Water Quality Monitoring in the Upper Illinois River Watershed and Upper White River Basin

Project 11-500

Brian E. Haggard
University of Arkansas

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

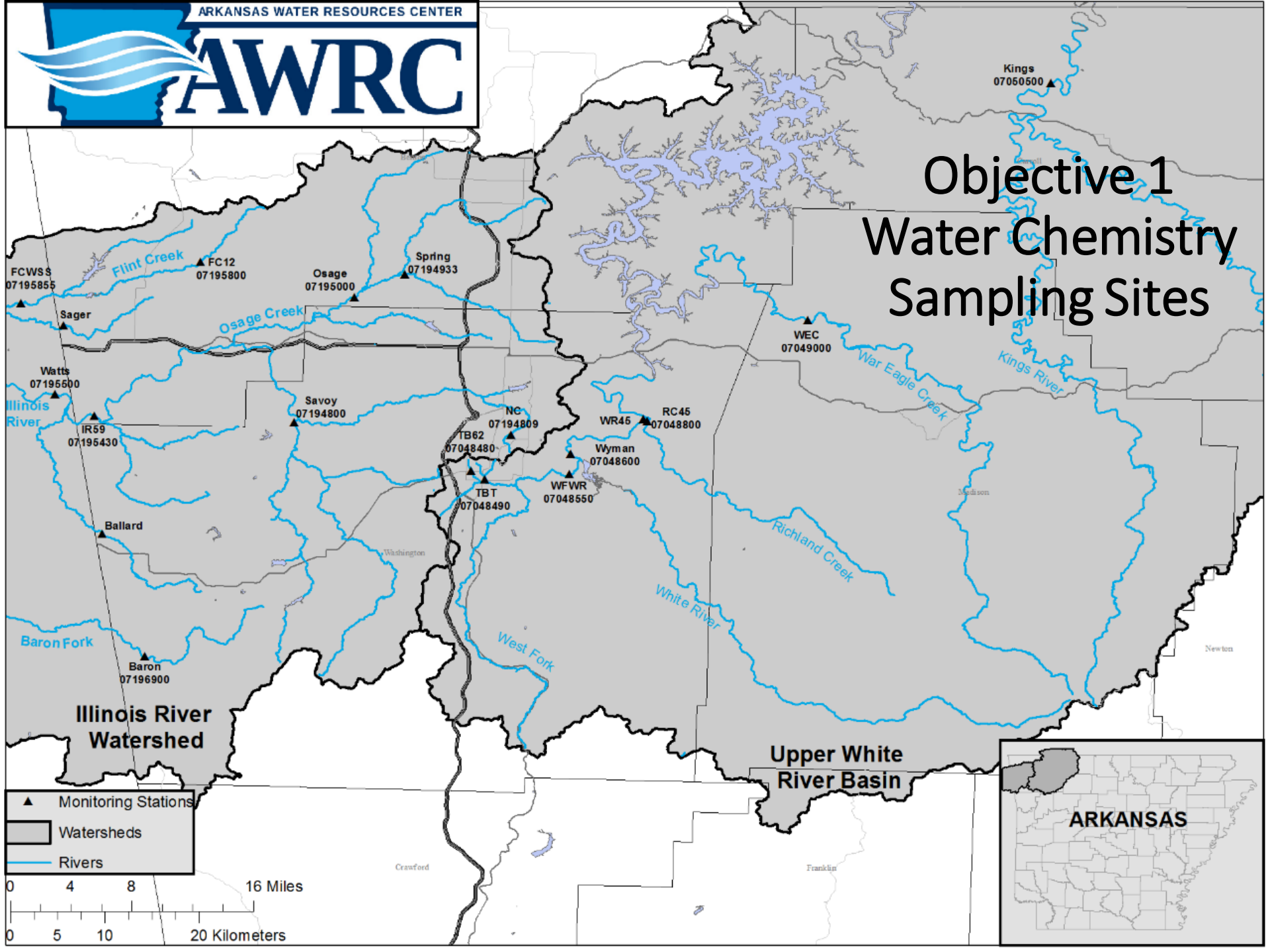
ARKANSAS WATER RESOURCES CENTER

Objectives

1. Collect water samples at ~20 sites to estimate constituent loads and evaluate trends in water chemistry, Upper Illinois River Watershed (UIRW) and Upper White River Basin (UWRB). **WATER CHEMISTRY**
2. Collect water samples across eight streams to measure E. coli and evaluated numbers against applicable water quality standards, UIRW **BACTERIA**
3. Evaluate dissolved oxygen changes from day to night in Leatherwood Creek and Kings River, UWRB. **DO**






ARKANSAS WATER RESOURCES CENTER
AWRC
Objective 1
Water Chemistry
Sampling Sites
Kings
07050500
FCWSS
07195855
Flint Creek
FC12
07195800
Osage
07195000
Spring
07194933
Sager
Osage Creek
WEC
07049000
War Eagle Creek
Kings River
Watts
07195500
Illinois
River
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07194800
IR59
07195430
NC
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TB62
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WFWR
07048550
Ballard
Richland Creek
White River
Baron Fork
West Fork
Baron
07196900
Illinois River
Watershed
Upper White
River Basin
Monitoring Stations
Watersheds
Rivers
0 4 8 16 Miles
0 5 10 20 Kilometers
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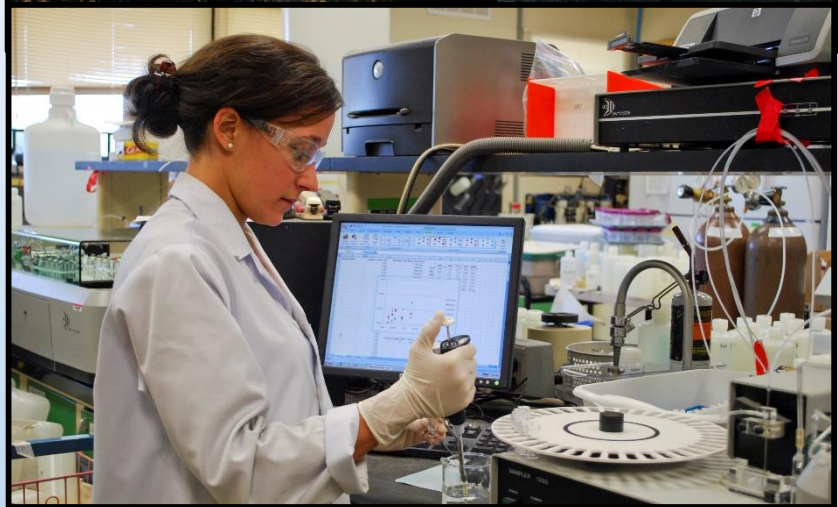
Water Chemistry

