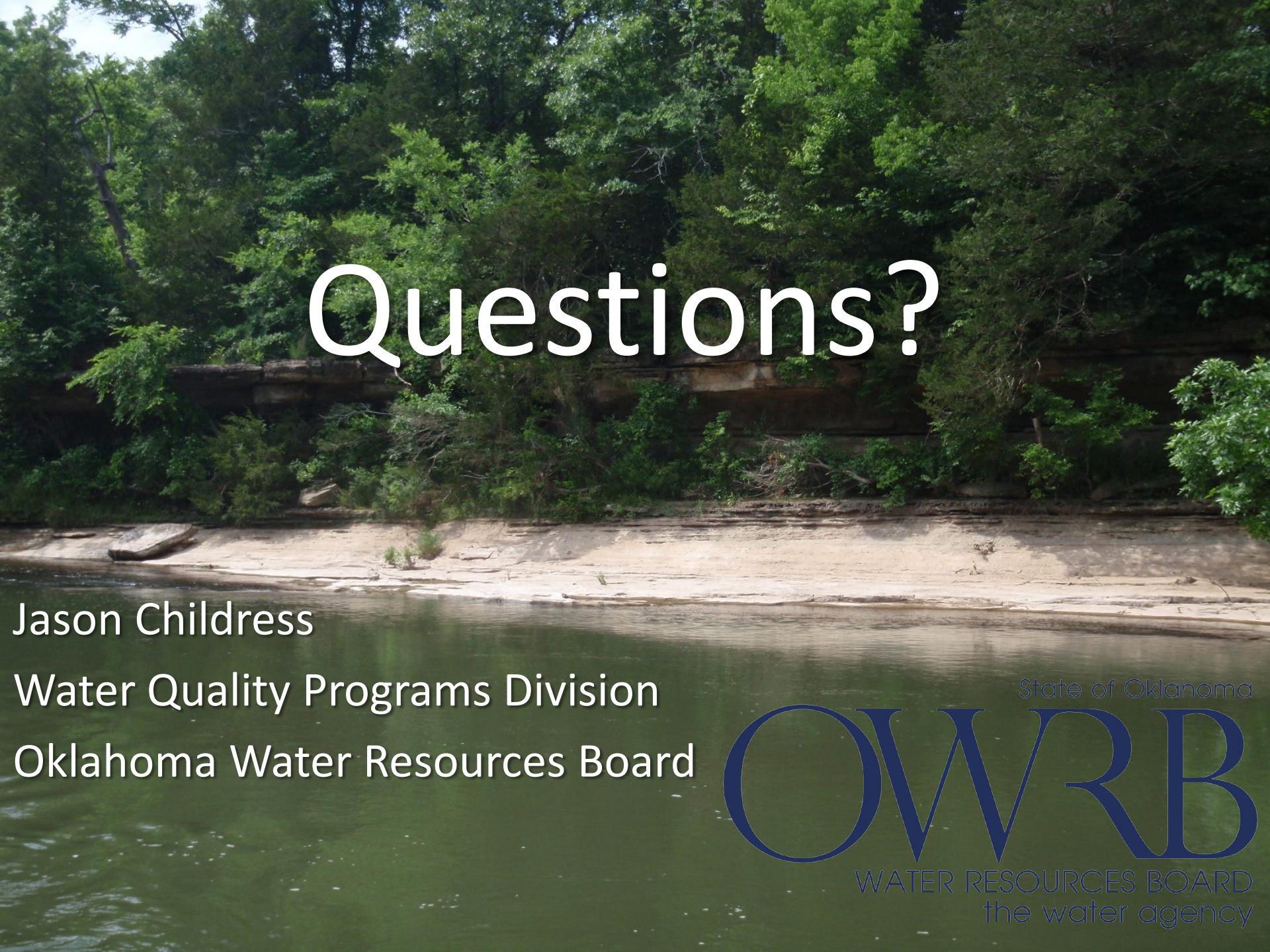
"After reviewing the "best scientific information available" as of the date of this report, no information was found that refuted the criterion. The TAG did not find information that the 0.037 mg/L total phosphorus (TP) criterion is outside of the acceptable range of TP concentrations necessary to inhibit or limit algae growth to protect the Aesthetics beneficial use of Oklahoma's Scenic Rivers."

Final Report, Oklahoma Scenic Rivers Phosphorus Criteria Review – Majority Report
(Page 5119 in the Board Packet)

Majority TAG Recommendation

"The majority of the Oklahoma Scenic Rivers Criterion TAG concludes that no change in the criterion is necessary due to the fact that the best scientific information currently available supports the criterion."

Final Report, Oklahoma Scenic Rivers Phosphorus Criteria Review – Majority Report
(Page 5119 in the Board Packet)



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Water Quality Programs Division
Oklahoma Water Resources Board

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