An Approach to Optimize Water Quality and Streamflow Monitoring within Indiana

Iroquois River at Foresman

Indiana Water Monitoring Council

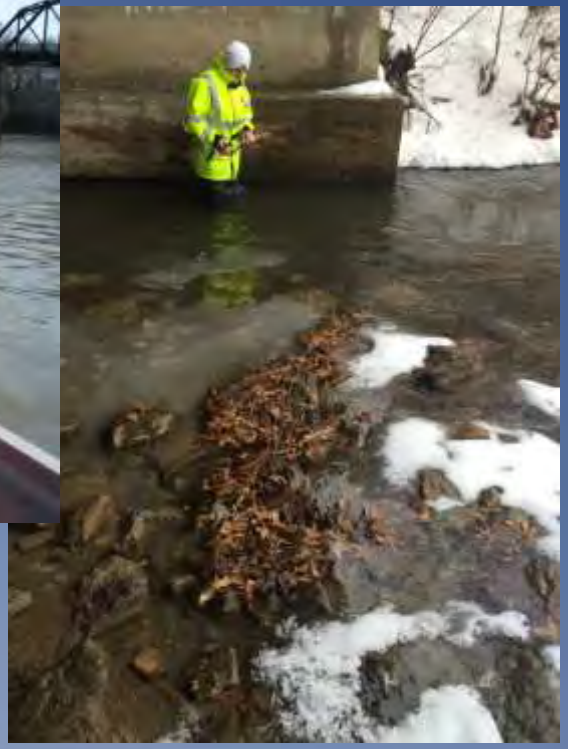
School Branch

Indiana Water Monitoring Council:
Jeff Frey, USGS; *Jody Arthur, IDEM*

USGS

Water Summit, 8-15-2019

Water-Quality Monitoring Needs to Happen When Water is High: All Year Round



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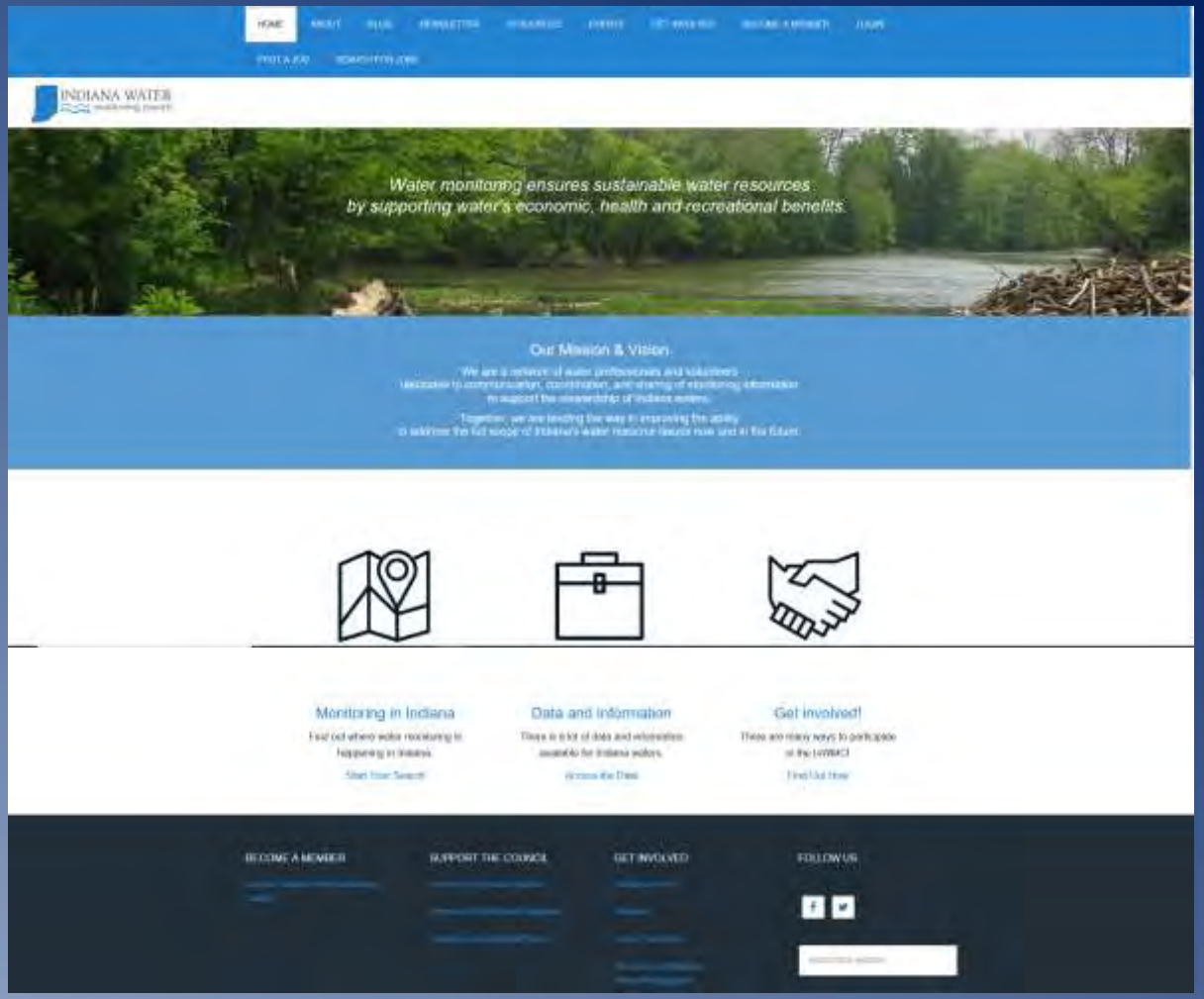
Indiana Water Monitoring Council

Indiana Water Monitoring Council

National Water Quality Monitoring Council

- Began in 2008
  - Collaboration
  - Coordination
  - Communication
- Board of Directors
  - State
  - Local
  - Federal
  - Universities
  - Consultants



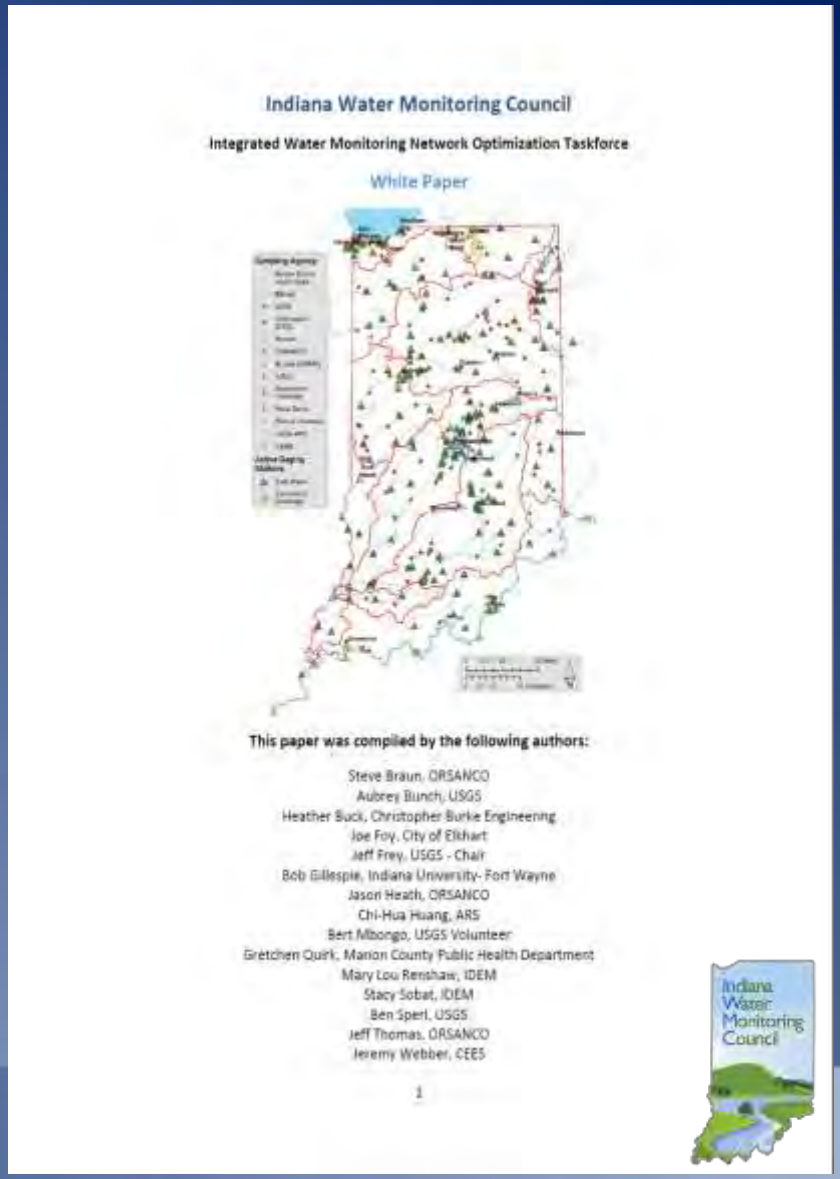
USGS

https://www.inwmc.net/

Integrated Water Monitoring Network Optimization

Indiana Water Monitoring Council White Paper

- Which agencies are actively monitoring?
- Where are the monitoring gaps?
- Which sampling sites are co-located at a gage so that loads can be calculated?
- Where is continuous monitoring going on?
- Which sites are being sampled by 2 or more agencies?



