Illinois Nutrient Water Quality Standards Development

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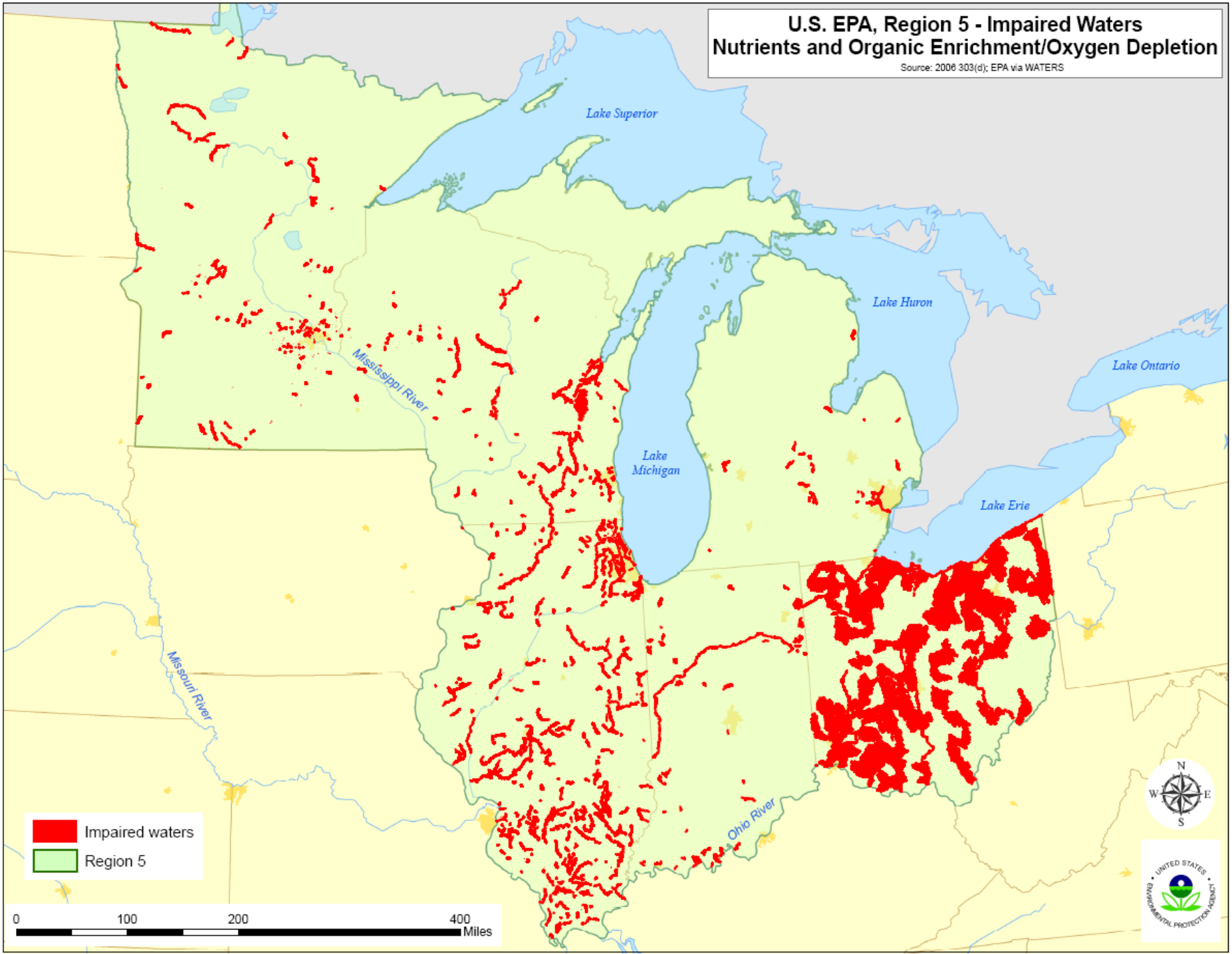
September 13, 2010

A Brief History……

- The nutrient standards development process apparently began in 1998 with a Vice Presidential Directive by Al Gore
- It was noted that many states listed nutrients as one of their leading causes of impairment
- Note that none of the states had stream criteria for nutrients then or now and that the listing process was state-specific and problems of consistency and accuracy exist


