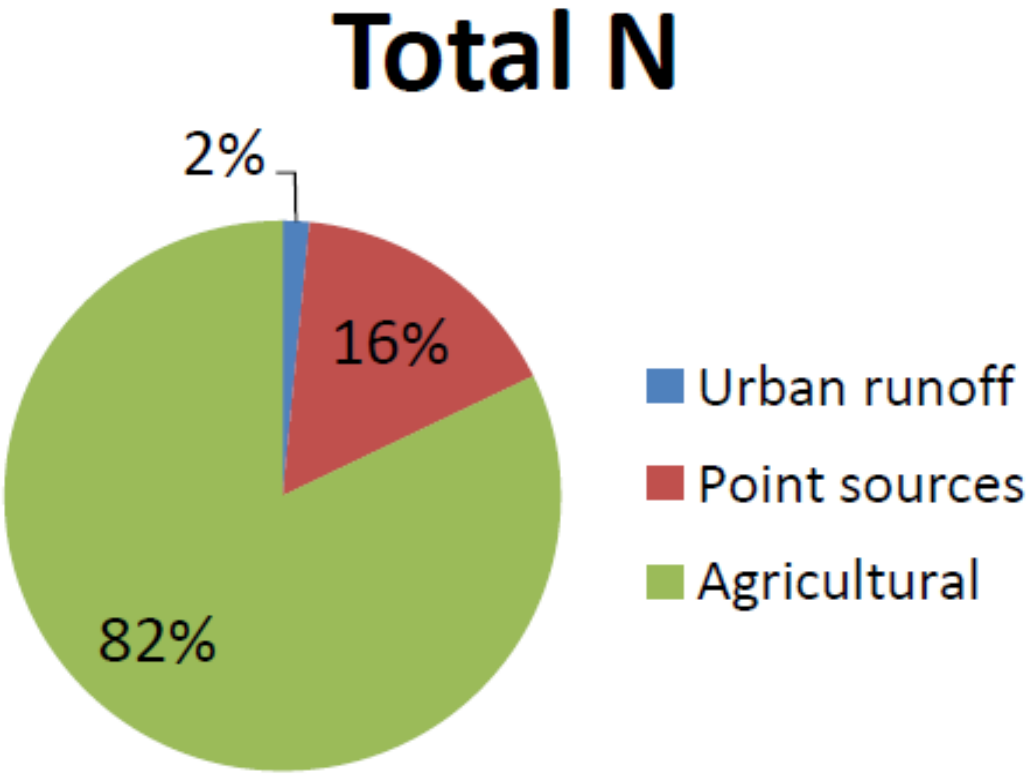
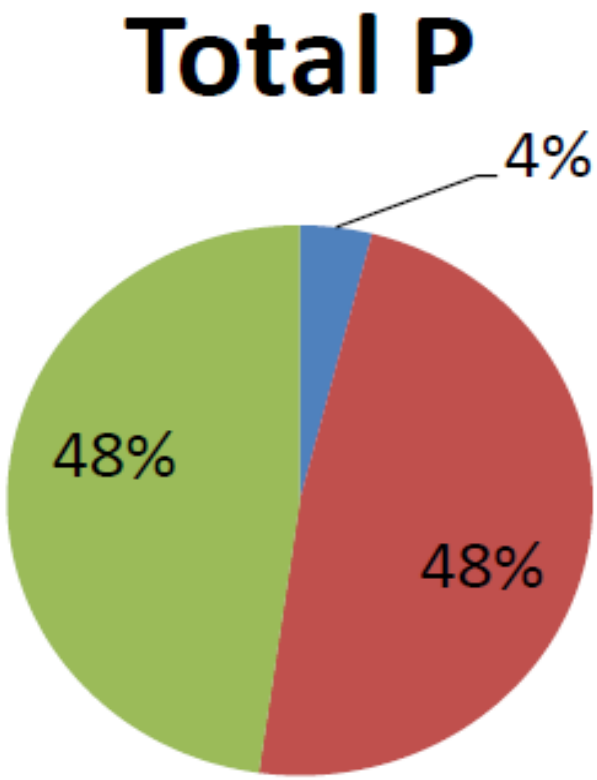
2014 Illinois Water

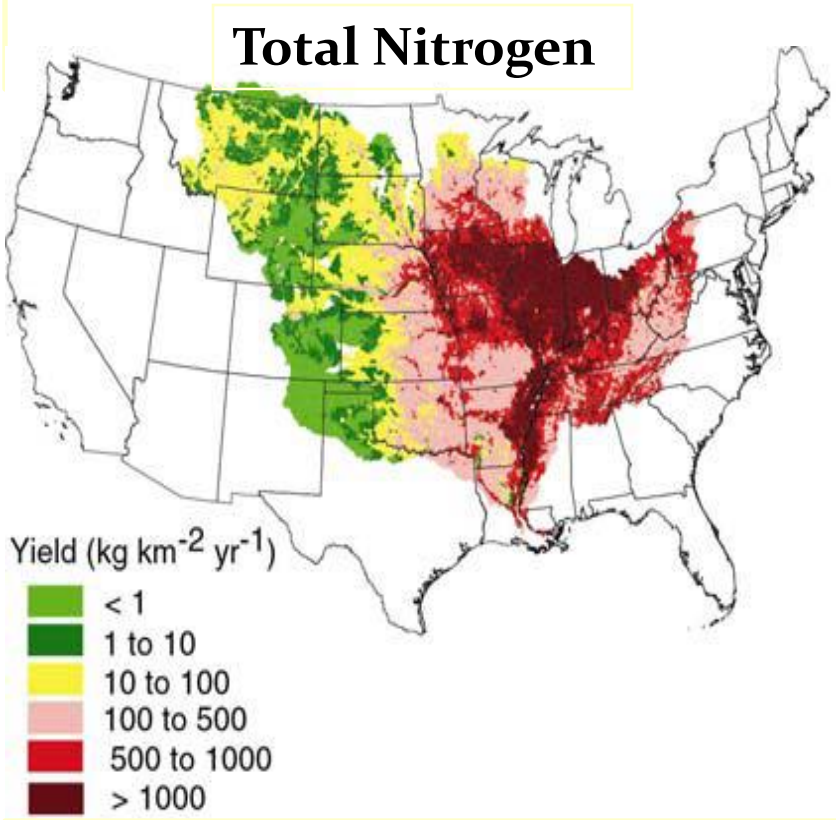
Rick Manner
Urbana & Champaign Sanitary District and
Illinois Association of Wastewater Agencies
Nutrient Committee