Indiana Water Monitoring Council

Integrated Water Monitoring Network Optimization Taskforce

White Paper

This paper was compiled by the following authors:

Steve Braun, ORSANCO
Aubrey Bunch, USGS
Heather Buck, Christopher Burke Engineering
Joe Foy, City of Elkhart
Jeff Frey, USGS - Chair
Bob Gillespie, Indiana University- Fort Wayne
Jason Heath, ORSANCO
Chi-Hua Huang, ARS
Bert Mbongo, USGS Volunteer
Gretchen Quirk, Marion County Public Health Department
Mary Lou Renshaw, IDEM
Stacy Sobat, IDEM
Ben Sperl, USGS
Jeff Thomas, ORSANCO
Jeremy Webber, CEES

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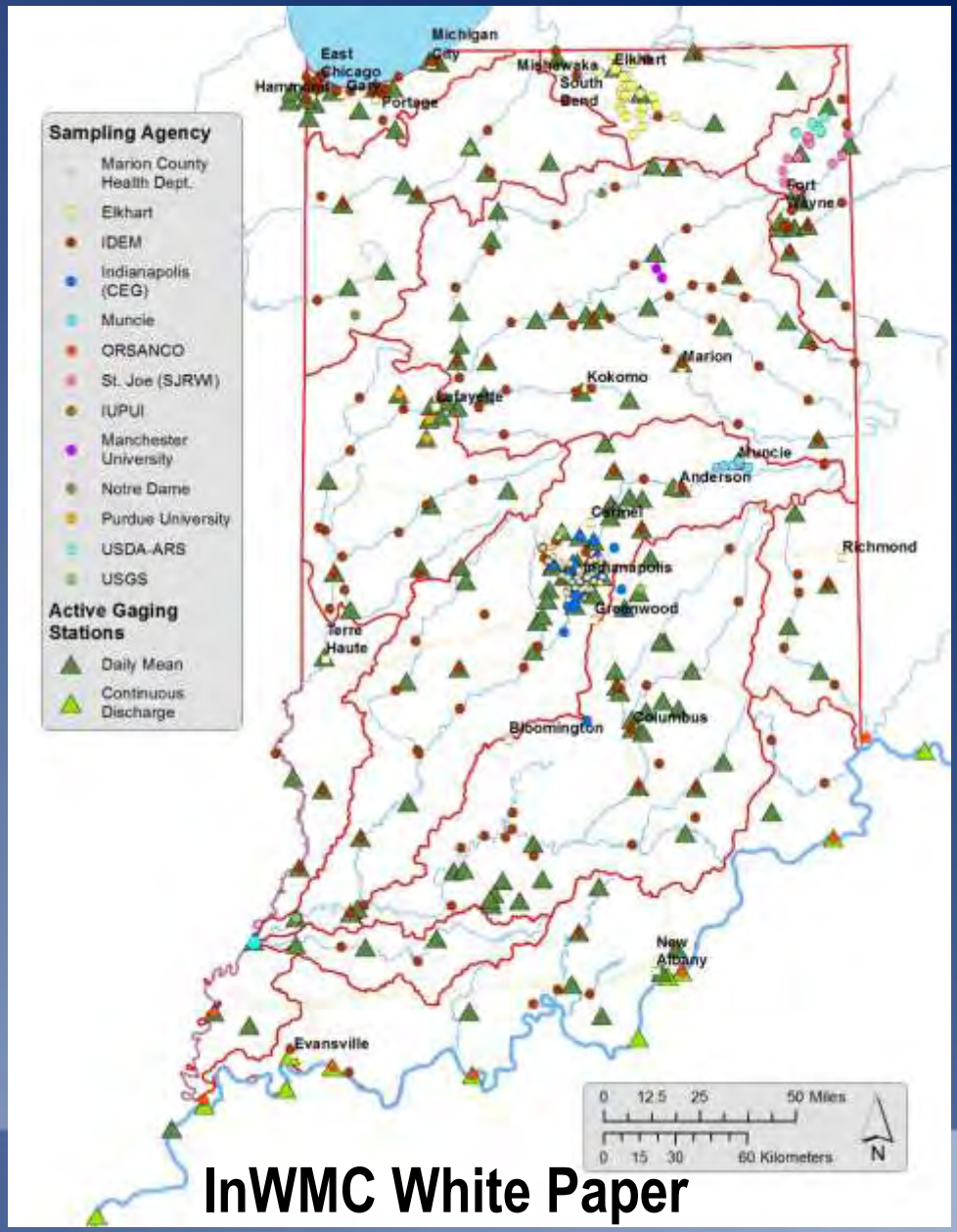
Water-Quality Monitoring in Indiana

Discrete sampling

- At least bimonthly sampling
- All sites sampled for N and P
- 13 agencies/groups
- 311 sampling sites



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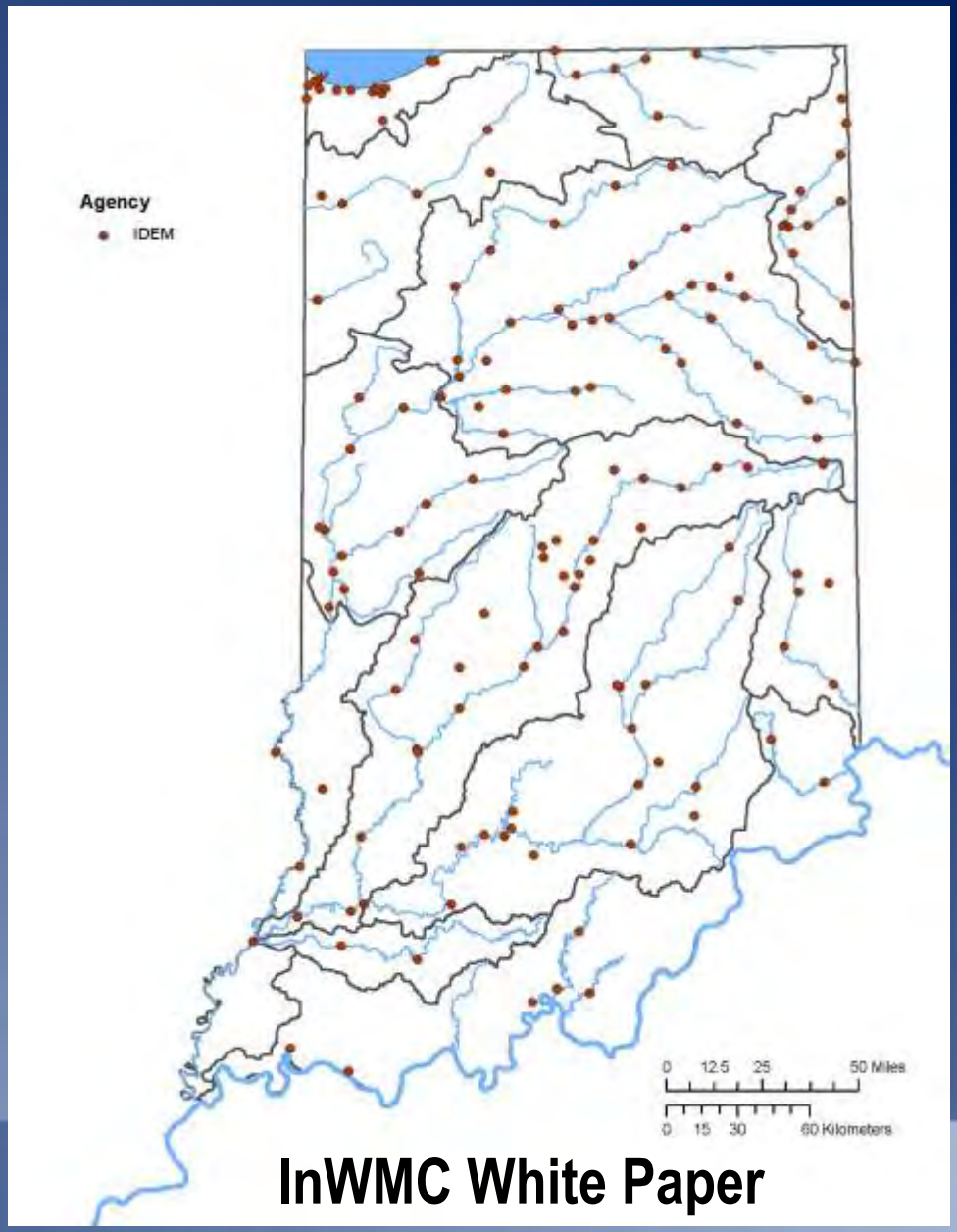
Water-Quality Monitoring in Indiana

Agency/group sampling

- Description of sampling
- Parameters
- Frequency of sampling
- Period of record



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Water-Quality Monitoring in Indiana

Indiana Water Report

- Annual update
- Description of sampling
- Parameters
- Frequency of sampling
- Period of record

INDIANA WATER
monitoring council

Our Mission & Vision

We are a network of water professionals and volunteers dedicated to communication, coordination, and sharing of monitoring information to support the stewardship of Indiana waters.

Together, we are leading the way in improving the ability to address the full scope of Indiana's water resource issues now and in the future.

Indiana Water Report

The Indiana Water Report is a publication of the Indiana Water Monitoring Council (InWMC) that summarizes important water-related monitoring and research happening in Indiana. The Indiana Water Report is intended to help those working to manage water resources in Indiana do so more effectively and with a fuller understanding of how their efforts fit into the larger picture and to support great communication and collaboration wherever possible.

Visit the Indiana Water Monitoring Council website (http://inwmc.net) or by scanning the image below with your mobile device to download the full report today or read it online to learn more about some of the important the work going on in Indiana to better understand, manage, protect, and restore our water resources.

Get the current Indiana Water Report! Scan the image to the right to visit the InWMC online and download it to your mobile device

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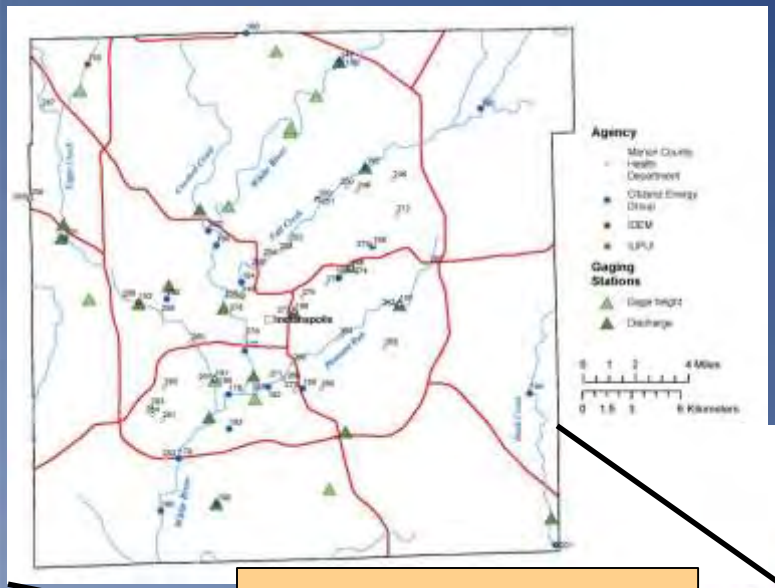
SCAN ME