Methods

- Collect water samples at 19 sites from July 2011 – June 2015
- 46 samples per project year during base and storm flow conditions
- Grab samples either in-stream or using alpha style horizontal sampler
- Analyzed for TN, NO_3-N, TP, SRP, TSS, Cl and SO_4 following approved QAPP
- Estimated constituent loads using regression models that account for discharge, time and seasonality
- Evaluated monotonic trends or linear increases or decreases in constituent concentrations after adjusting for flow



Water Chemistry

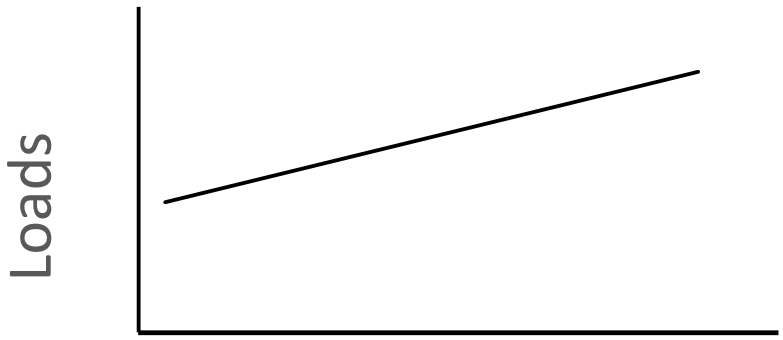
Results: How do loads vary spatially?

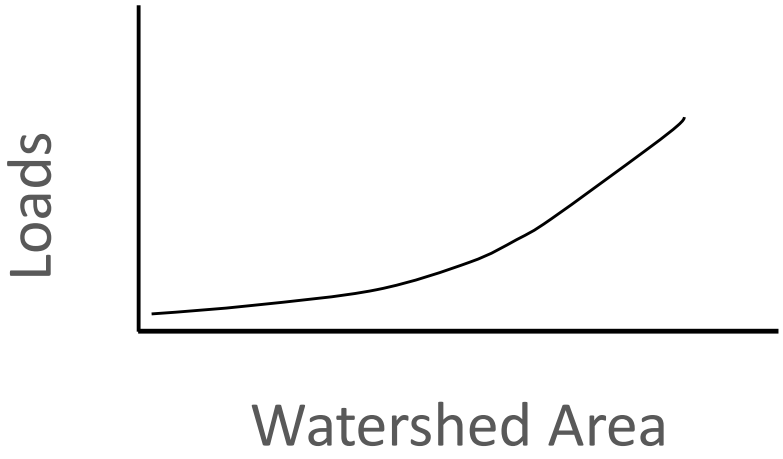
– Constituent loads generally following discharge patterns, that is increase with increasing discharge.

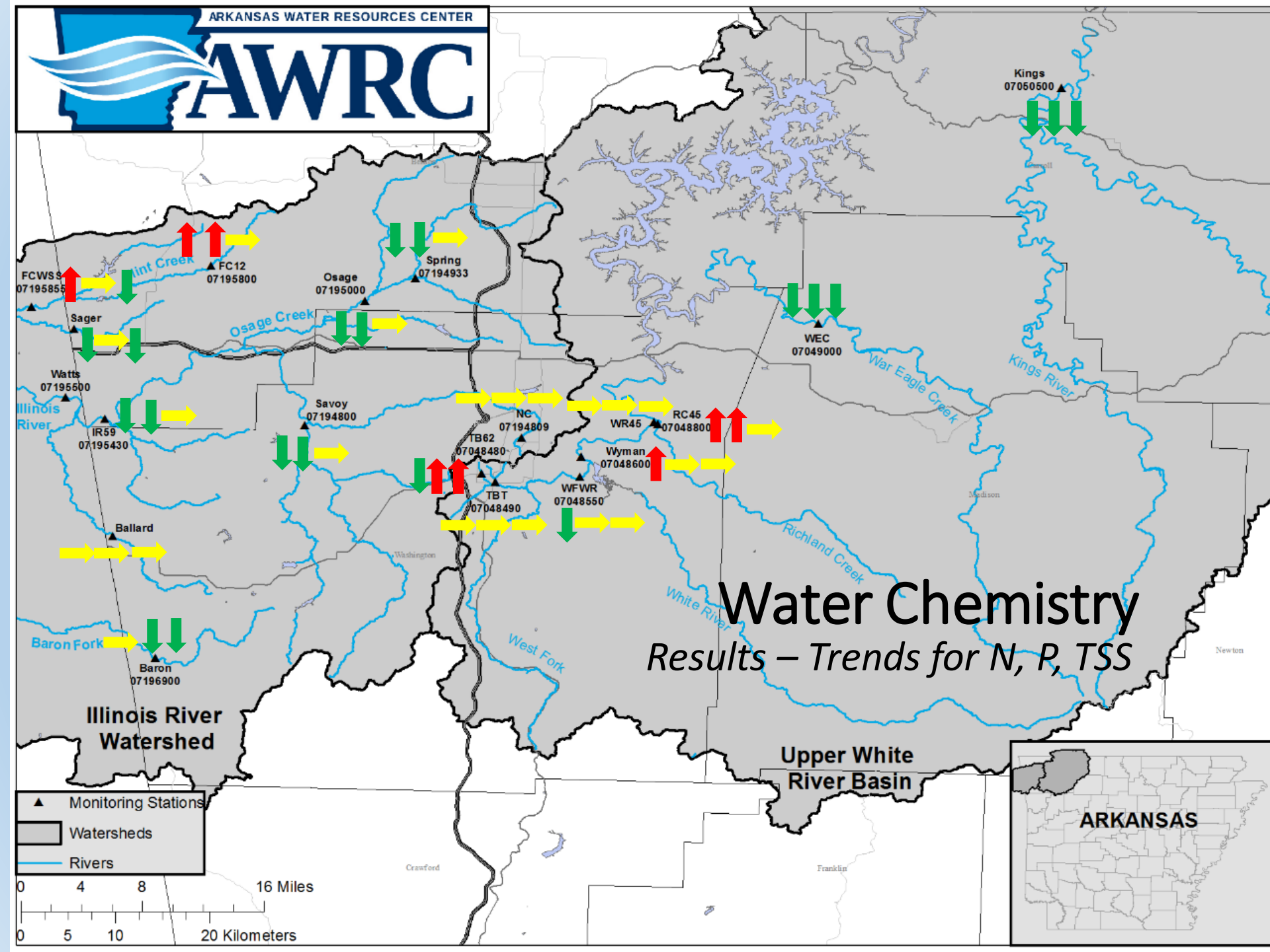
– Constituent loads tend to increase with increasing watershed area.

– Constituent loads reflect watershed specific hydrology and characteristics.

– So, what we are really interested in is how are things changing over time?