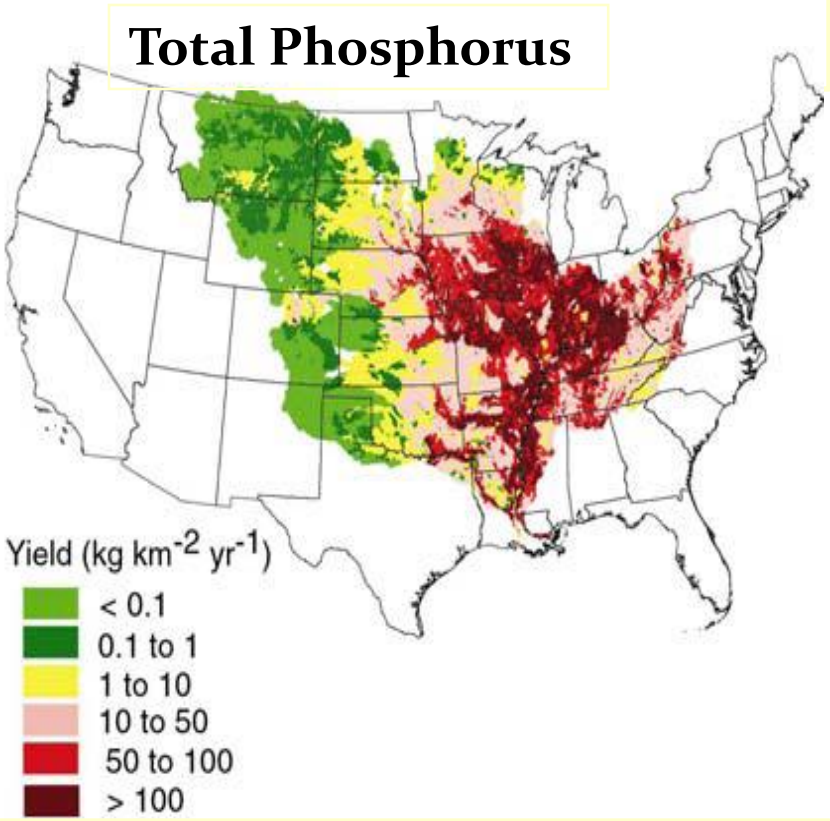
Nutrient Delivery to the Gulf of Mexico Sources Within Illinois