USGS

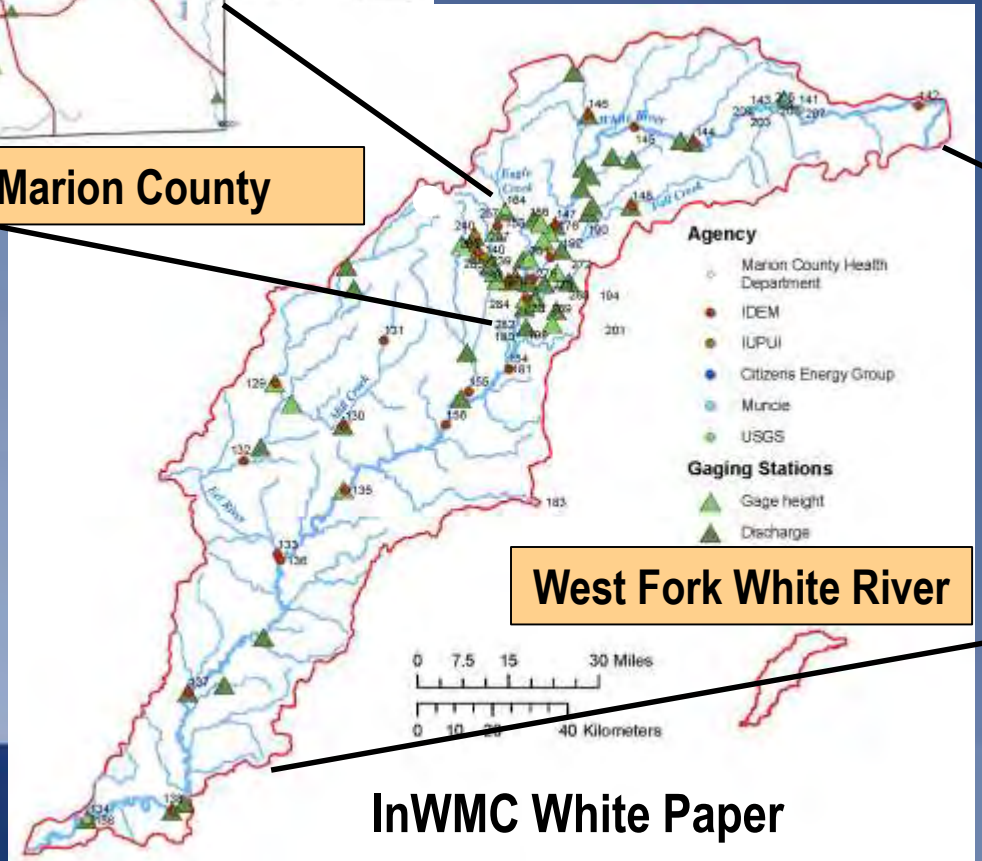
Indiana Water Monitoring Council

IDEM Major River Basins were used to identify Important Missing Sites

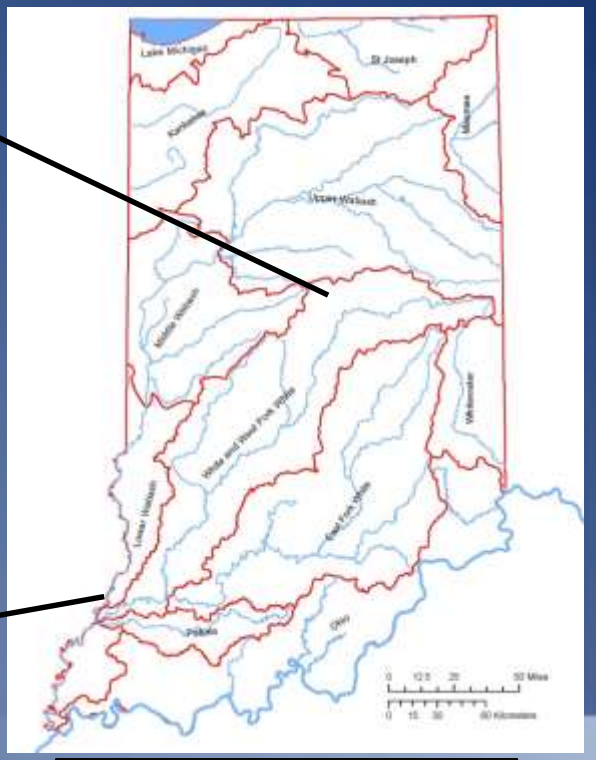
- **Major River Basins:**
  - Spatial coverage
  - Important pour points



Marion County



West Fork White River



Major River Basins

InWMC White Paper

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Estimating Contaminant Load

Contaminant Load =

- Concentration x Streamflow

Streamflow =

- Volume of water per unit of time (e.g. gpm, ft^3/sec)

Why are loads important?

- Concentration only can be misleading
- Wet versus dry years
- Small streams versus larger streams

USGS

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What is a Load?

Load= Concentration X Streamflow

Maumee River near Defiance:

Total Phosphorus load = 1,960 metric tons

March 1 to July 31, 2015

Which is about 356 elephants

(5.5 metric tons/ elephant)

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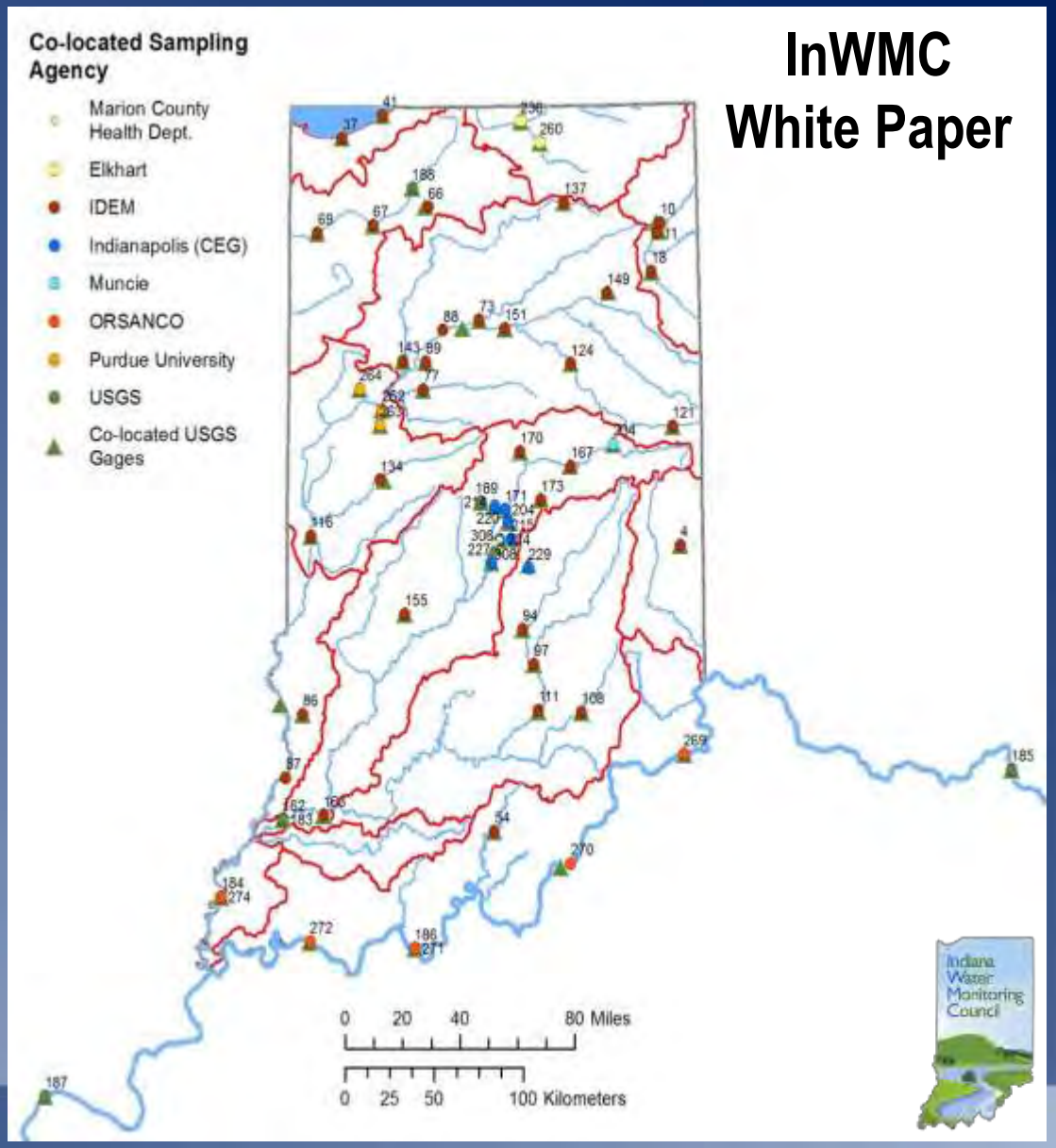
Sites Capable of Determining Loads in Indiana

Co-located sites:

- 8 agencies/groups
- 150 capable of loads assessment
- Located at gage
  - 0.1 – 5%
  - 5 – 10%
  - >10%