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Water Chemistry
Results – Trends for N, P, TSS
Illinois River Watershed
Upper White River Basin
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Watersheds
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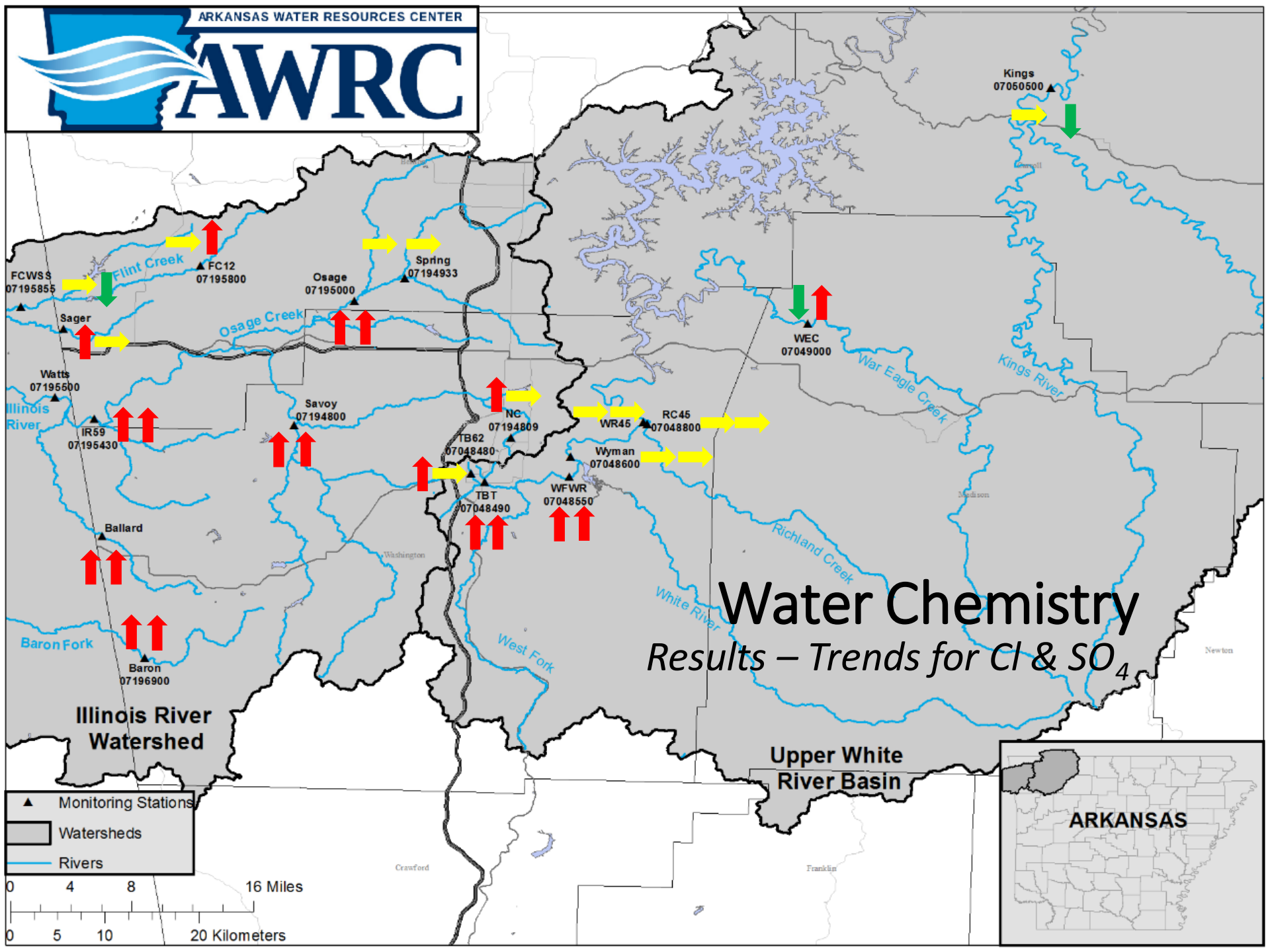
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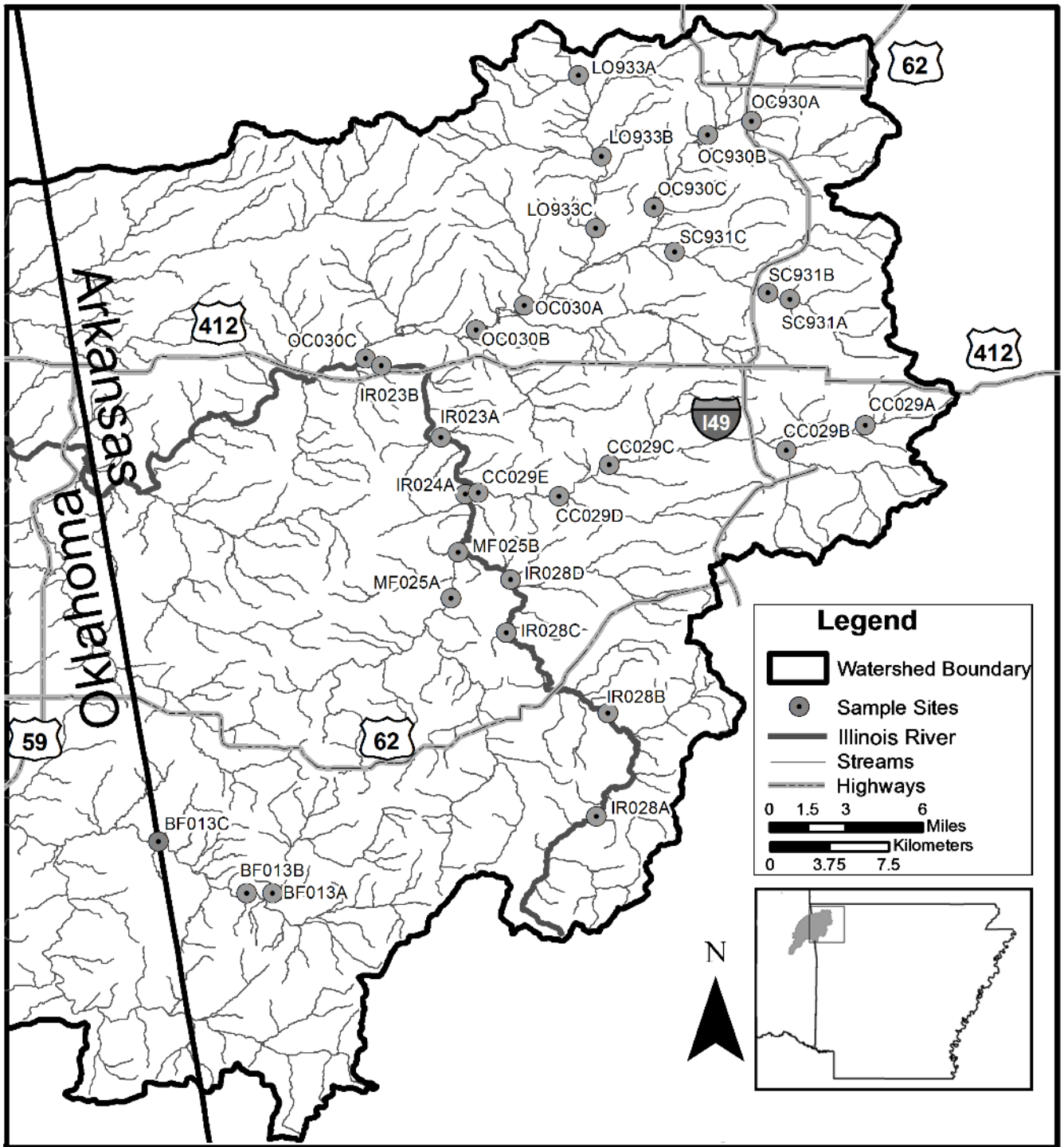