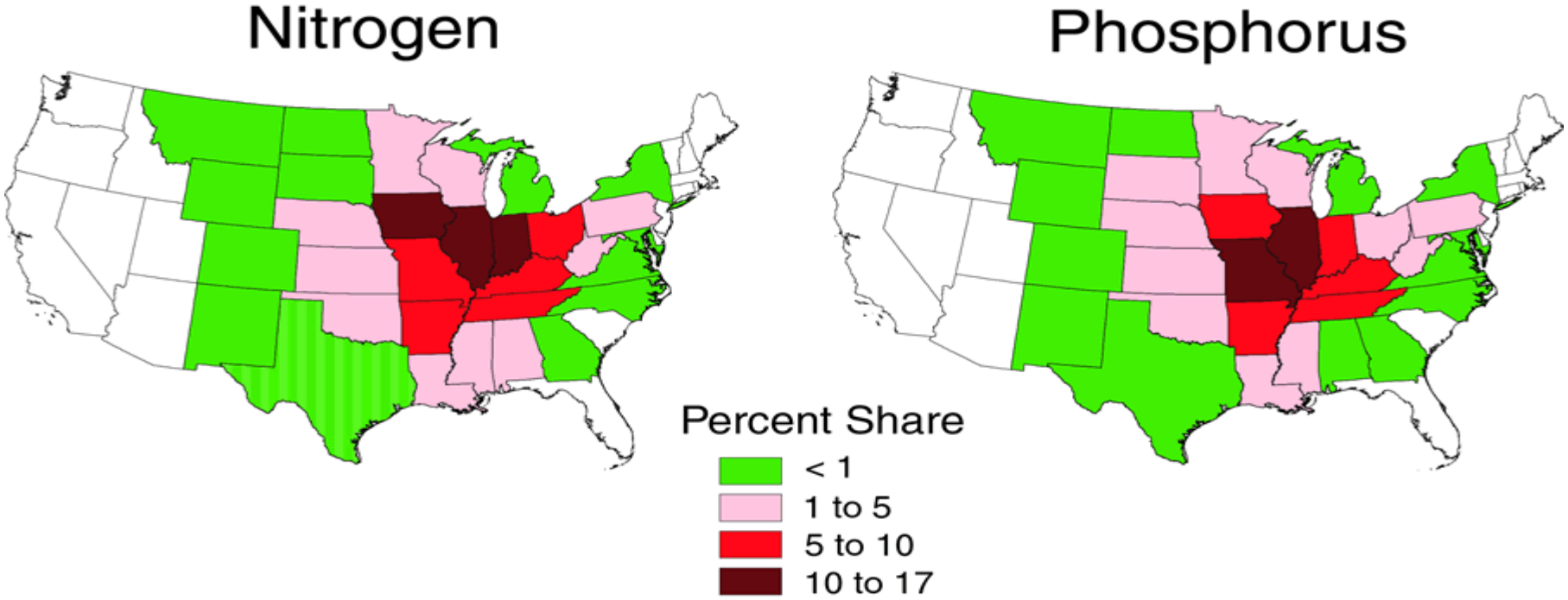
Nutrient Delivery to the Gulf of Mexico



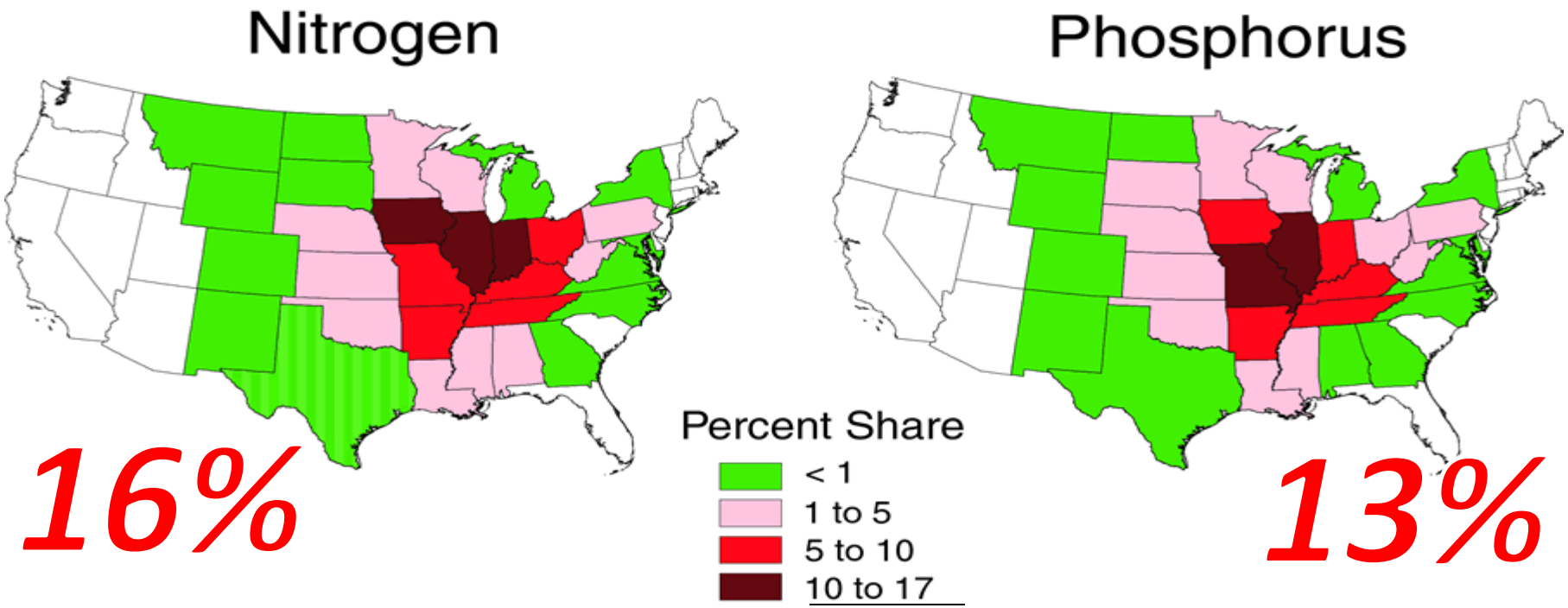


Alexander, et al, *Environ. Sci. Tech.*, 2008

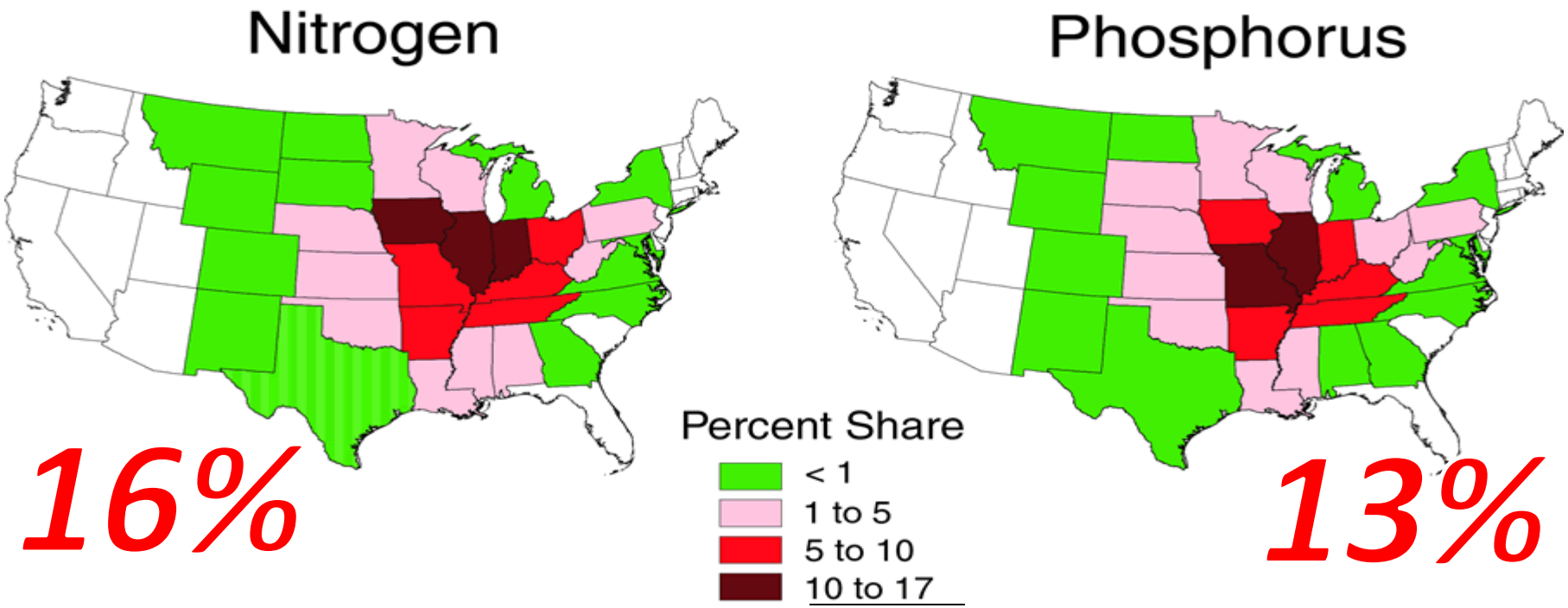
Nutrient Delivery to the Gulf of Mexico



WE'RE #1 !


Nitrogen
Phosphorus
Percent Share
< 1
