

# Monitoring Antibiotic Resistant Bacteria in the Black Hawk Lake Watershed, Iowa

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# Overview

- Study Background
- Study objective
- Methods
- Results from first year of monitoring
- Initial conclusions

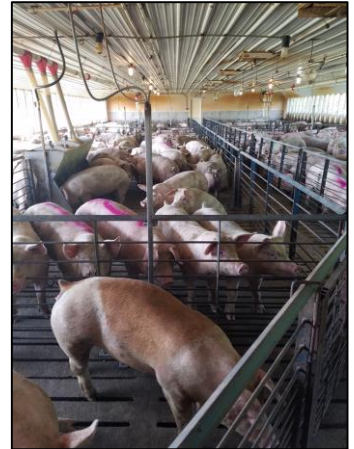


# Antibiotic use in Agriculture

Estimated Annual Totals from 2016 (medically important)

Cattle: 7,960,766 lbs

Swine: 6,907,660 lbs



**Veterinary Feed Directive 2017** – Makes medically important antibiotics illegal to use for production purposes and requires veterinary approval for prevention and treatment.

This study focuses on:

- Tylosin (Macrolide): Cattle and swine

  - Ex. Erythromycin is a macrolide used when a patient is allergic to penicillin

- Tetracyclines: Human, swine, and poultry

  - Ex. Used in acne products and to treat a number of infections

# Sources of Fecal Indicator Bacteria in the environment

- Wildlife – mostly geese
- Septic Systems – leakage, residual
- Manure application on row crops as fertilizer
  - Concentrated Animal Feeding Operations (CAFOs)



# NWQI Monitoring Project

- 5-year project (2015-2019) sponsored by Iowa DNR to analyze water quality in three subwatersheds within Black Hawk Lake watershed.
- Compliments existing DNR watershed and lake monitoring.
- Opportunity to monitor bacteria
  - Lead to USDA funding for bacteria monitoring

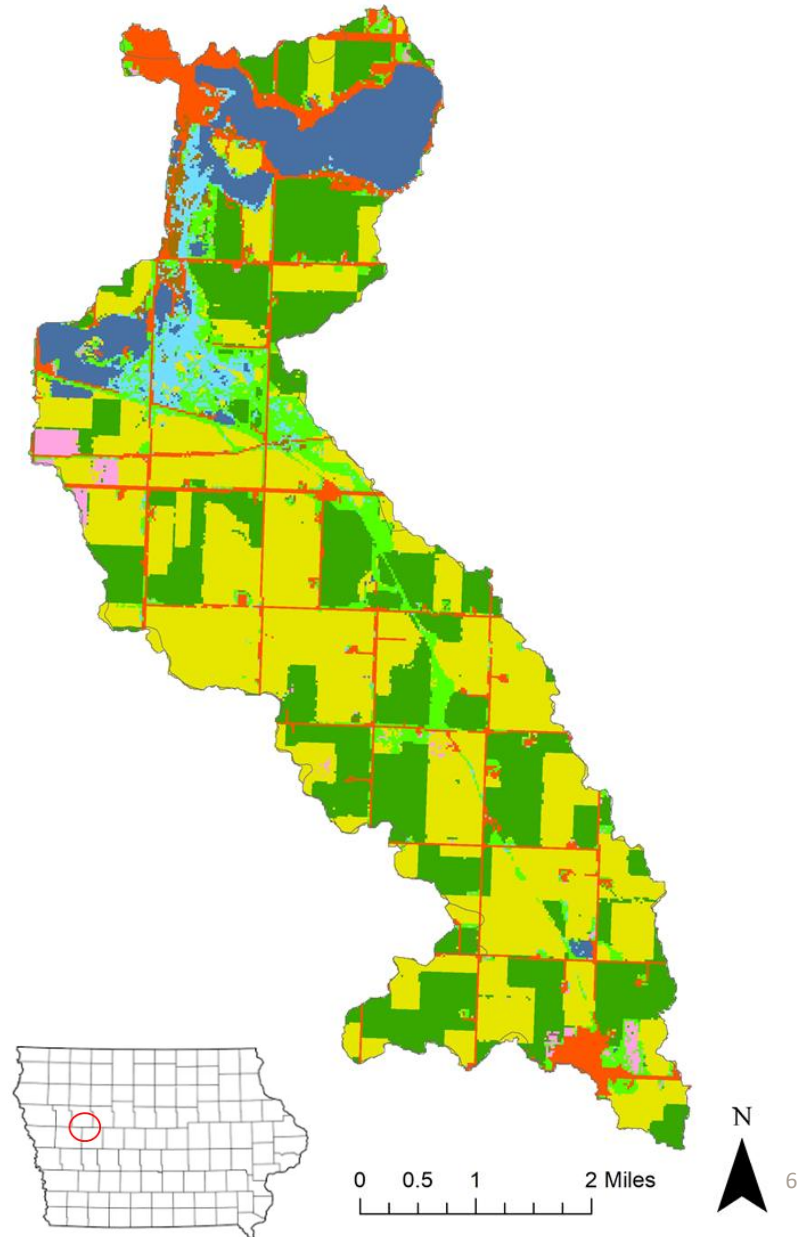
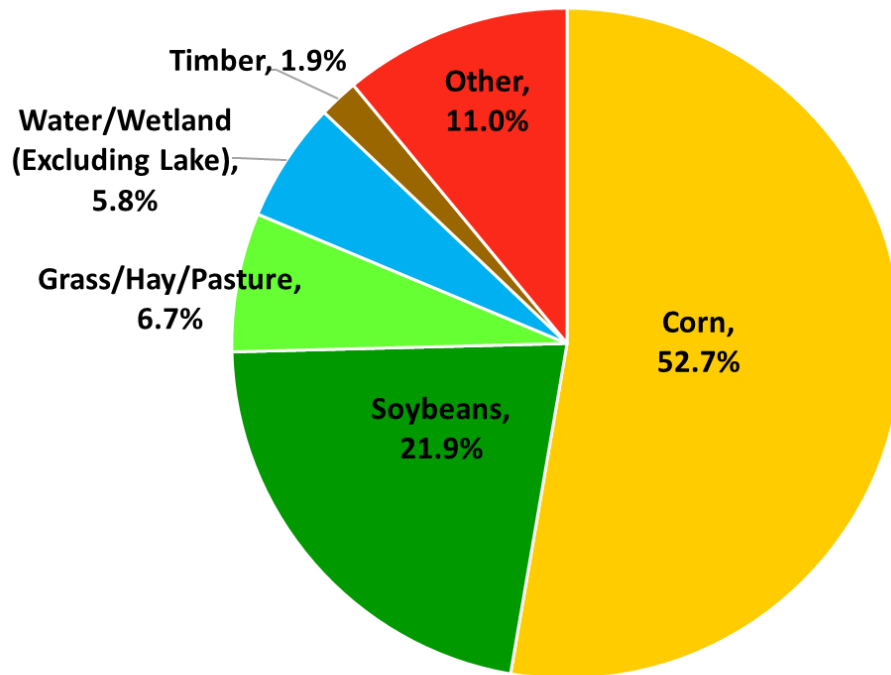