Objective 2 Pathogens Sampling Sites

10 Reaches
7 Streams

Osage Creek

Little Osage Creek

Spring Creek

Clear Creek

Muddy Fork

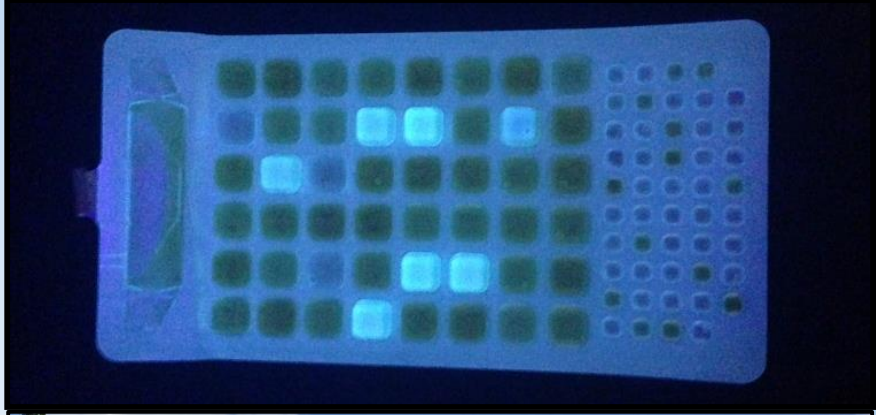
Baron Fork

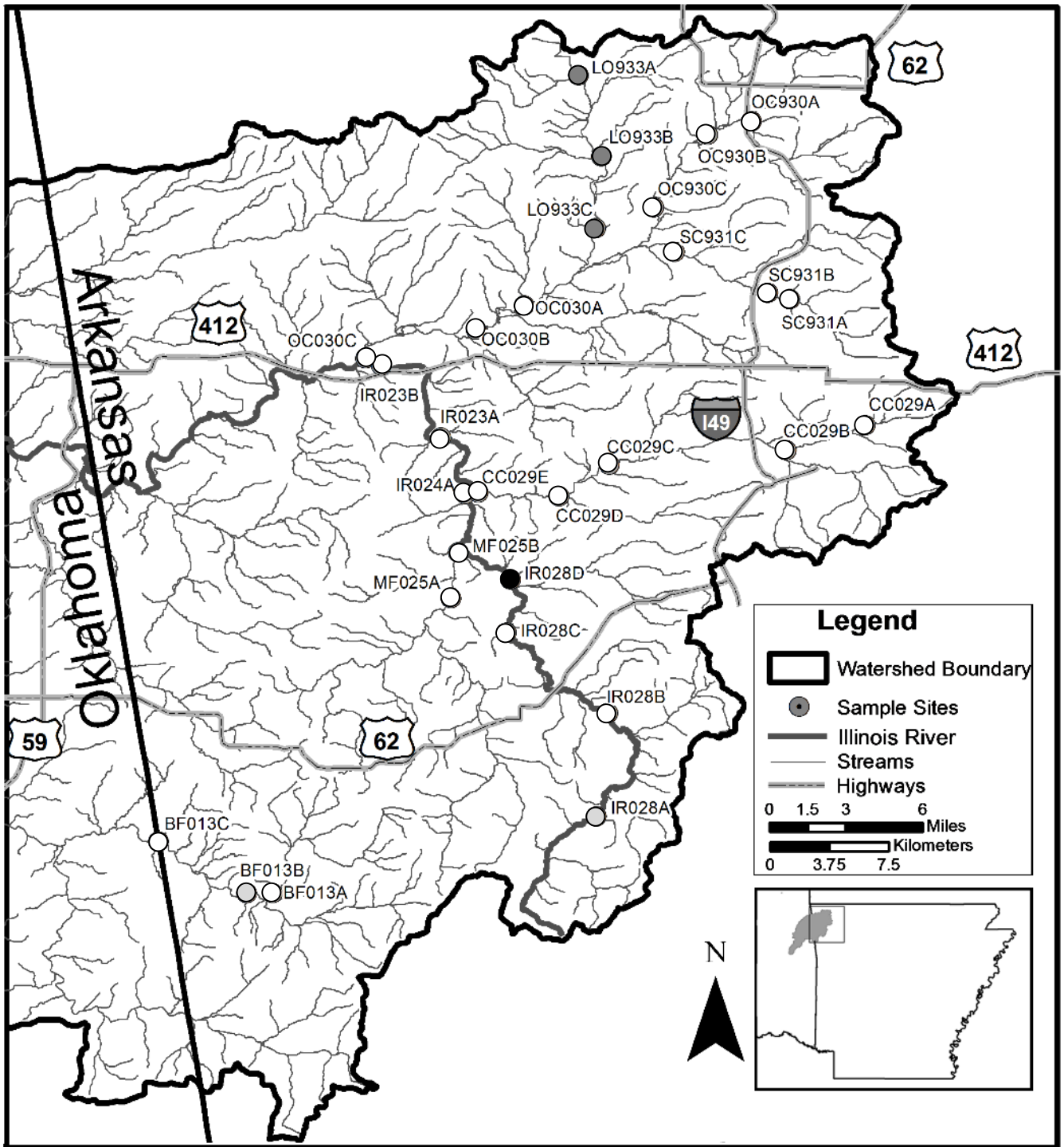
Illinois River

Pathogens

Methods

- Water samples collected 8 or 9 times during the primary contract season (May through September) in 2012, 2013 and 2014.
- Water samples collected in sterile containers and kept on ice.
- Water samples were analyzed for *E. coli* in AWRC WQ laboratory, certified for bacteria.
- *E. coli* enumerated as most probable number of colonies per 100 mL (col/100 mL).
- Data evaluated against APCEC Regulation 2, based on percent exceeding applicable value.
- We delineated the riparian zone to estimate land use, e.g. pasture land use close to the stream within a select distance upstream.