1 to 5
5 to 10
10 to 17
16%
13%

WE'RE #1 !



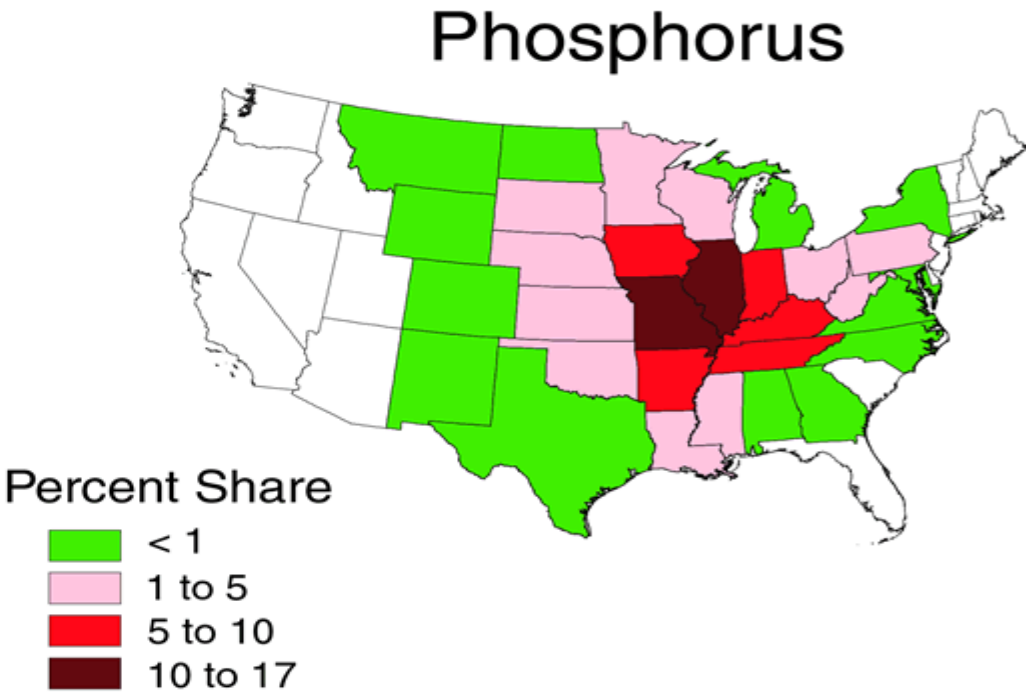
Illinois' Urban Contribution to Basin:

IL cities are about **15%** of population total

IL cities are about **2%** of nitrogen total

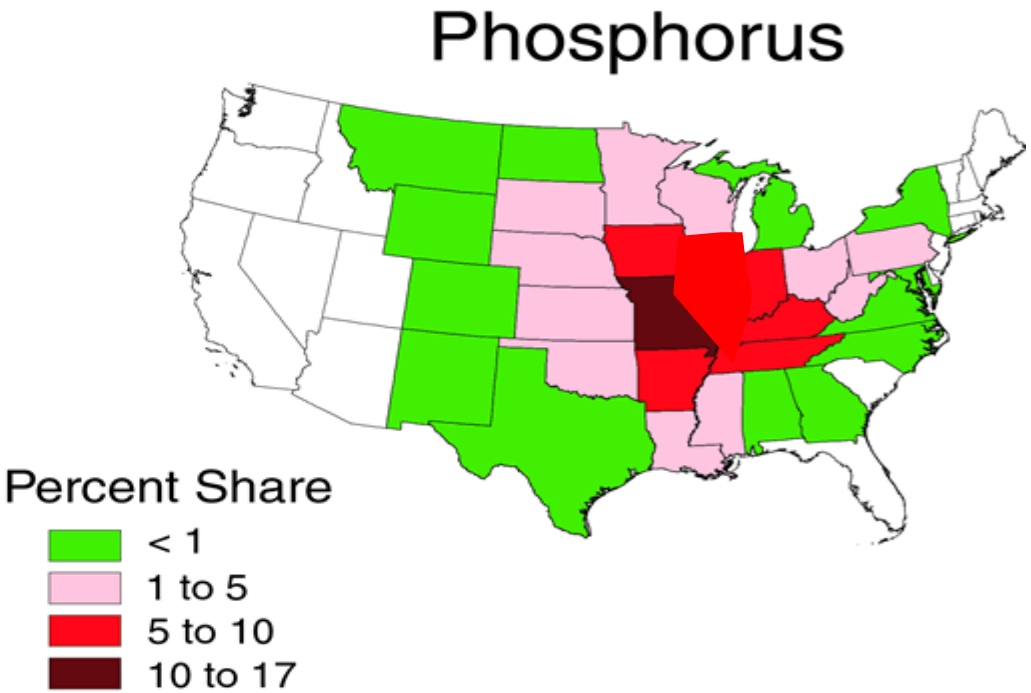
IL cities are about **6%** of phosphorous total