U.S. EPA, Region 5 - Impaired Waters
Nutrients and Organic Enrichment/Oxygen Depletion
Source: 2006 303(d); EPA via WATERS
Lake Superior
Lake Huron
Lake Ontario
Lake Michigan
Lake Erie
Mississippi River
Missouri River
Ohio River
Impaired waters
Region 5
0
100
200
400
Miles
N
W
E
S
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

USEPA Criteria

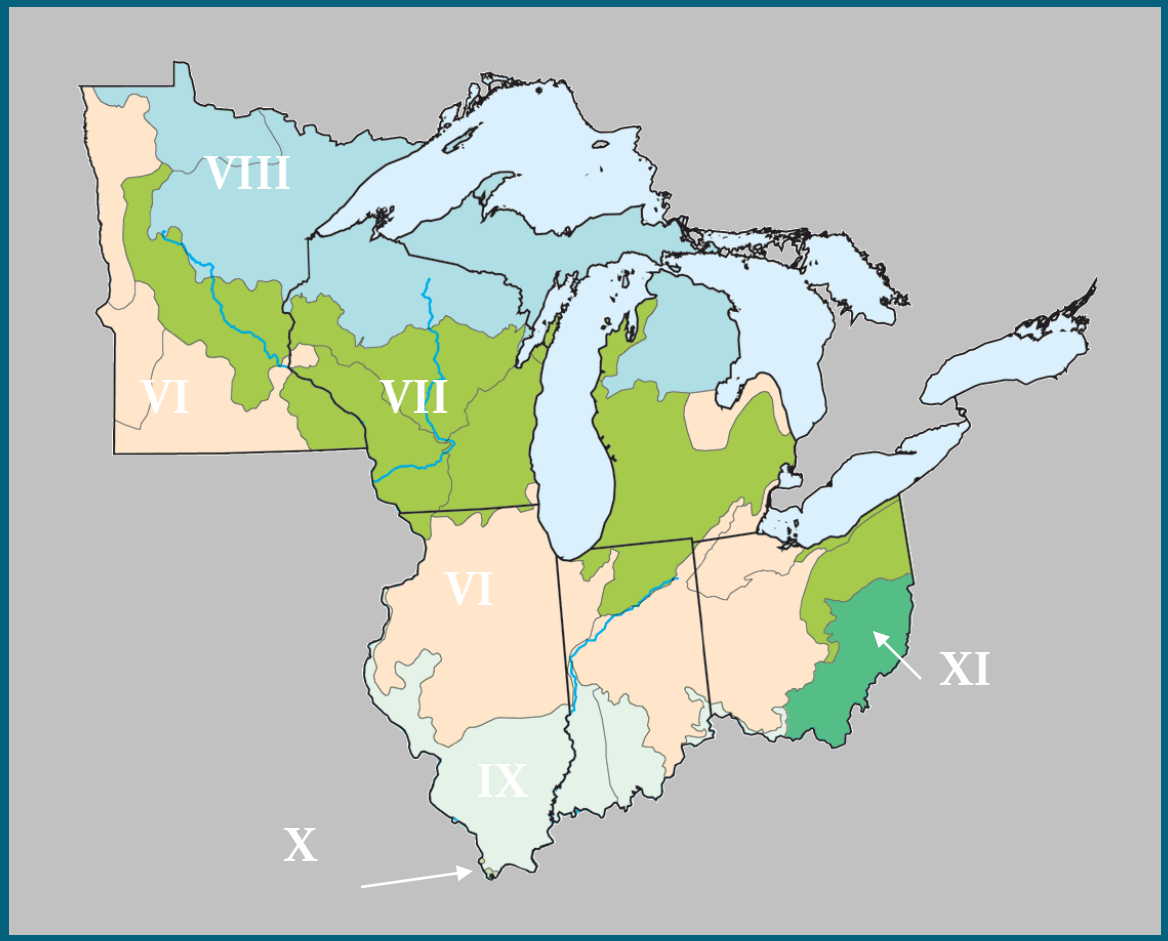
- USEPA adopted water quality criteria for four nutrient parameters (N, P, chlorophyll and turbidity) and under the CWA states are required to adopt these as state water quality standards
- USEPA used a statistical process based on the 25th percentile values from water quality databases
- A set of criteria were calculated for each perceived ecoregion across the nation

EPA Criteria Recommendations for Rivers and Streams 2000, 2001

Ecoregion	TP mg/L
VI	0.076
VII	0.033
VIII	0.010
IX	0.036
X	0.128*
XI	0.010

EPA aggregated national ambient water quality data from 1990-1998, then designated the 25th percentile as the reference conditions.