Pathogens

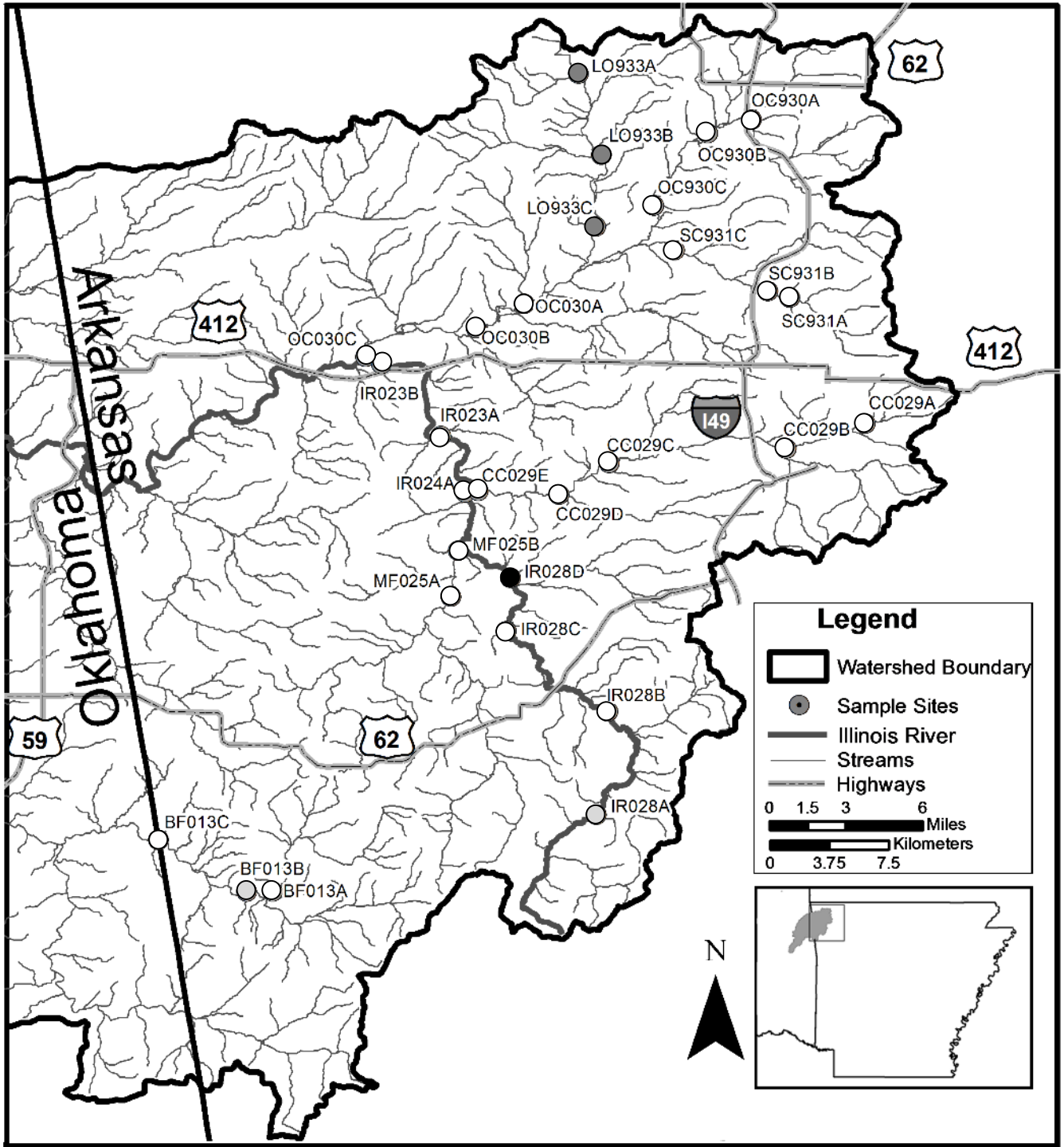
Results

APCEC Regulation 2

E. coli numbers should not exceed the applicable limit* in more than 25% of the water samples collected in no less than 8 samples taken during the primary contact season.

The *limits are:

- Illinois River (ecologically sensitive waterbody, Neosho Mucket mussel) → 298 col/100 mL
- All other streams → 410 col/100 mL



Pathogens

Results

Applicable Limits:

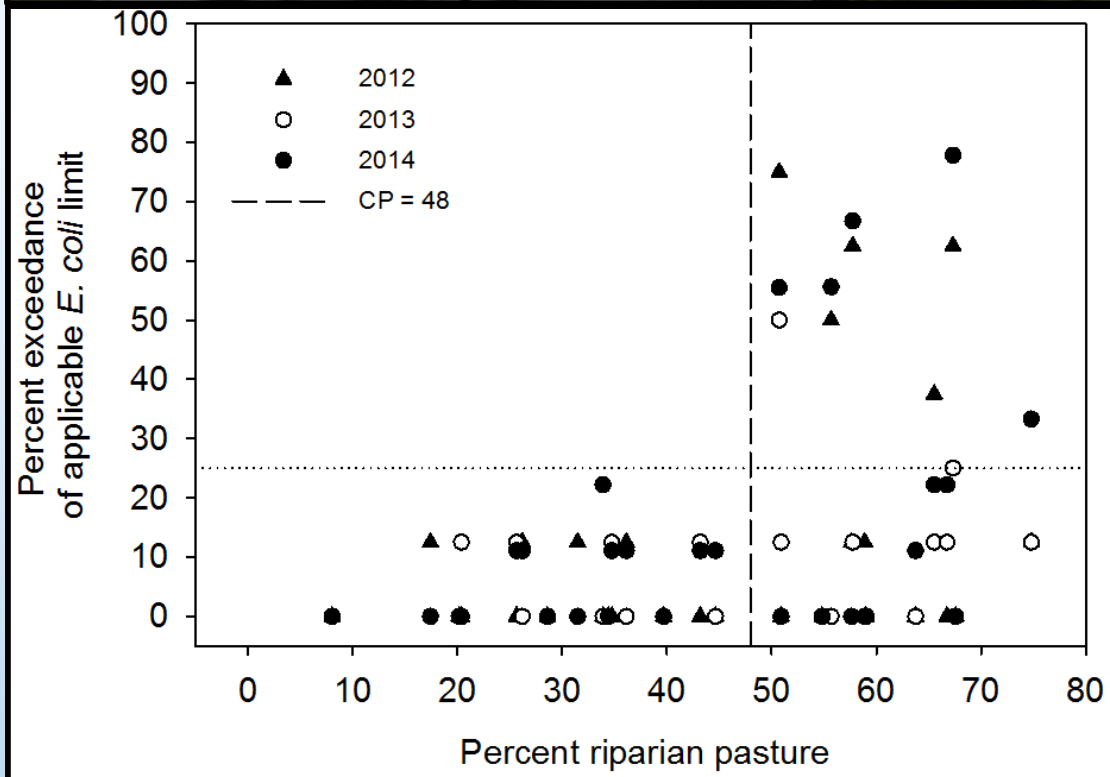
- **Illinois River**
  → 298 col/100 mL
- **All other streams**
  → 410 col/100 mL