WE'RE #1 !



	Percent of Total Flux	Cumulative Percent of Total Flux	Delivered Yield ($kg\ km^{-2}\ yr^{-1}$)
Illinois	12.9	12.9	117.4
Missouri	12.1	25.0	89.4
Iowa	9.8	34.8	89.2

WE'RE #3 ?



	Percent of Total Flux	Cumulative Percent of Total Flux	Delivered Yield (kg km^{-2} yr^{-1})
Illinois	12.9	12.9	117.4
Missouri	12.1	25.0	89.4
Iowa	9.8	34.8	89.2

Current Illinois Nutrient Standards

- Nitrate WQS of 10 mg/L @ d-water supply intake (1972)
- P WQS of 0.05 mg/L for lakes > 20 acres (1972)
- < 25 miles upstream of lakes get 1 mg/L P effluent (1986)
- Narrative offensive conditions standard (1972)

- 1.0 mg/L P limit for new or expanded > 1 MGD **(2006)** "The Interim P Rule"

Illinois Nutrient Standards - Current

- First 4 compliance rules address **local** problems

- Interim 1.0 mg/L P standard has impacted numerous plants
  - Lacks the typical local effect or scientific basis for passage
  - However, it already was the smart design already
  - This limit kicks in when a plant is new or expanding
  - Without waiting for expansions, many facilities would have relied upon chemical P precipitation

Illinois Nutrient Standards – Near Term

- Expecting to add narrative standards clarifications
- Expecting to add voluntary “Nutrient Facilities Plan”

Illinois Nutrient Standards - Results

- Phase I P Milestone is primarily point source reductions
  - Currently point sources are about 48% of IL loading
  - Point sources expecting to exceed Gulf Hypoxia goal of 45% reduction from baseline
  - Expecting 9 million lb P/yr reduction
    - Interim P limits has impacted many plants
    - Voluntary reductions from MWRDGC (including N, if possible)
    - Reductions from Des Plaines, DuPage, and Fox River watershed communities
    - Interim P trend will continue

Illinois Nutrient Standards - Results

- Phase I N Milestone must be a mixture of reductions
  - Currently point sources are 16% of Illinois' loading
  - 45% reduction may be difficult with current tech
  - Point source reductions will be a combination:
    - Incidental reductions via bio-P installations
    - Voluntary reductions
    - Nutrient Facilities Plan will document successes

Nutrient Facilities Plan

- Facilities Plans are planning documents that evaluate alternatives and expectations for the next 10 to 20 years
  - When doing this for nutrients expect to:
    - Document current discharges for N and P
    - Identify any existing, low-cost reductions
    - Confirm roadblocks stopping more reductions
    - Evaluate alternatives for future

Nutrient Facilities Plan – Why?

- Sewage treatment is complicated
  - Must balance multiple goals – P, N, NH_3, SSO, CSO, excess flows, e-coli, pharmaceuticals, energy demands, security
  - Existing infrastructure provides many constraints
  - No one-size-fits-all solutions
  - Cost per pound goes up geometrically

Illinois Nutrient Standards - Future

- Consider establishing a private-sector, Environmental Utility

UCSD - Northeast Plant

Just nominated- IEPA's Best Operated Plant in 2014 !

- Contact Info:
- Rick Manner
- UCSD
- 217-367-3409 ext. 230
- rmanner@u-csd.com

Current Illinois Nutrient Standards

- Nitrate WQS of 10 mg/L @ d-water supply intake (1972)
- P WQS of 0.05 mg/L for lakes > 20 acres (1972)
- < 25 miles of certain lakes 1 mg/L P effluent (1986)
- Narrative offensive conditions standard (1972)

- 1.0 mg/L **P limit** for new or expanded > 1 MGD (2006)
- Gulf of Mexico impacts (????)
  N limits based upon these

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

CFAR Grant - 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

CFAR Grant - Lessons Learned

- A study by Hill (INHS) of a stream before and after a new sewage treatment plant was operational found that although stream phosphorus concentration increased markedly with the discharge of the new effluent, algae growth in the stream did not increase significantly and aquatic life did not decline.

- Illinois EPA biologists do not attribute many stream impairments to nutrients.
  - Few streams have notable algae growth.

USEPA Stressor Response Analysis

- USEPA contracted TetraTech to analyze Illinois stream nutrient data and fish and macroinvertebrate data to find correlations.
- No clear correlations were found. (IEPA/IAWA agrees)

- SUBSEQUENT WORK BY ANGRANDI (2013)
  - USEPA says "<u>it is possible to detect statistically significant, biological responses to phosphorous</u>"… in <u>Illinois</u>.