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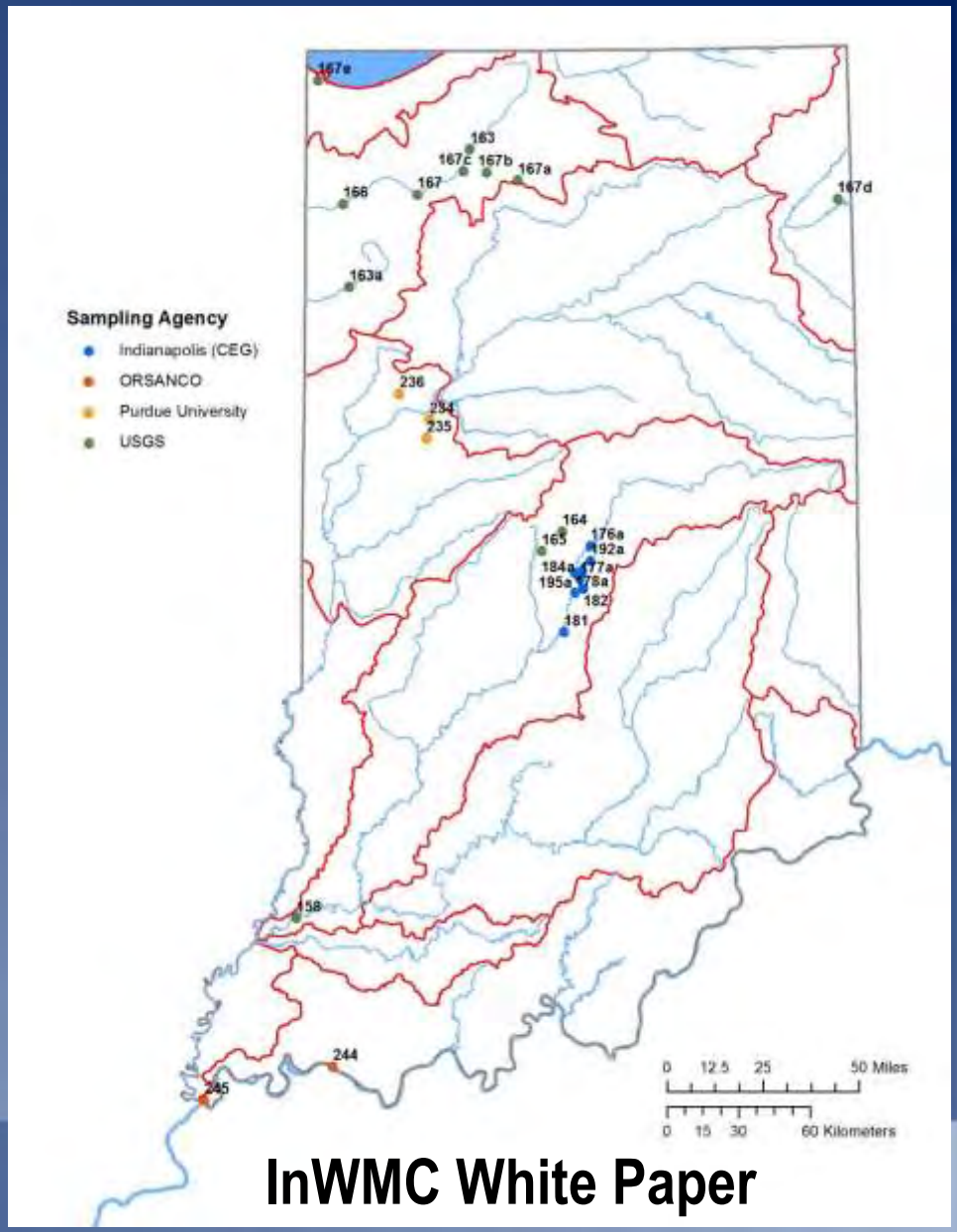
Continuous Water-Quality Monitoring

- 4 agency/groups
- QW parameters:
  - pH, DO, SC, T, turb (25,15)
  - Nitrate (7)
  - Orthophosphate (3)
- Surrogates
  - Suspended sediment (6)
  - Total phosphorus



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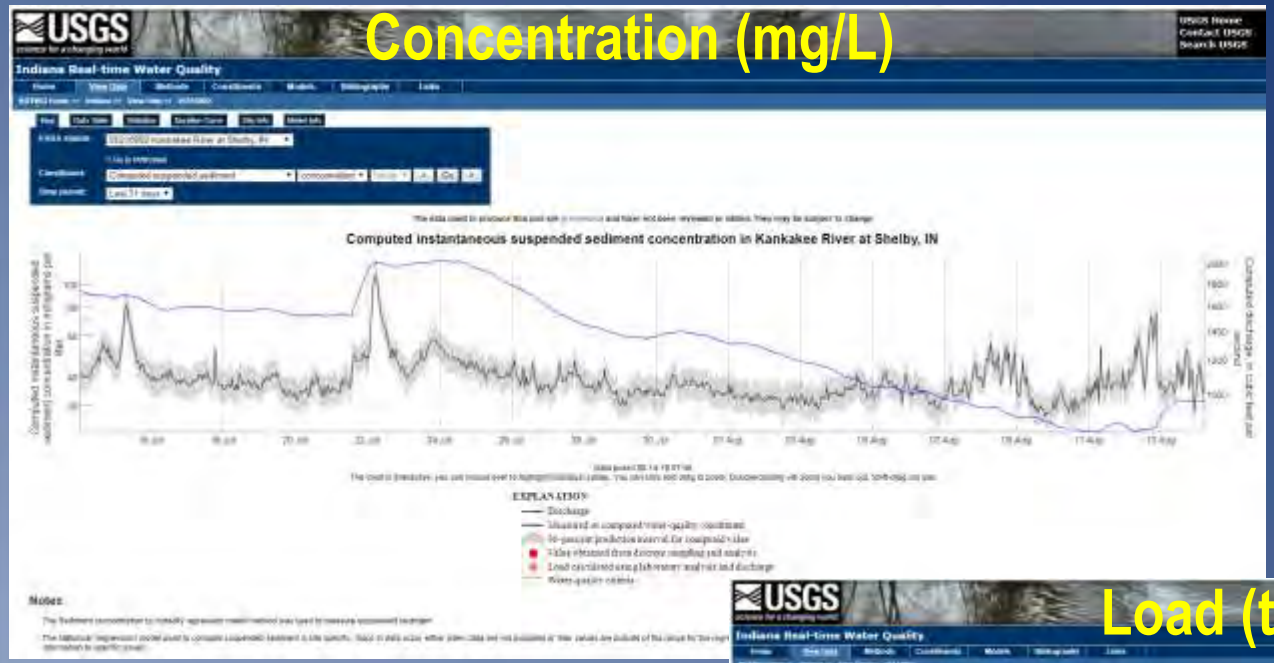
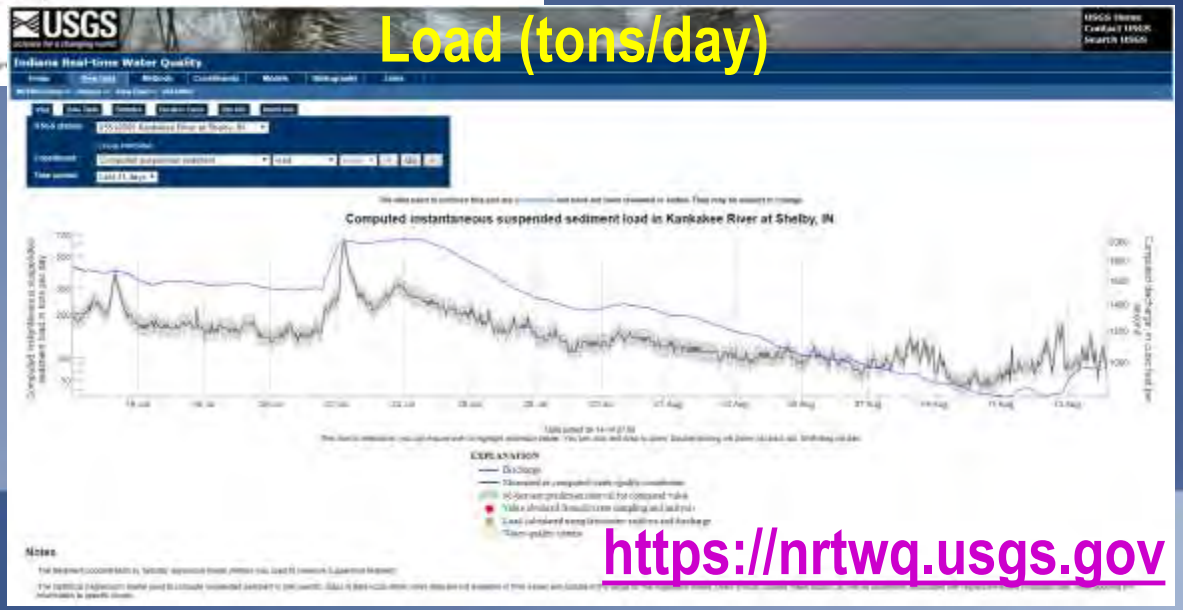
Continuous Water-Quality Monitoring

Surrogate: Suspended sediment

Concentration (mg/L)



Load (tons/day)