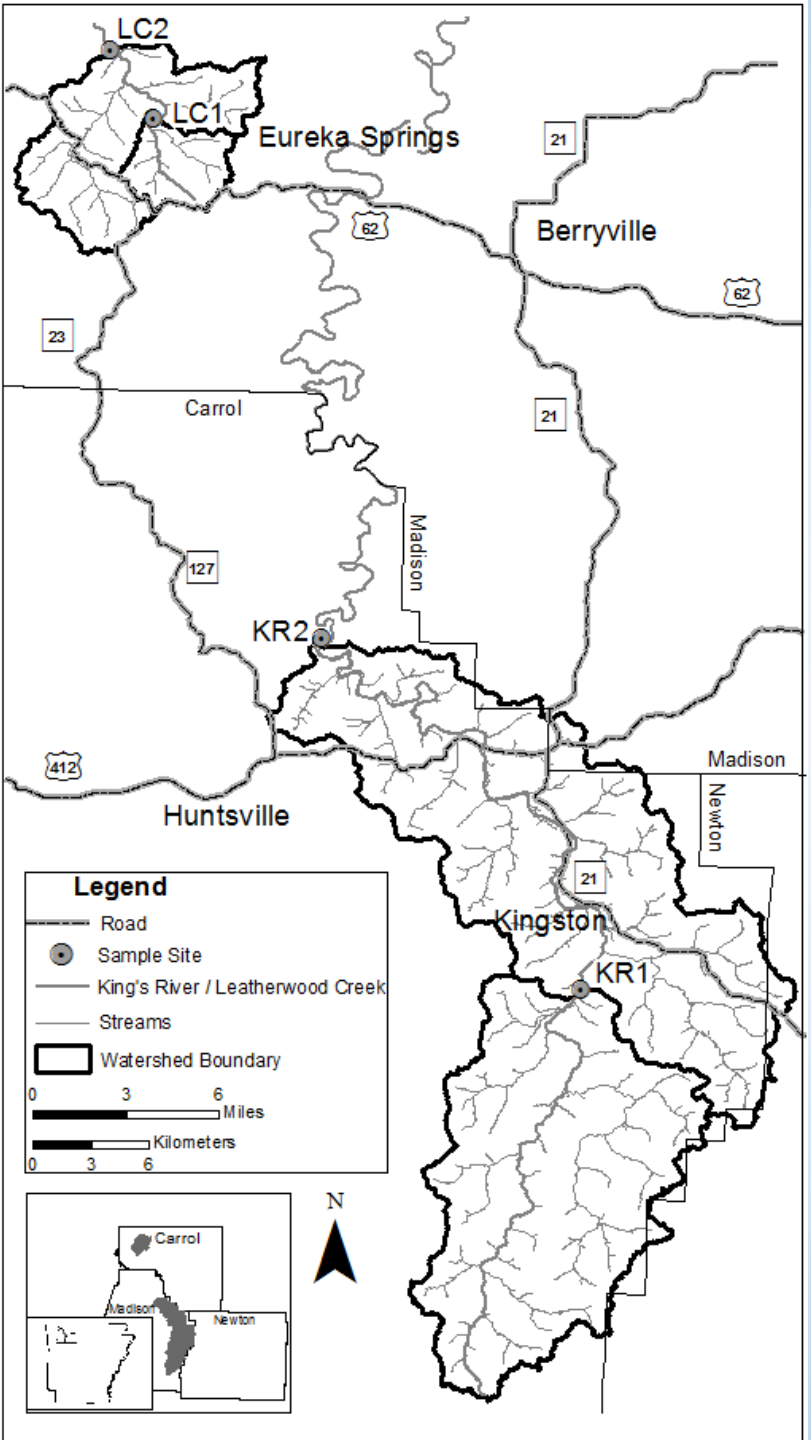
- E. coli numbers varied
  - Spatially
  - Temporally
- Little Osage Creek had E. coli numbers that exceeded limit.
- One site on the Illinois River exceeded limit every year (IR028D)
- ***Overall, thumbs up!***

Pathogens

Why are these sites high?

- We looked at the relation between elevated levels of *E. coli* and pasture land in riparian zone.
- ***The only sites where E. coli numbers exceeded the applicable limits had more than <u>50% pasture land</u> in the riparian zone.***
- *E. coli* seems to be a localized issue, likely driven by cattle access to streams.
- There is on-going work trying to track the source.





Objective 3
Dissolved Oxygen Sampling Sites

Two Sampling Sites
Two Reaches
Two Different Streams

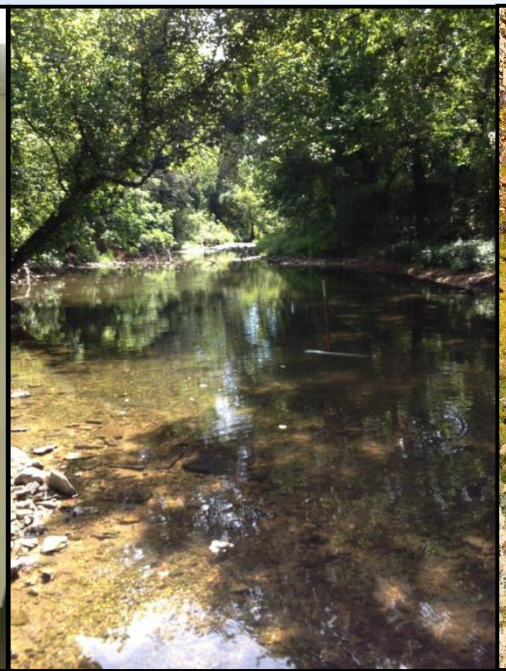
Leatherwood Creek

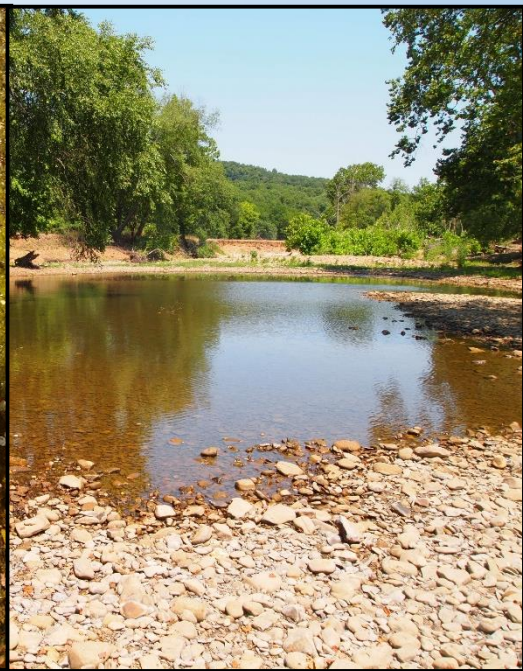
Kings River

Dissolved Oxygen

Methods

- Data sondes were calibrated in the lab.
- Data sondes were deployed in the field and record data for over 72 hours.
- Four deployments per year (for 3 years):
  - two during critical season (May-Sept)
  - two during primary season (Sept-May)
- Measured dissolved oxygen, pH, temperature and conductivity