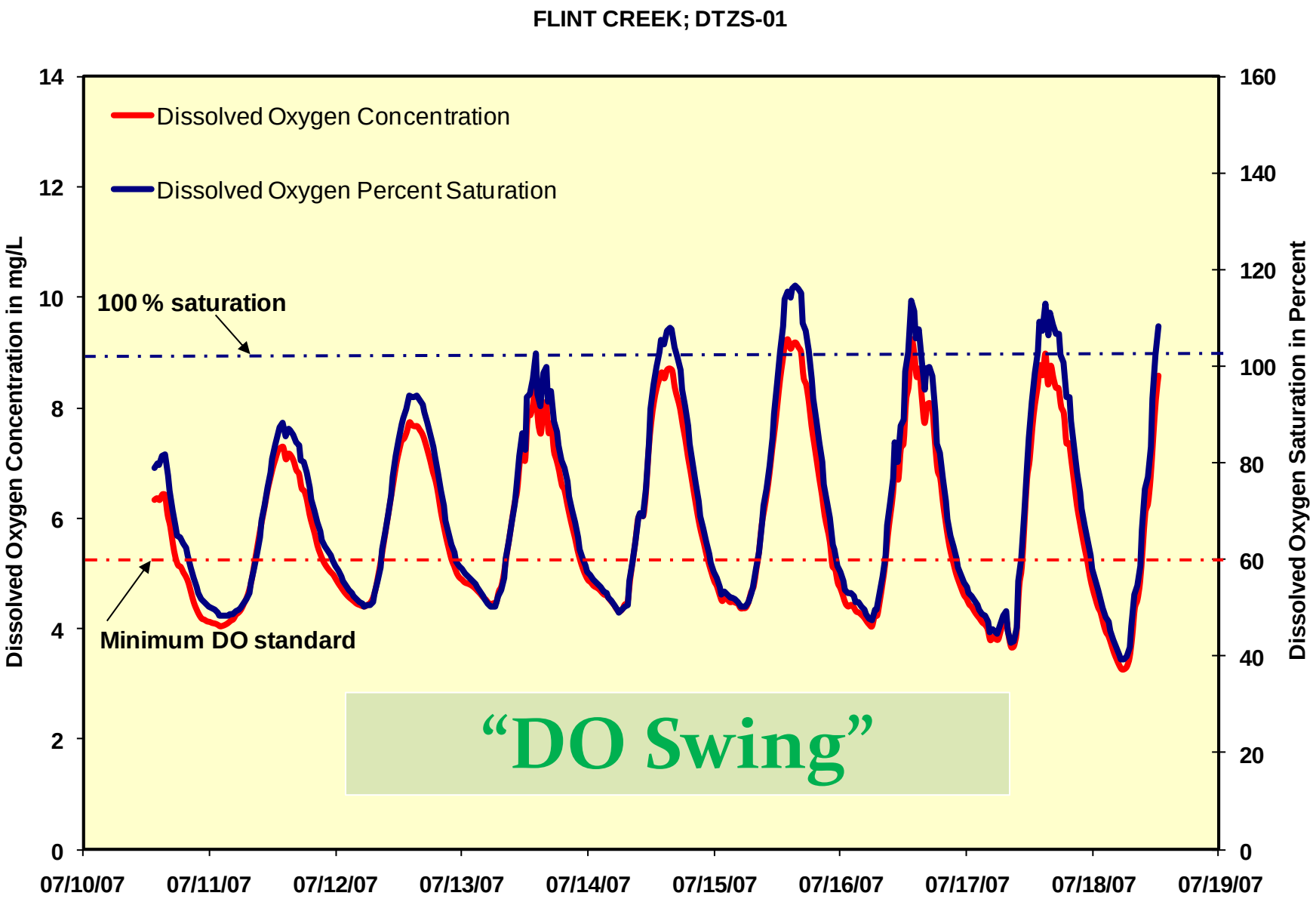
    (IAWA disagrees)

Can Algae Impaired Streams Be Identified?

Can Algae Impaired Streams Be Identified?

- Should we revise narrative standard to reflect thick mats of algae = impairment?

- IAWA has agreed that this is a direct link to nutrients and would be expected to generate nutrient limits. (Scenario A, Scenario B, etc…)


FLINT CREEK; DTZS-01
Dissolved Oxygen Concentration
Dissolved Oxygen Percent Saturation
100 % saturation
Minimum DO standard
"DO Swing"
Dissolved Oxygen Concentration in mg/L
Dissolved Oxygen Saturation in Percent
0
2
4
6
8
10
12
14
0
20
40
60
80
100
120
140
160
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