*may either be a statistical anomaly or reflects a unique condition.



In the case of nutrients, EPA 304(a) criteria establish values for causal variables and response variables. The causal variables are TN and TP; the response variables are turbidity and chlorophyll-a.

Illinois' Approach

- Illinois, as did all other states, decided that the statistical approach was inappropriate and embarked upon a search for cause/effect based standards
- Illinois joined the Region 5 RTAG as did the other states and this became our venue for learning USEPA's expectations for developing and adopting standards
- Illinois early on created a Stakeholder Group
- One important understanding that came about very early was that states were to develop standards to protect local waters, not the Gulf of Mexico

The CFAR Grant Studies

- The search for a cause/effect approach for stream standards was aided by four teams of researchers:
  - U of I – Mark David
  - IL SWS – Mike Machesky
  - ISU – Bill Perry
  - IL NHS – Walter Hill
- These teams conducted Illinois-specific studies attempting to learn what concentrations of N, P or algae/chlorophyll produce impaired conditions

Lessons Learned

- Most Illinois streams are P limited
- Stream plant/algal growth is usually limited by habitat before nutrients enter the picture
  - Light (canopy shading and water-column penetration)
  - Substrate
- No clear and consistent cause/effect relationship was identified between nutrient concentrations and impact

Difficulties Encountered

- If algae growth is the bellwether , how much is too much?
- Are prairie streams naturally high in nutrients and therefore acclimated to high levels?
- How should algae abundance be measured?
- What form of P should the standard be based on?
- Should the WQS regulate average concentrations?
- Should considerations be made for seasons?

Implementation Issues

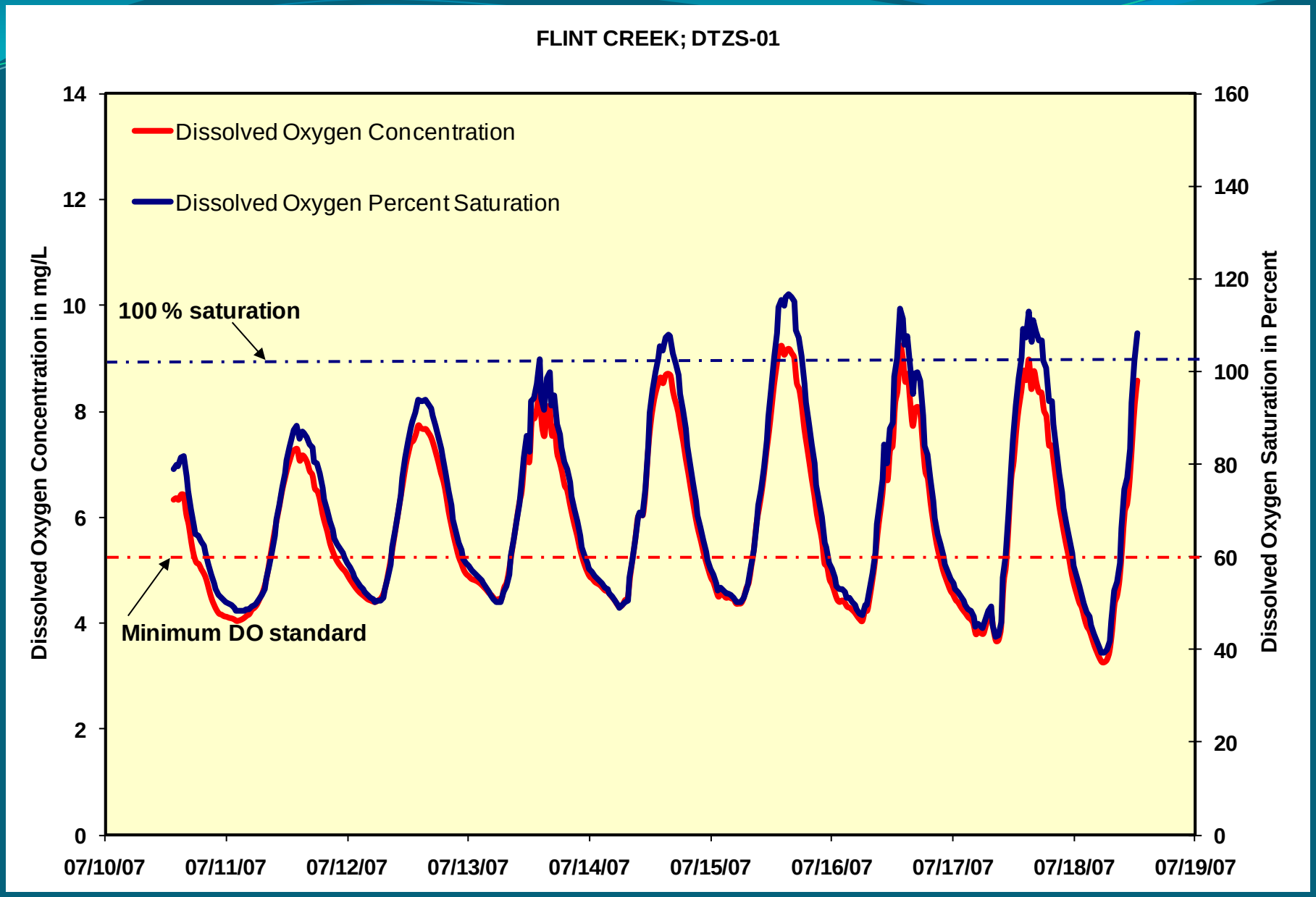
- While nutrient trading is often mentioned as an implementation tool, the CWA need to meet numeric water quality standards everywhere seems to exclude trading as a possibility
- IEPA has numerous questions on regulatory issues that remain unanswered:
  - Will WQBELs be required of all NPDES dischargers regardless of size?
  - Will there be a technology-type limit for P that will trump WQBELs?
  - If phosphorus is the limiting nutrient, why regulate nitrogen?
  - What about urban and agricultural non-point sources?