Dissolved Oxygen

Results

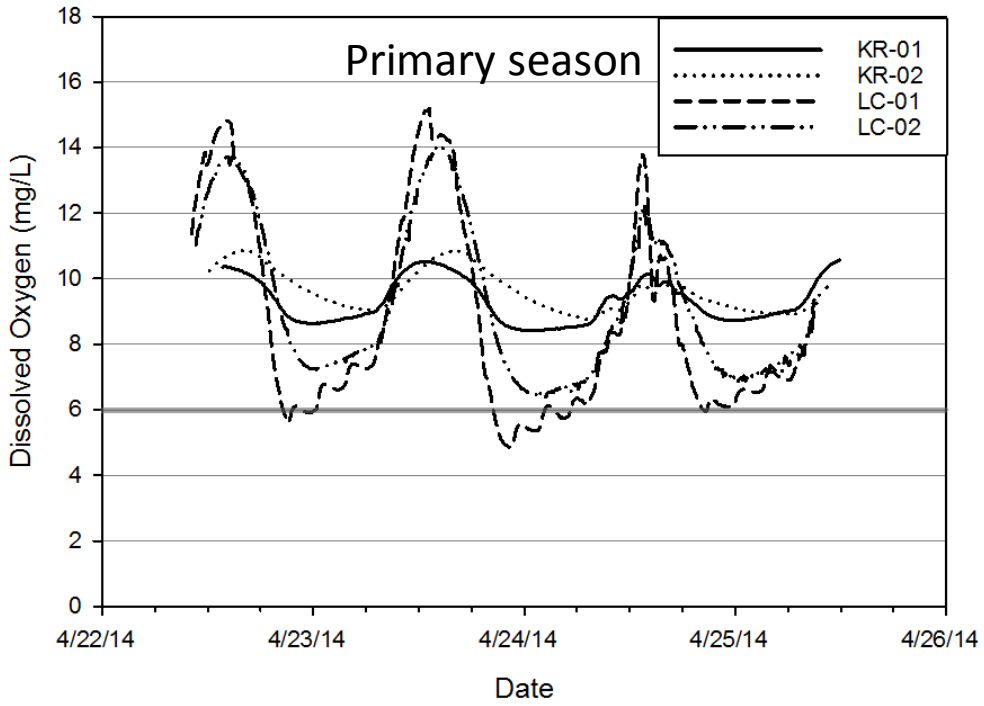
APCEC Regulation 2

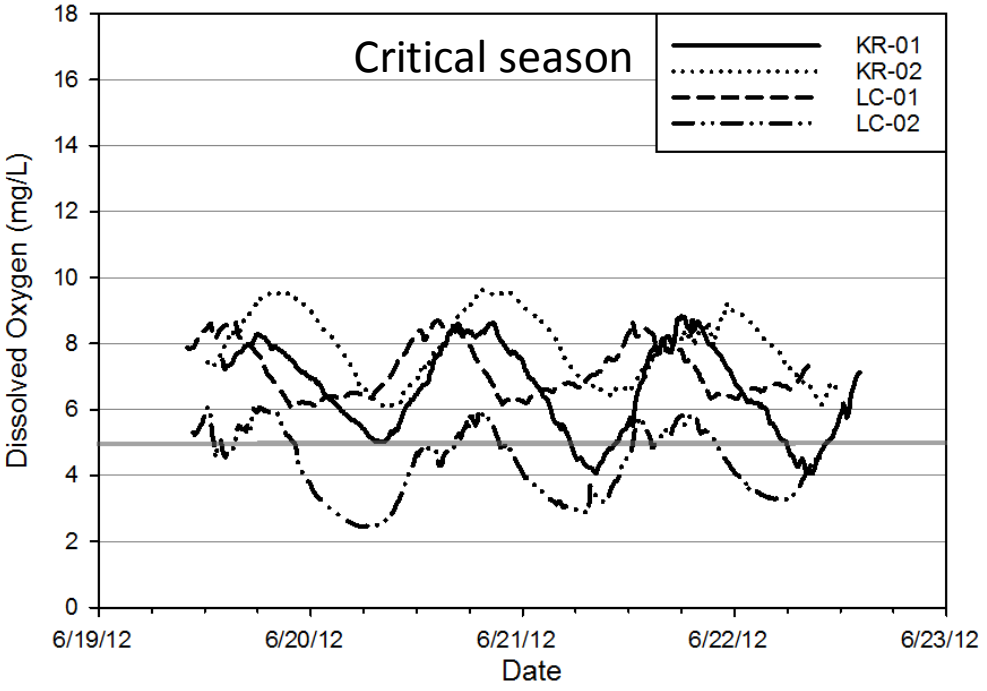
Primary Season – all streams must have DO at or above 6 mg/L

Critical Season – the DO limit is based on watershed area

- *LC01 - 5 mg/L (<10 mi², flow >1 cfs)*
- *LC02 - 5 mg/L (10 to 100 mi²)*
- *KR01 - 5 mg/L (10 to 100 mi²)*
- *KR02 – 6 mg/L (>100 mi²)*

An example of the data is displayed to the right, showing diurnal DO variations and how sites and reaches differ.