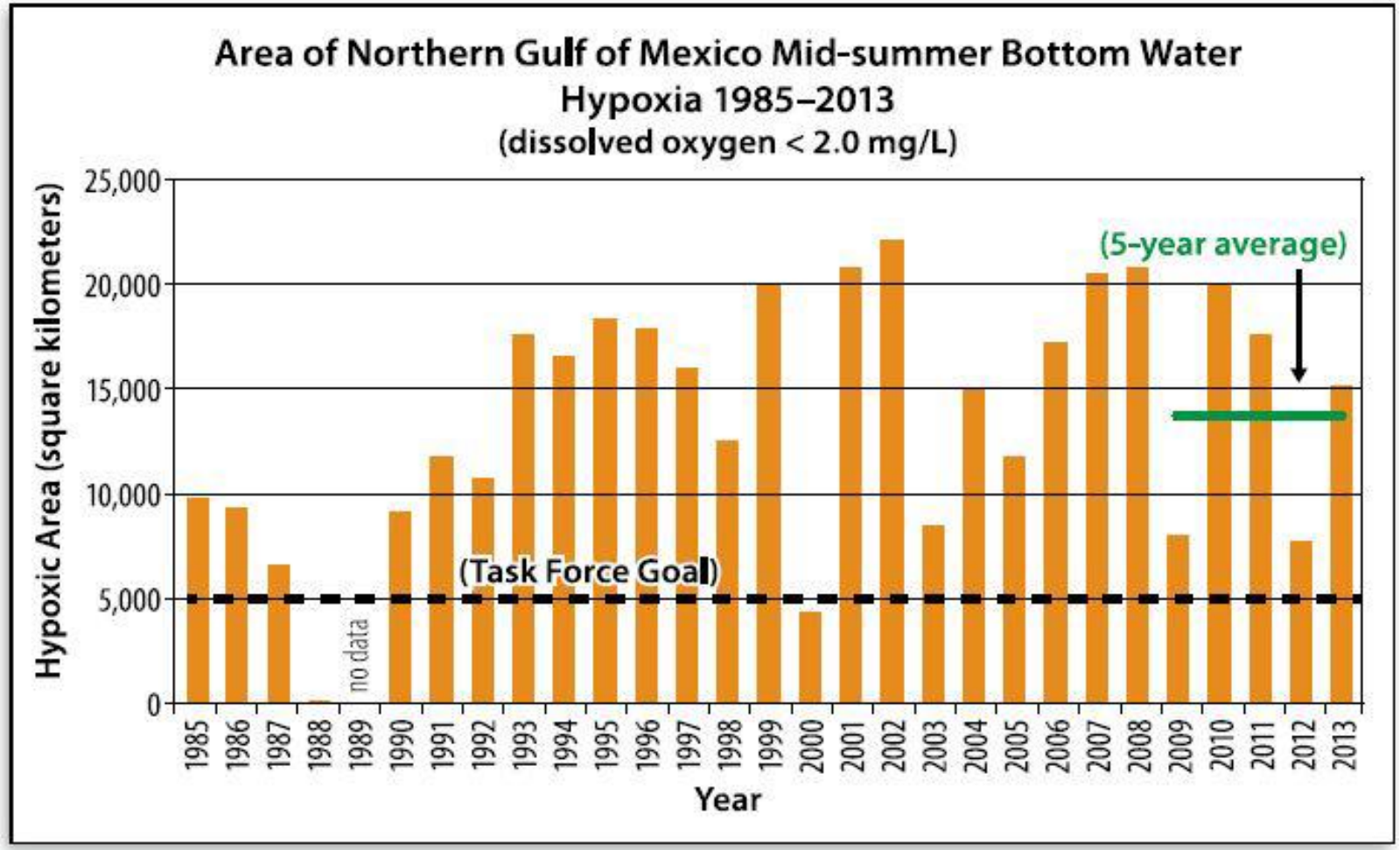
Gulf Hypoxia Action Plan 2008

for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin

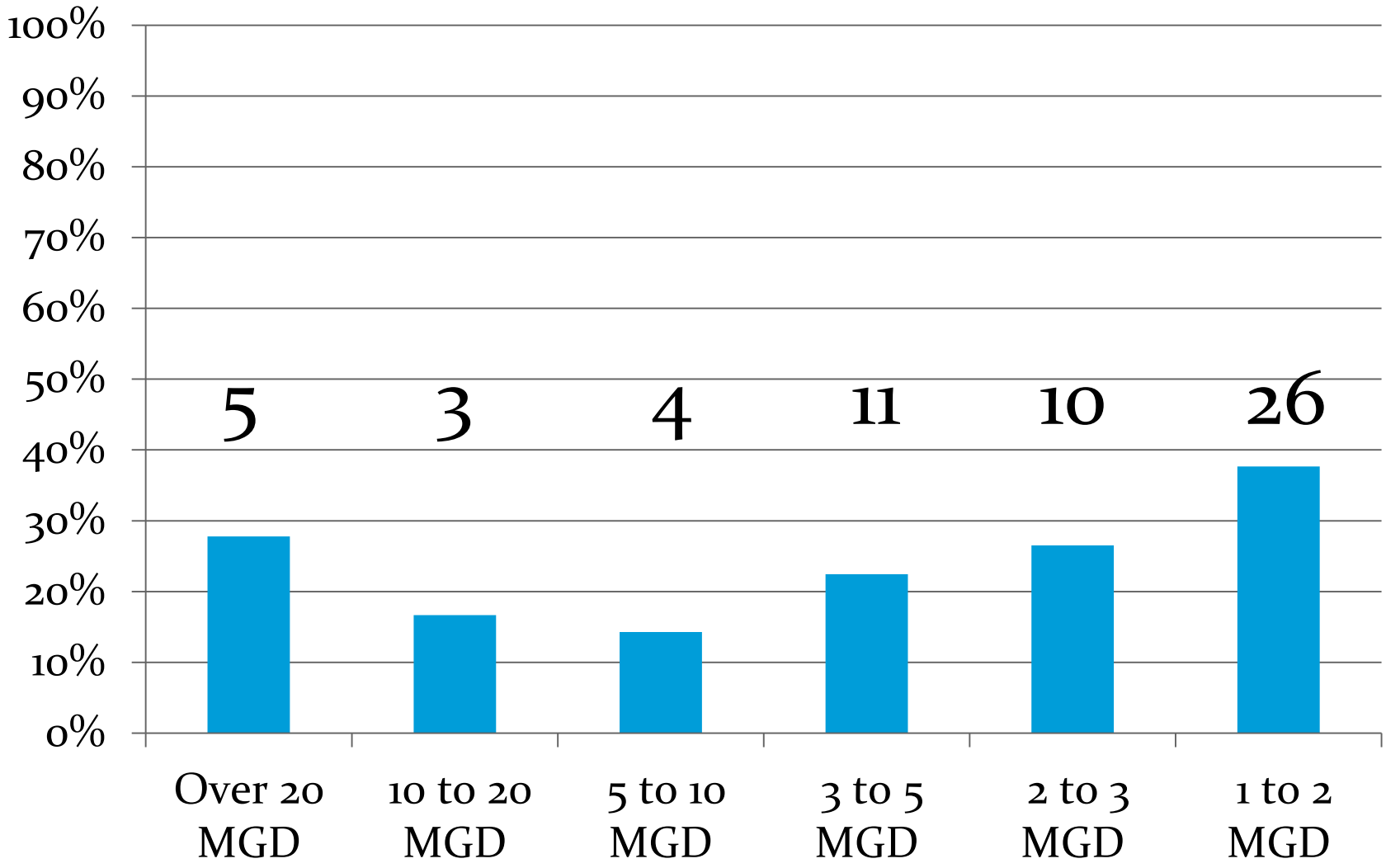
Mississippi River Gulf of Mexico Watershed Nutrient Task Force