Kankakee River at Shelby, IN
05518000

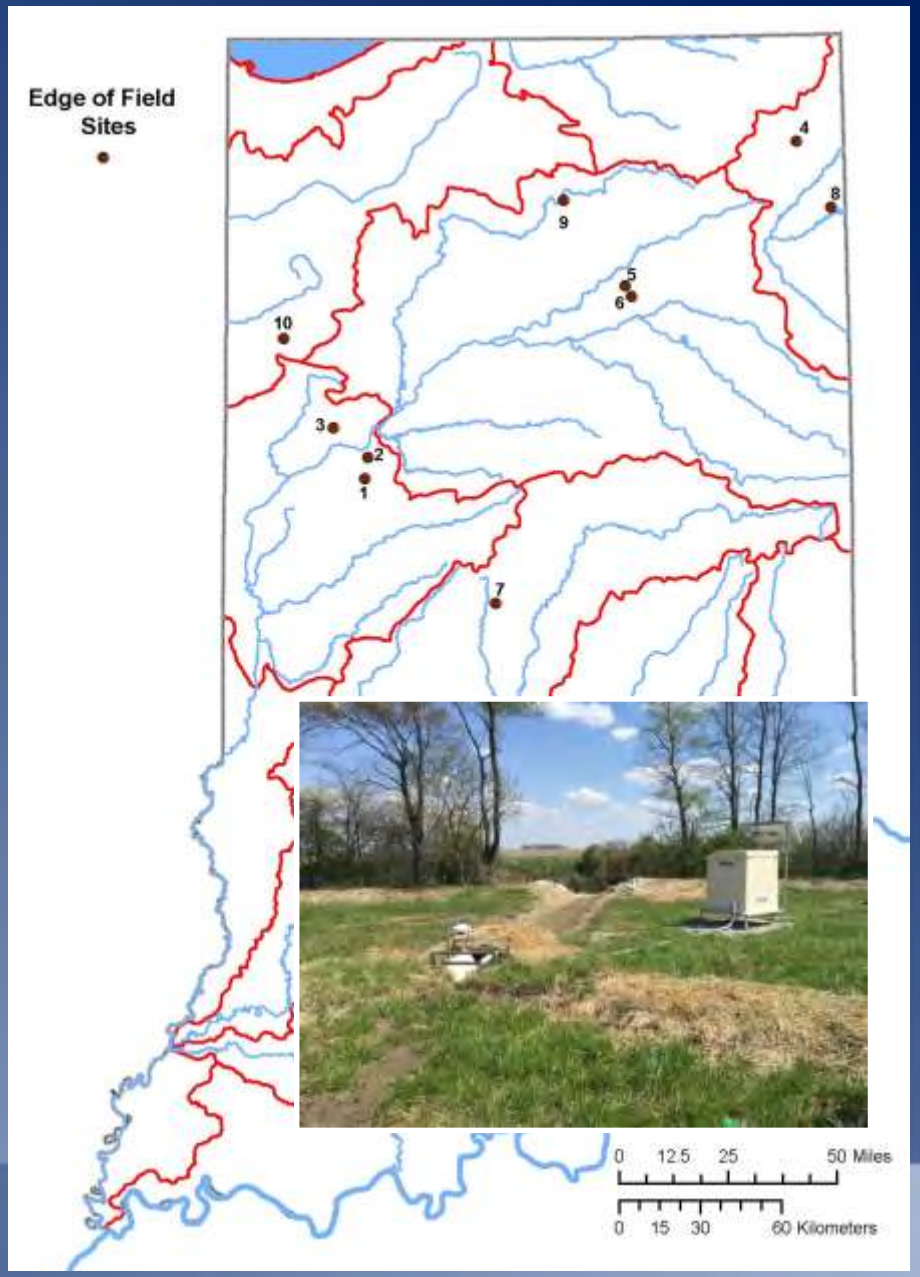
Indiana Water Monitoring Council

USGS

https://nrtwq.usgs.gov

Edge of Field Monitoring in Indiana

- Water quality budgets and autosamplers
  - IUPUI – CEES (7)
  - USGS – GLRI (8)
  - USDA – ARS (4)
- Paired watersheds
  - Manchester University (5-6)
  - Purdue University (1-3)
  - Notre Dame/IU (9-10)



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Regional Nutrient Monitoring

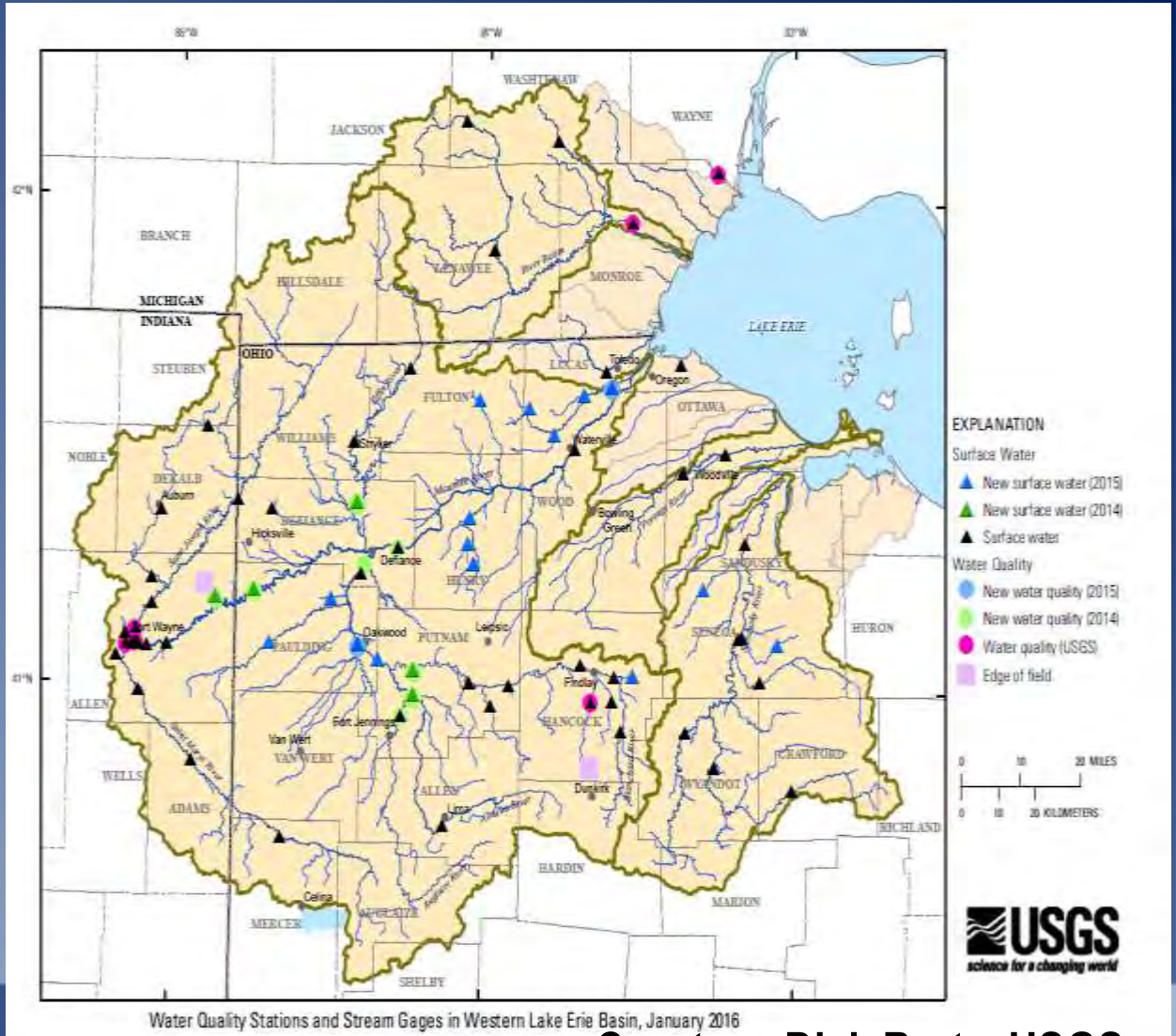
Maumee River Basin

Multistate and multinational

- OH, MI, and IN
- Canada

Multiple objectives

- Annex 4
- State of Indiana
- City of Fort Wayne



Water Quality Stations and Stream Gages in Western Lake Erie Basin, January 2016

Courtesy Dick Bartz, USGS

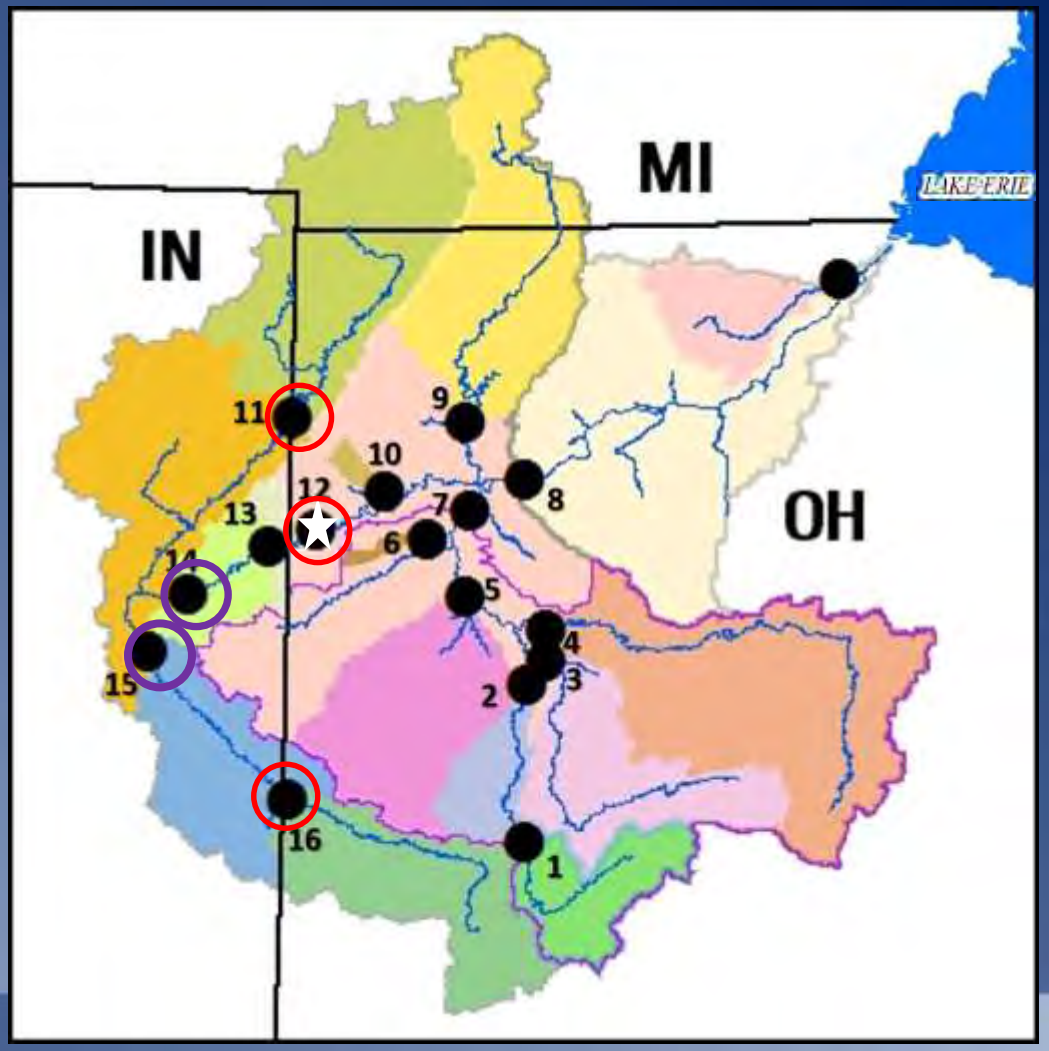
USGS

Regional Nutrient Monitoring

Maumee River Basin

Outcomes:

- Annex 4
  - Maumee River at Antwerp, OH (OEPA)
- State of Indiana (IDEM)
- Unidentified monitoring
  - City of Fort Wayne
  - Tri-State