Where are we now?

Alternative Nutrient Standard Configurations

(Discussed at Stakeholder Meeting February 2008)

- Technology based P effluent limits.
- "Limiting" P concentration (0.05 – 0.08 mg/L)
  - Targeted standard based upon observed biologically driven dissolved-oxygen response.
  - Targeted standard based upon habitat and stream environmental characteristics.
  - Statewide


FLINT CREEK; DTZS-01
Dissolved Oxygen Concentration
Dissolved Oxygen Percent Saturation
100 % saturation
Minimum DO standard
Dissolved Oxygen Concentration in mg/L
Dissolved Oxygen Saturation in Percent
14
12
10
8
6
4
2
0
160
140
120
100
80
60
40
20
0
07/10/07
07/11/07
07/12/07
07/13/07
07/14/07
07/15/07
07/16/07
07/17/07
07/18/07
07/19/07

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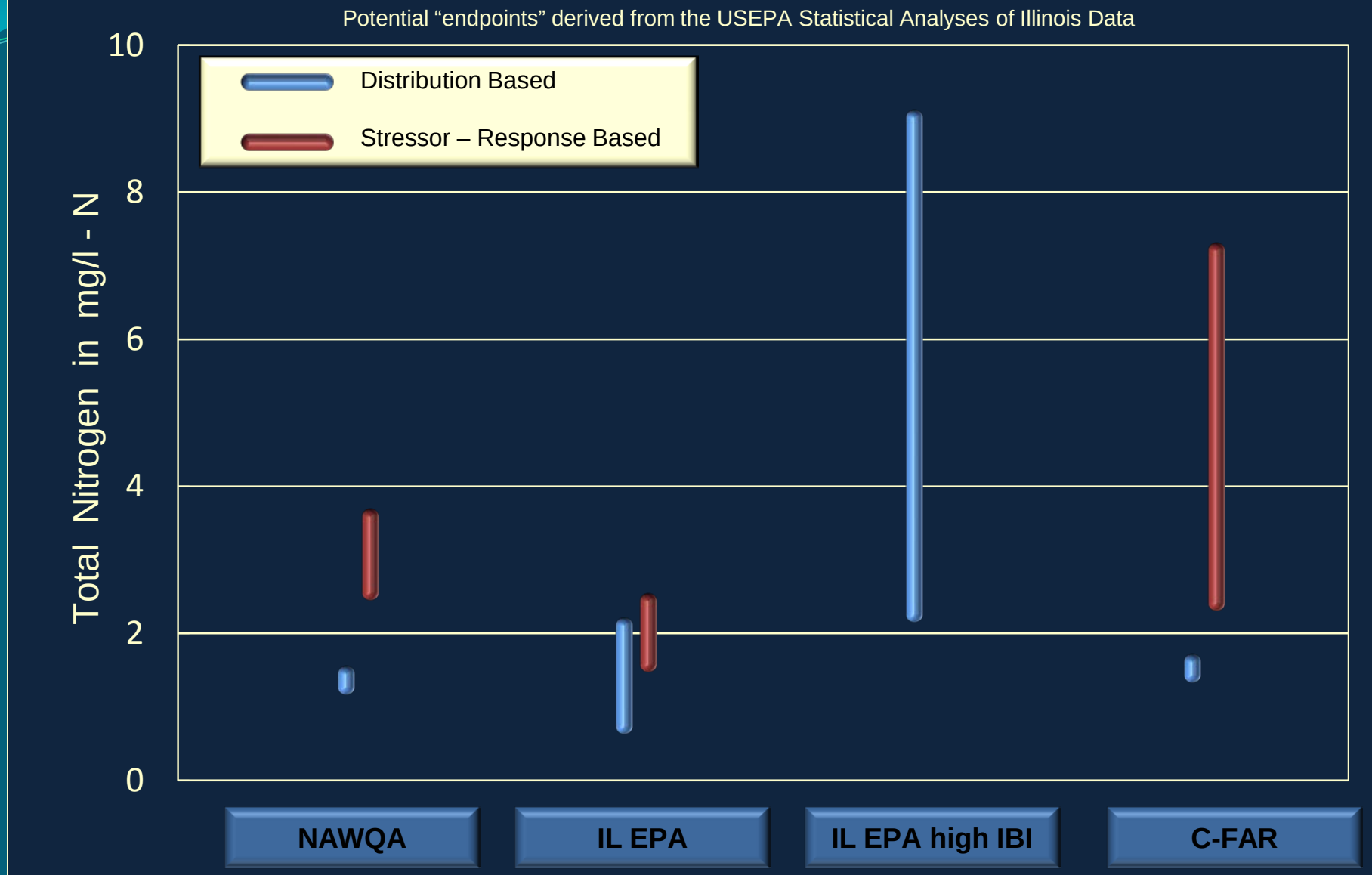
Alternative Standard Configurations