Mississippi/Atchafalaya River Basin

Size of the Gulf Hypoxic Zone (1985-2013)



IL Majors With P Removal - 2013



Focus on Phosphorous

- Reductions via working on local problems
  - Local, cultural eutrophication
  - TMDLs
- Voluntary via Nutrient Facilities Plan

Current Illinois Nutrient Standards

- Limit are intended to resolve local issues
- 4 of them are scientifically based and do that

- Limit on expanding plant is exception, but building that way is practical

- Gulf Hypoxia is a national issue
  - Reductions anywhere are equally effective
  - Current trends have point sources reducing P by 45+%
  - N reductions at point sources will often be a byproduct of choosing biological P control

Focus on Nitrogen

- Very few local impacts
- Reductions via solving local problems
- TMDLs
- Nitrogen reductions via incidental impacts of bio-P
- Voluntary via Nutrient Facilities Plan

Solving the Correct Problem?

- Studies do not imply an N or P problem
  - Only IL relationship, better biota at **high** N
  - CFAR = no or trivial correlation to chemistry
  - Hill = more effluent resulted in better biota
  - MWRDGC = less P gave no improvement
  - Most IL streams have excess of N and P
    - Most streams will continue to have excess

Solving the Correct Problem?

- Limits are chemistry solutions
  - Will not improve habitat, shading or substrate
  - Will consume public funds for projects
    - Rates go up and river is still green!
- Alternative solutions
  - Du Page River & Salt Creek Watershed Group
    - Highest scoring projects are not chemistry
    - Formed when it was obvious that a chemistry solution was not appropriate

Solving the Correct Problem?

- Alternative solutions
  - Du Page River & Salt Creek Watershed Group
    - Highest scoring projects are not chemistry
    - Formed when it was obvious that a chemistry solution was not appropriate
  - Statewide Environmental Utility

IAWA Summary – Nov. 2013

Want: Flexibility, Alternatives,
Integrated Planning,
Time for Planned Construction

Prefer: BNR and "Green" Solutions
(where they can work, they often
out-perform limits substantially)

IAWA Summary – Nov. 2013

Local Impacts Matter

Honor Watershed Workgroups

Interim P works for expansion

Narrative Std. to include DO Swing

Protect low P streams

Current Suite of Rules Mostly Sufficient

IAWA Summary – Nov. 2013

Gulf is a New National Impact

Reductions Anywhere Are Equally Effective

Much Progress Already Made

Voluntary Reductions **1**st/Best (Can they suffice?)

"Nutrient Facilities Plan" = Evaluation @ NPDES

Identify unique circumstances, barriers. Plan for future.

Nutrient Reduction Strategy

What's Next?

IEPA's Current Regulations for Nutrients

- TMDL for P or N
  - 19 point source related
- Interim P limit (Section 304.123)
- Upstream of lakes (Section 304.123(b))
- Antidegradation for potential to degrade (Section 302.105)
- Narrative for unnatural algae (Section 302.203)
  - Nov 2011 IEPA committed to add limits in such cases

Nutrient Reduction Strategy for Point Sources

- Currently at 87 M lbs/yr N and 18 M lbs/yr P

- 16% of N from Point Sources - this is a typical fraction
  - Point sources small part of problem
  - Point sources are not targeted for active change as of today

- 48% of P from Point Sources - **NOT** typical fraction
  - **Point sources in IL are considered part of the problem**
- 8 M lbs/yr reduction for P overall
  - ~4 M lbs/yr reduction from point sources "done" or "soon"
    - Will drop Illinois' point sources to more typical levels
    - **Will probably manage 45% reduction goal for Gulf Hypoxia**

Current Illinois Nutrient Standards

- Nitrate WQS of 10 mg/L @ d-water supply intake (1972)
- P WQS of 0.05 mg/L for lakes > 20 acres (1972)
- < 25 miles of certain lakes 1 mg/L P effluent (1986)
- Narrative offensive conditions standard (1972)

- 1.0 mg/L P limit for new or expanded > 1 MGD (2006)
- Gulf of Mexico impacts (**N** limits based upon these)