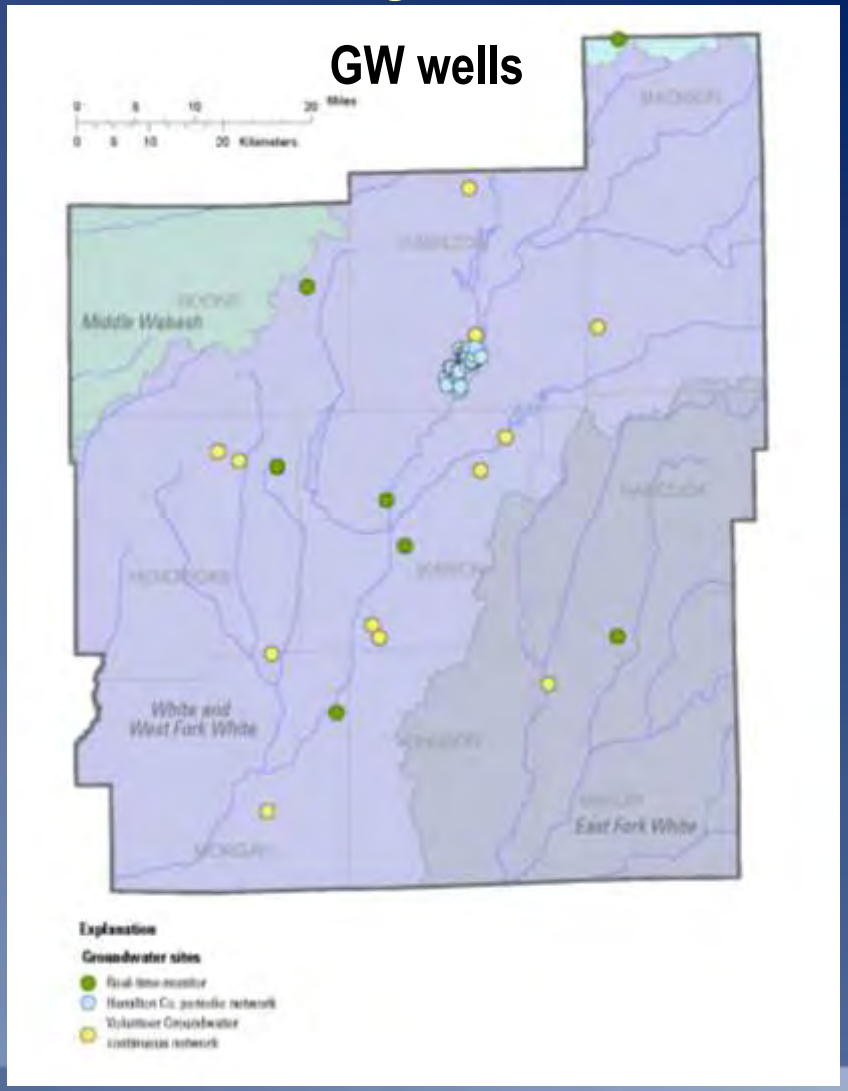
USGS

Regional Monitoring

Indiana Finance Authority

Streamgages

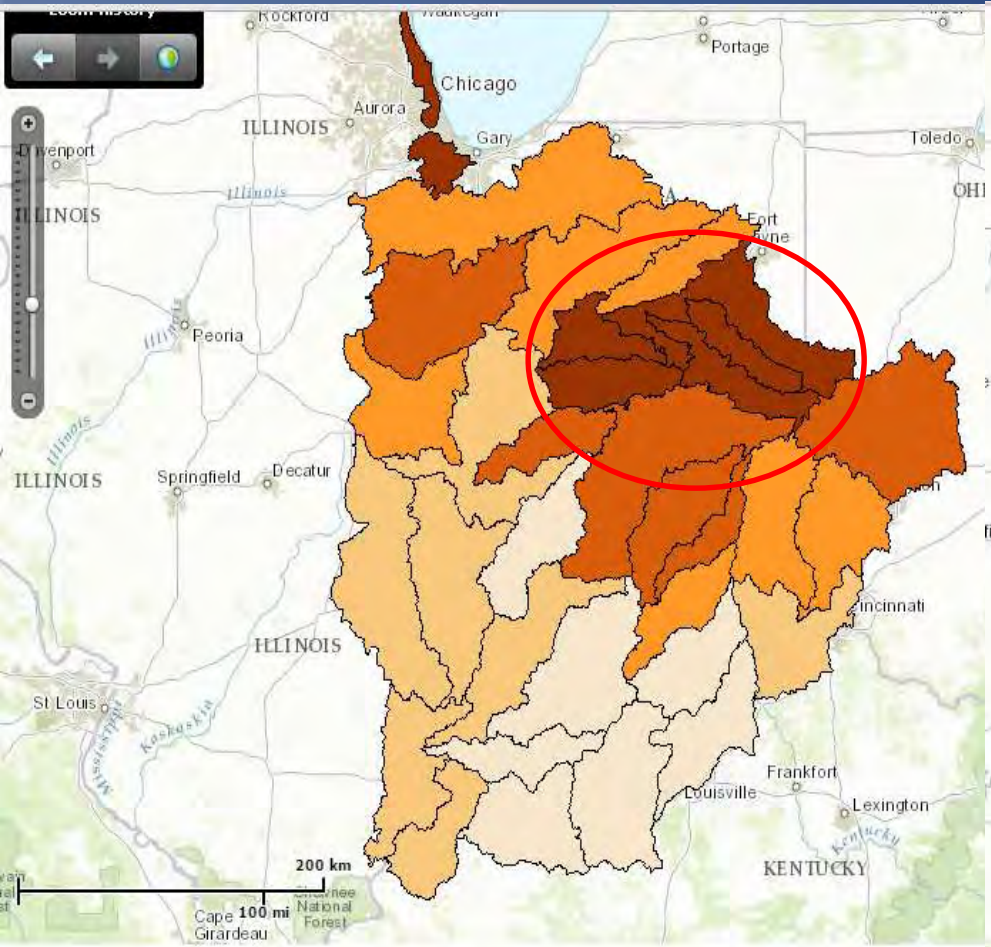
GW wells



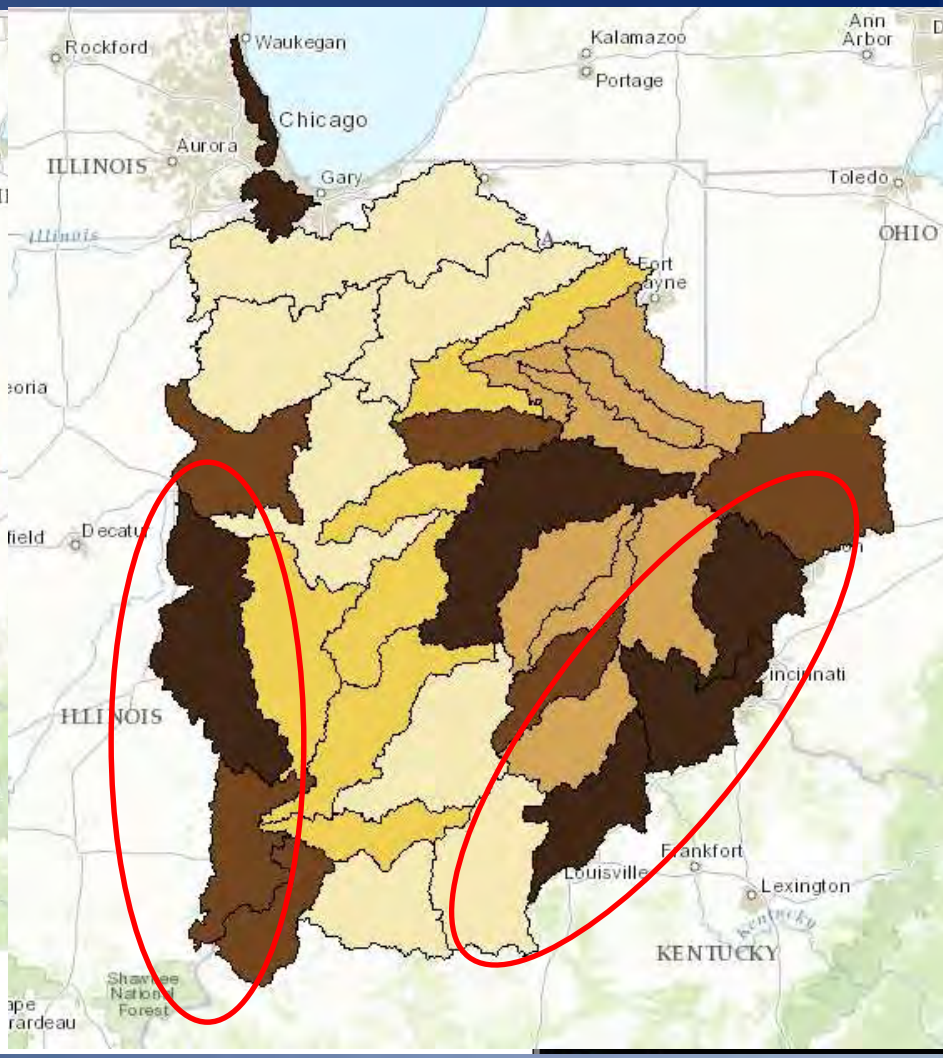
USGS

The highest Total Nitrogen yields are IN derived but Total Phosphorus yields had major interstate inputs