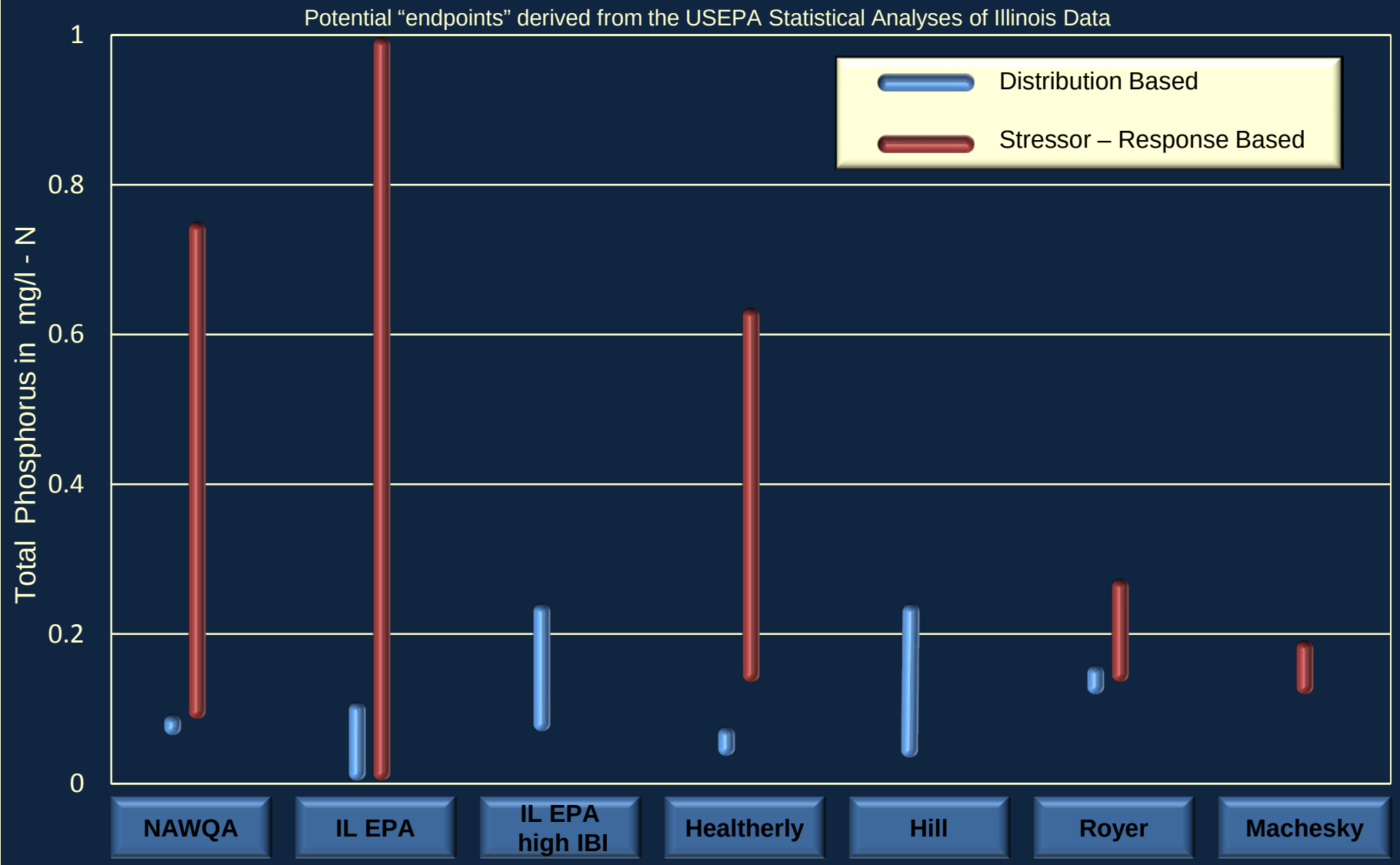
No consensus on any one alternative.

- Targets one source, does not address major source.
- Too protective, not needed.
- Not protective enough, too late, reactionary.
- Need statewide standard (USEPA)

Where Are We Now?

- USEPA analysis of IL data using statistical methods used in some other states (October 2008)
  - Change-point analysis & Conditional probability
  - Wide range of "endpoint" P concentrations (potential criteria)
  - Lack of strong statistical relationships
- Subsequent review of this methodology by a USEPA SAB acknowledged the value of these analyses, but cautioned that they should not be used in isolation or as a stand-alone determination of criteria.


Potential “endpoints” derived from the USEPA Statistical Analyses of Illinois Data
Distribution Based
Stressor – Response Based
Total Nitrogen in mg/l - N
10
8
6
4
2
0
NAWQA
IL EPA
IL EPA high IBI
C-FAR


Potential “endpoints” derived from the USEPA Statistical Analyses of Illinois Data
Total Phosphorus in mg/l - N
1
0.8
0.6
0.4
0.2
0
Distribution Based
Stressor – Response Based
NAWQA
IL EPA
IL EPA high IBI
Healtherly
Hill
Royer
Machesky

Where Are We Now?

- Subsequent analysis to be performed by USEPA on more recent data (2006-2008).
- USEPA has indicated that they will use data from other states in some phases of the new analyses of IL data
- Specifics of this analysis are being discussed.

Other Midwestern States

- MN – New Standards adopted for lakes and reservoirs; working on stream standards
- WI – Standards scheduled to go to rulemaking in 2010
- MI – Standards authority rescinded, standards prepared.
- OH – Proposed standards in review at USEPA HQ
  (Incorporates some dissolved oxygen -based qualifications)
- IN – No proposed standards at this time.
- IA – No proposed standards at this time.
- MO – New Standards adopted for lakes and reservoirs; working on stream standards