Dissolved Oxygen

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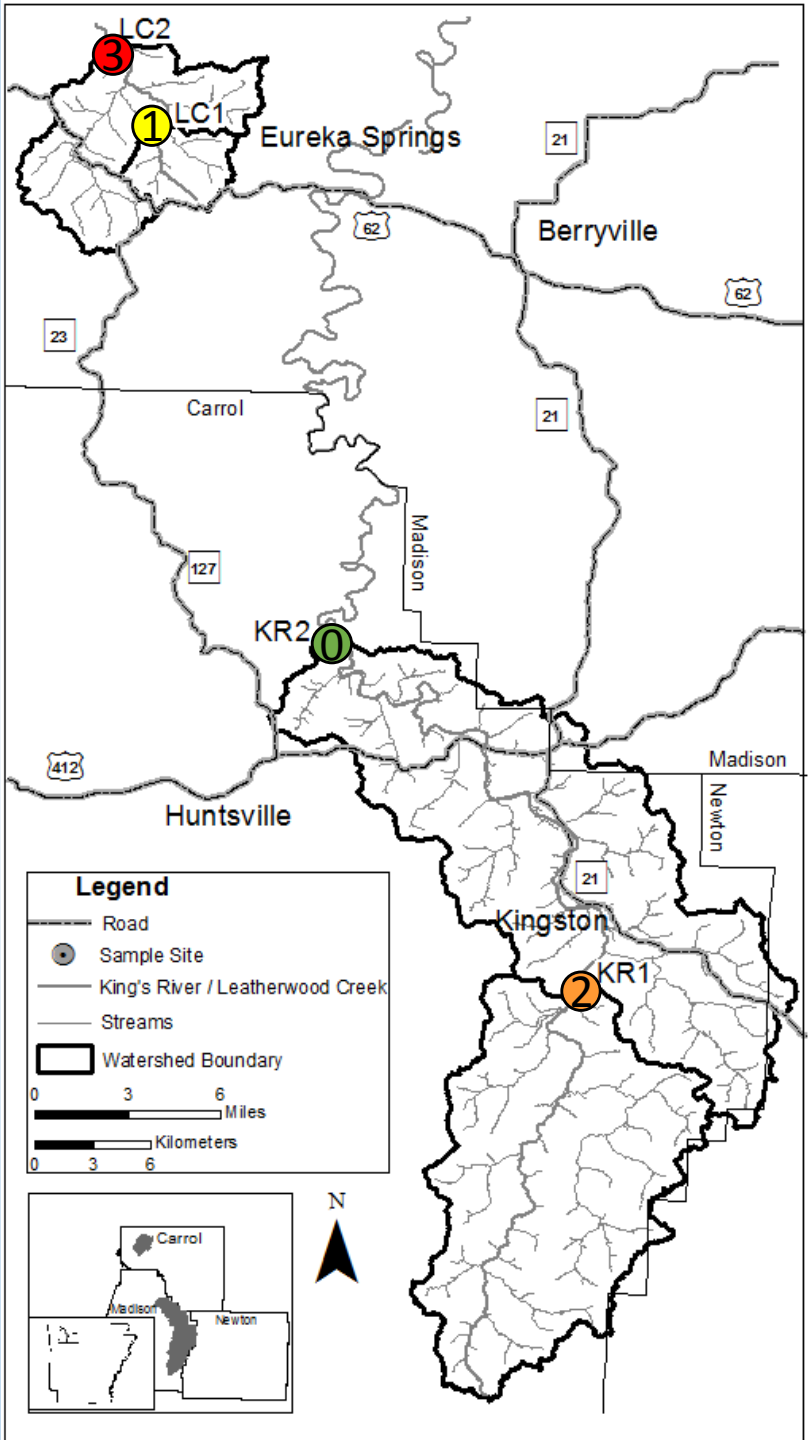
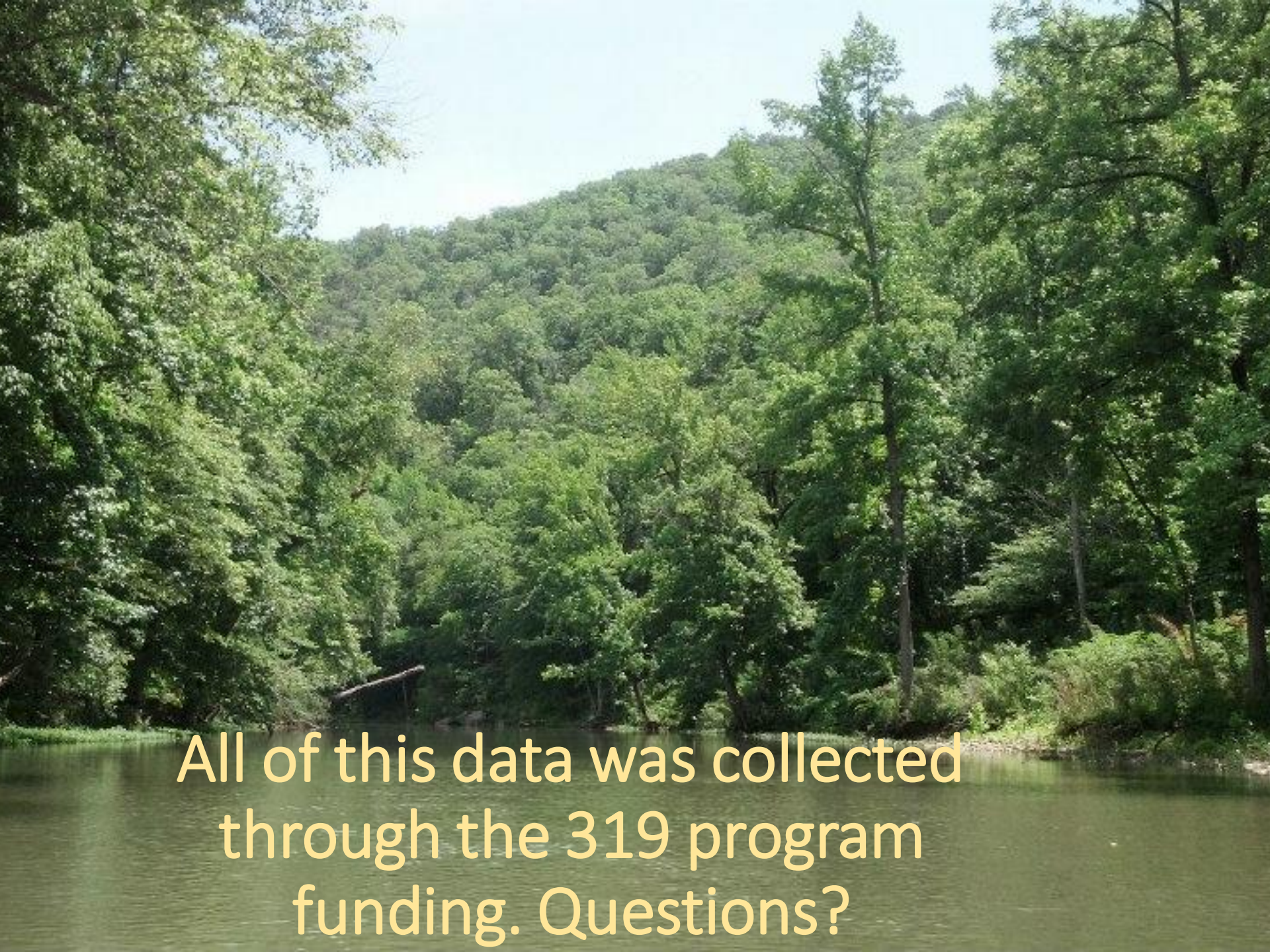
- *Potential DO violations were variable across sites and reaches.*




All of this data was collected through the 319 program funding. Questions?