Total Nitrogen



Total Phosphorus



USGS

http://wim.usgs.gov/sparrowmarb/sparrowmarbmapper.html#

18 sites are being sampled by multiple agencies/groups

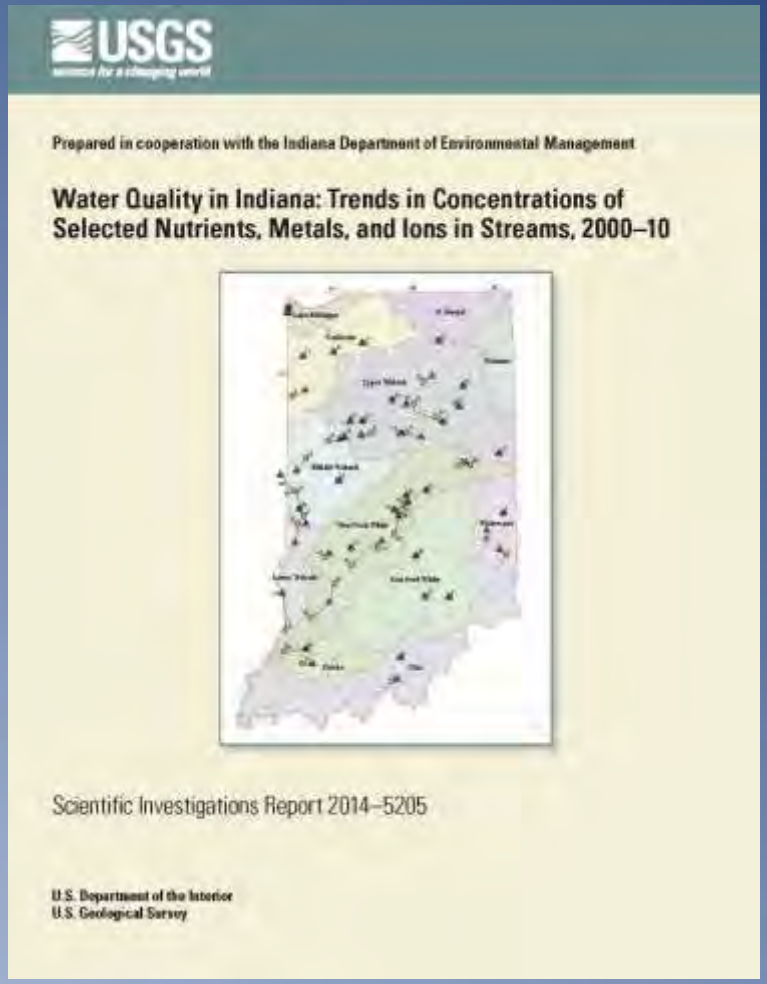
Site	Agencies (Map ID)
1) Wabash River at New Harmony, IN	ORSANCO (246), USGS-NASQAN (159)
2) Ohio River at Cannelton, KY	ORSANCO (243), USGS-NASQAN (161)
3) White River at Nora (82nd St.)	IDEM (147), CEG (176)
4) White River at Hazelton	USGS-NAWQA (158), IDEM (134)
5) White River at Waverly (SR 144)	IDEM (154), CEG (181)
6) White River at Memorial Dr.	IDEM (141), Muncie (207)
7) Eagle Creek at Raymond St.	CEG (185), MCPHD (261), IDEM (151)
8) Pogues Run at 21st St.	CEG (188), MCPHD (274)
9) Pogues Run at Rural St.	CEG (197), MCPHD (275)
10) Pogues Run at Emerson Ave.	CEG (198), MCPHD(273)
11) Bean Creek at Garfield Park	CEG (183), MCPHD (271)
12) Fall Creek at Keystone Ave.	IDEM (150), MCPHD (251)
13) Fall Creek at Stadium Dr.	IDEM(149), MCPHD (256)
14) Elkhart River SR 120 (Jackson St.)	IDEM (36), ELK (212)
15) School Branch at Maloney Road	MCPHD (286), IDEM (139)
16) School Branch at Raceway Road	MCPHD (285), IDEM (140)
17) Kankakee River at Dunn's Bridge	IDEM (52), USGS (167)
18) Kankakee River at Shelby	IDEM (54), USGS (166)

Outcome: Several groups have met.

- **Done side by side sampling;**
- **Worked on spacing samples to increase the sample size**

USGS

What have we learned from our current monitoring network?



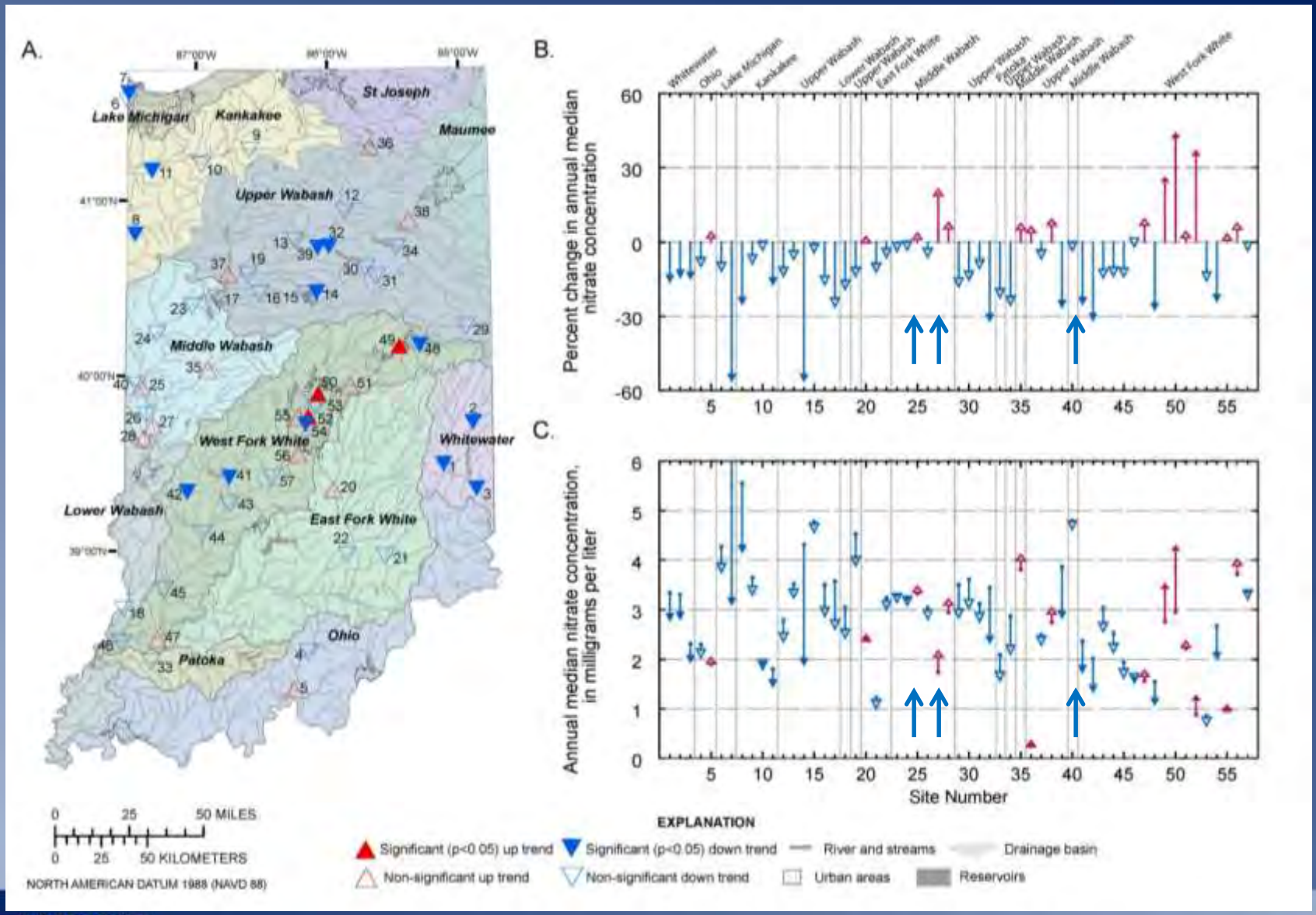
A collaboration with the Indiana Department of Environmental Management

By Martin Risch, Aubrey Bunch, Aldo Vecchia, Jeffrey Martin, and Nancy Baker

http://pubs.usgs.gov/sir/2014/5205/

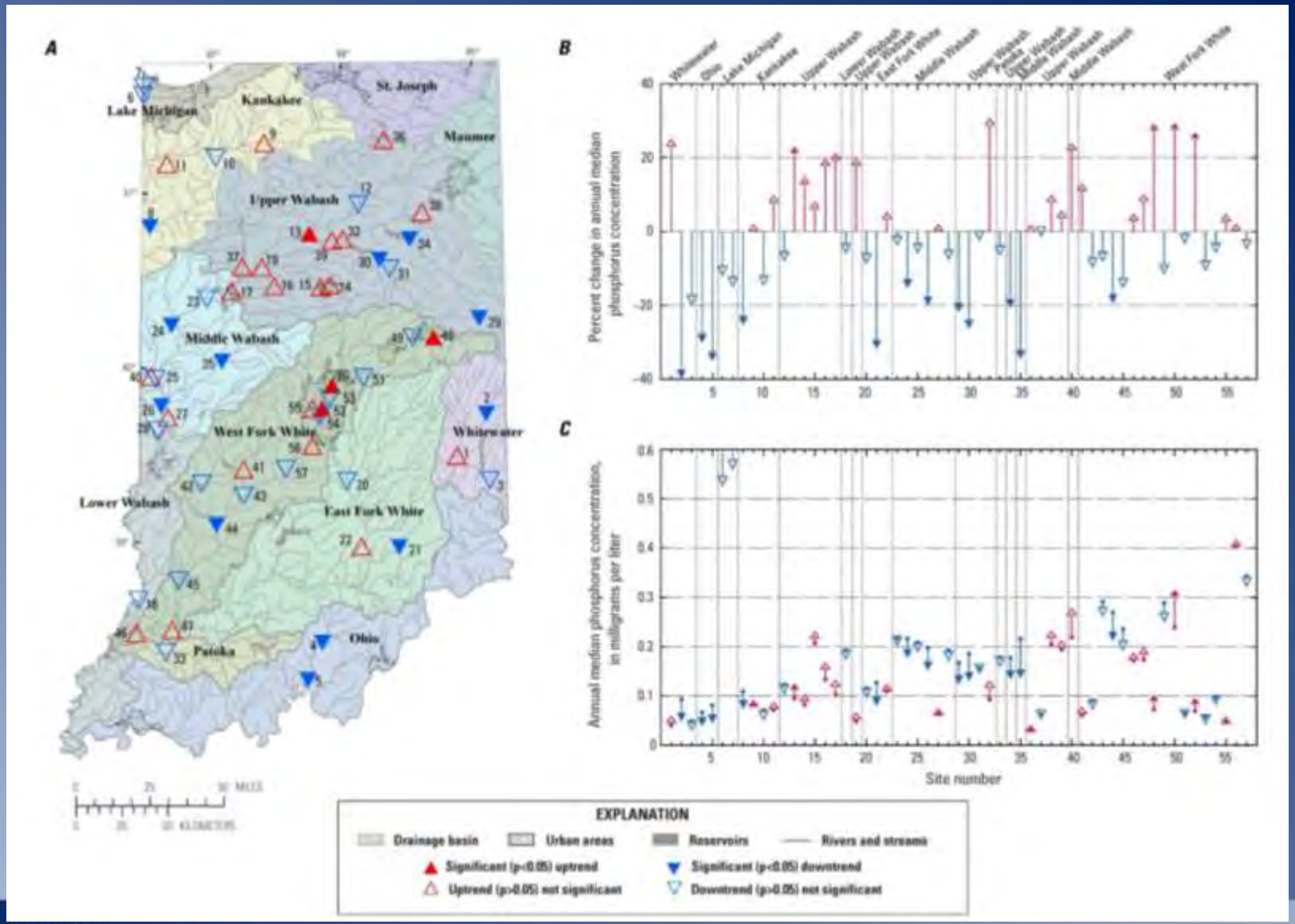
USGS

Nitrate: 74% percent of sites show decrease; Statistically significant: 3 uptrends and 13 downtrends



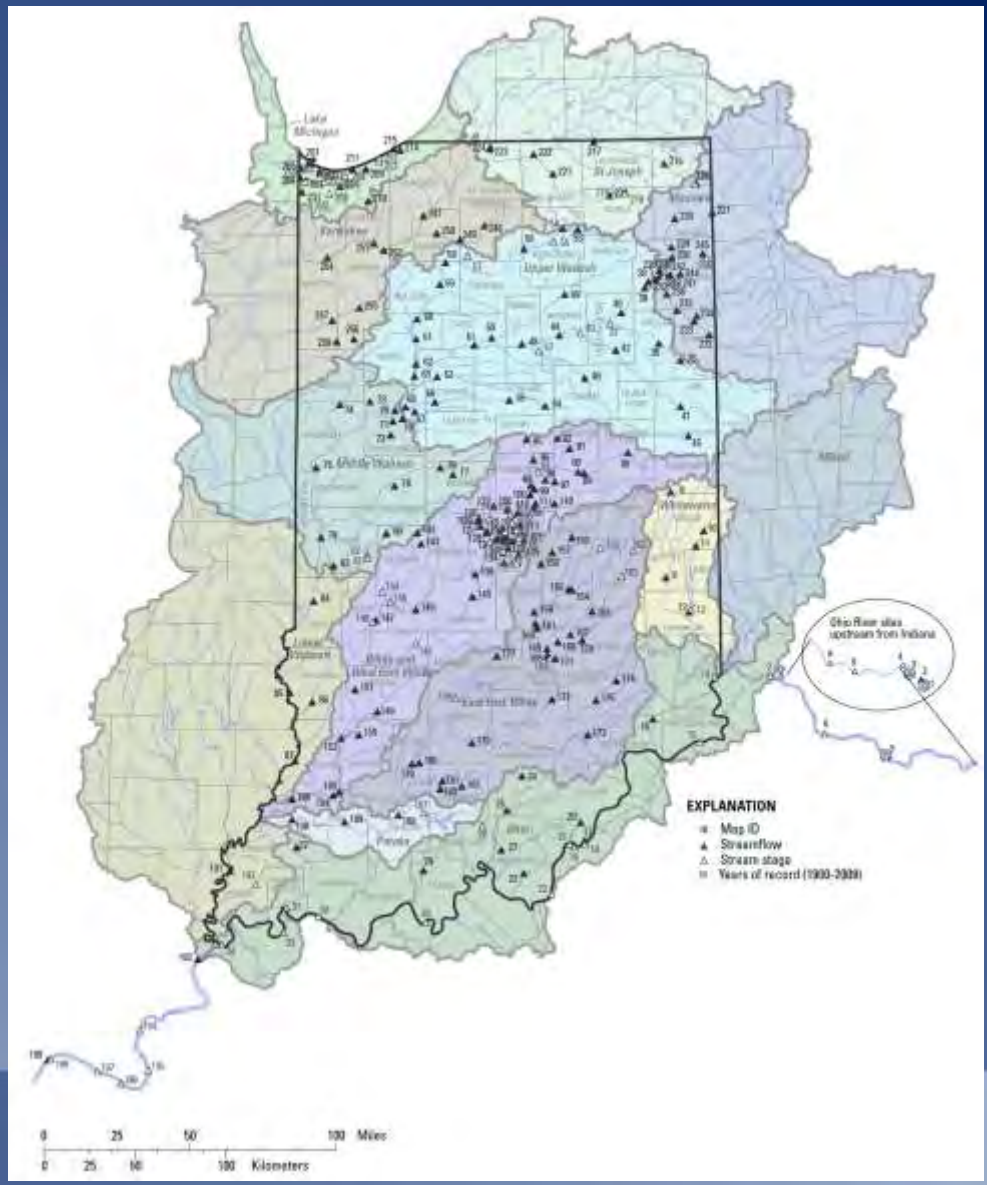
USGS

Total phosphorus: 58% percent of sites show decrease; Statistically significant: 4 uptrends and 12 downtrends



USGS

Identified existing USGS streamgages to leverage potential new sampling sites



USGS

An optimization was done of USGS streamgages to assess hazards and water quality

Streamflow information			Optimization Scorecard									
Site number	Station name	Drainage area (mi2)	Discharge site	Temp	Precip	Has QW parameter	Supergage	Used to calculate loads	NOAA Forecast site	Used by County EM	FIM Library	Total score
05518000	KANKAKEE RIVER AT SHELBY, IN	1753	10	5	5	10	10	10	10	30		90
03331500	TIPPECANOE RIVER NEAR ORA, IN	856.0	10	5					10	60		85
03331753	TIPPECANOE RIVER AT WINAMAC, IN	942	10					5	10	40	20	85
05517500	KANKAKEE RIVER AT DUNNS BRIDGE, IN	1352	10			10	10	10	10	30		80
03322900	WABASH RIVER AT LINN GROVE, IN	453	10	5				10	10	40		75
03325000	WABASH RIVER AT WABASH, IN	1768	10	5	5				10	40		70
03353200	EAGLE CREEK AT ZIONSVILLE, IN	103	10	5	5	10	10	10	10	10		70
03374100	WHITE RIVER AT HAZLETON, IN	11,305	10	5	5	10	10	10	10	10		70
05515500	KANKAKEE RIVER AT DAVIS, IN	537	10	5	5	10	10	10	10	10		70
03364000	EAST FORK WHITE RIVER AT COLUMBUS, IN	1,707	10	5				10	10	20	10	65
03373500	EAST FORK WHITE RIVER AT SHOALS, IN	4,927	10	5				10	10	20	10	65
03303280	OHIO RIVER AT CANNELTON DAM AT CANNELTON, IN	97,000	10	5				10	10	30		65
03328000	EEL RIVER AT NORTH MANCHESTER, IN	417	10						10	40		60
03329000	WABASH RIVER AT LOGANSPORT, IN	3,779	10					10	10	20	10	60
03335500	WABASH RIVER AT LAFAYETTE, IN	7,267	10					10	10	20	10	60
03341500	WABASH RIVER AT TERRE HAUTE, IN	12,263	10					10	10	20	10	60
03347000	WHITE RIVER AT MUNCIE, IN	241	10					10	10	20	10	60
03371500	EAST FORK WHITE RIVER NEAR BEDFORD, IN	3,861	10					10	10	20	10	60
05517530	KANKAKEE RIVER NR KOUTS, IN	1376	10						10	40		60
05524500	IROQUOIS RIVER NEAR FORESMAN, IN	449	10	5	5	10	10		10	10		60
03333050	TIPPECANOE RIVER NEAR DELPHI, IN	1,869	10	5				10	10	10	10	55
03336000	WABASH RIVER AT COVINGTON, IN	8,218	20	5				10	10	10		55
03340500	WABASH RIVER AT MONTEZUMA, IN	11,118	20	5				10	10	10		55
04181500	ST. MARYS RIVER AT DECATUR, IN	621	10					5	10	20	10	55
05517000	YELLOW RIVER AT KNOX, IN	435	10		5		10	10	10	10		55
05522500	IROQUOIS RIVER AT RENSSELAER, IN	203	10	5					10	20	10	55

What Is IDEM's External Data Framework (EDF)?

- **A *systematic, transparent,* and *voluntary process* for external organizations to submit their water quality data to IDEM for potential use in agency programs**

Why IDEM Built the EDF

- **CWA Act §305(b) and §303(d) require it**
- **Indiana, like many states, is facing increasingly limited monitoring resources coupled with ever increasing need for monitoring data**

- **Effective water resource management across the board requires data of known quality, and LOTS of it**

A Key Feature of IDEM's EDF

- **Three tiers based on the level of scientific rigor with which the data are collected and each with specific data quality requirements**
- **For the purposes of the EDF, scientific rigor means:**
  - **Data collection follows *documented* field, laboratory, and data handling procedures**
  - **Data collection activities include sufficient controls to ensure the quality of the resulting data set is *commensurate with its intended use***

EDF Tier 1

- Data quality is unknown or characterized by a low level of scientific rigor
- Not reliable for decision-making but may be useful as anecdotal and/or supplementary information

EDF Tier 2

- Data possess at least a moderate level of scientific rigor
- Reliable for non-regulatory decision-making by OWQ and a number of other local-level uses

EDF Tier 3

- Data possess a high level of scientific rigor
- Reliable for OWQ regulatory decision-making processes

Increasing Level of Scientific Rigor

Tier 1 Uses

- Education and building awareness of water resources and the issues affecting them
- Supplementary information for total maximum daily load (TMDL) development
- Supplementary information for OWQ's Integrated Report

Tier 2 Uses

- Supplementary information for use in planning or prioritizing OWQ's monitoring and TMDL development
- Demonstrating success of water quality restoration or protection measures
- Watershed management planning
- Determining water quality trends
- Screening data

Tier 3 Uses

- CWA 305(b) water quality assessment and 303(d) listing decisions
- Total maximum daily load modeling
- Determining representative background conditions for National Pollutant Discharge Elimination System permits
- Determining/changing the antidegradation classification of a waterbody

Data Quality Review

- **OWQ will review the documentation provided with data sets to see if it contains the information needed to conduct a data quality assessment**

  - **Method comparability and sensitivity**
  - **Quality controls (QC) used in the field/lab (along with any analytical quality control results)**
  - **Other indicators of data quality**
- **This determines the tier of potential uses**

Successes to date

New additional sampling

- IN-OH border sampling
  - Maumee River at Antwerp, OH (OEPA)
  - St. Mary's at Wilshire, OH (OEPA)
  - St. Joseph River at Newville, IN (OEPA)
- State of Indiana (IDEM)
  - Maumee River at New Haven, IN
  - St. Mary's at Fort Wayne, IN
- OH River contributions
  - Super gage at Wabash River at New Harmony (TNC and IN Dept of Ag)

Successes to date

Unidentified sampling

- Cities: Fort Wayne, Evansville, Fishers, Anderson…
- Tri-State

- Regional Studies can identify needed sampling sites
  - IFA will be adding streamgages and groundwater wells to add to our networks

- External Data Framework will be the driving force to expand the quality of data collected in IN

Information and Contacts

Indiana Water Monitoring Council

http://www.inwmc.org/

Jeff Frey
(317) 600-2751 jwfrey@usgs.gov

Jody Arthur,
(317) 308-3179 jarthur@in.idem.gov

USGS