# Black Hawk Lake Watershed

- Located in the western portion of the Des Moines Lobe
- Located in both Sac and Carroll Counties
  - Watershed Area: 13,156 acres

## Land uses:



# Black Hawk Lake Watershed

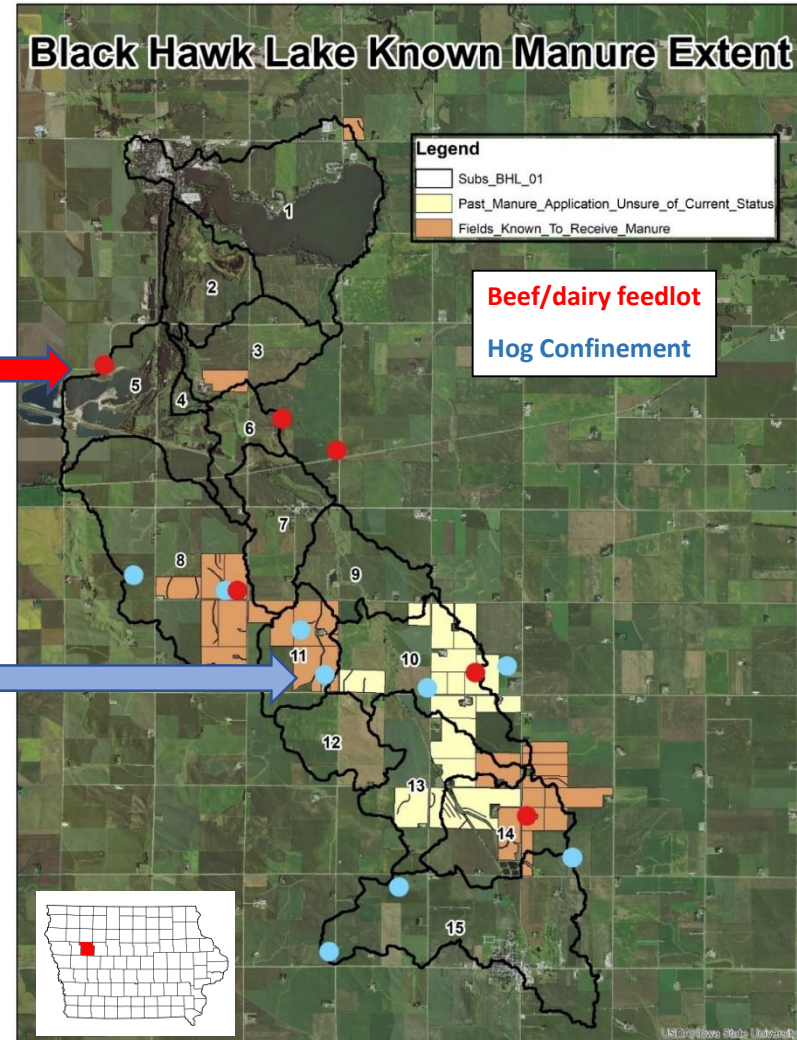
## Concern:

- Enrichment of the natural environment with antibiotic resistant bacteria
- Harmless antibiotic resistant bacteria can pass resistance genes to pathogenic (infection causing) bacteria



## Broader Impact:

- May eventually make its way to public areas
- Cause drug-resistant infections



# Study Objective

- Monitor total fecal indicator bacteria (FIB) (*E.coli* and enterococci) and tylosin and tetracycline resistant enterococci from drainage and runoff in a highly agriculturalized watershed

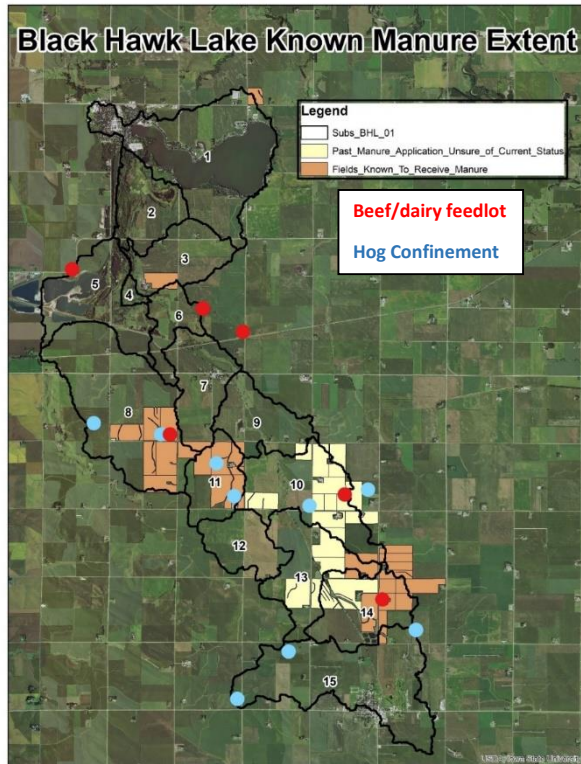
Two year sampling effort, Summer 2017- Late Fall 2018



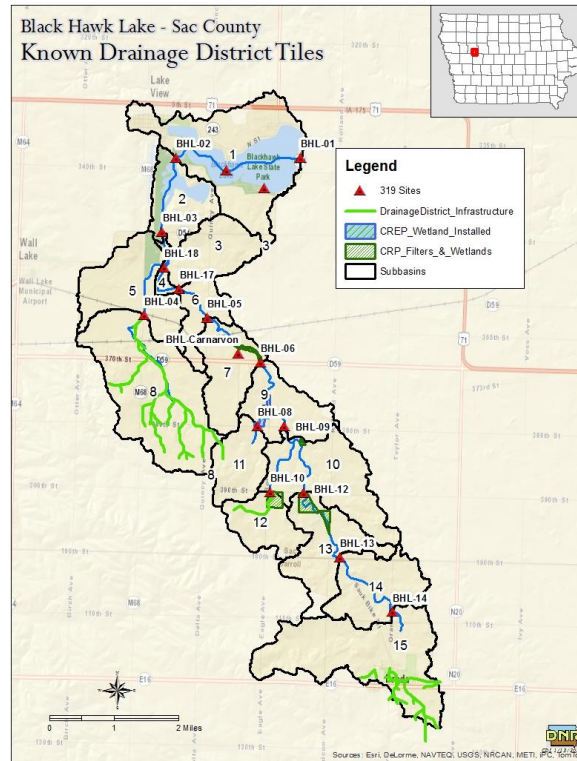


# BHL watershed has differences in manure application, tile and surface drainage, and best management practices

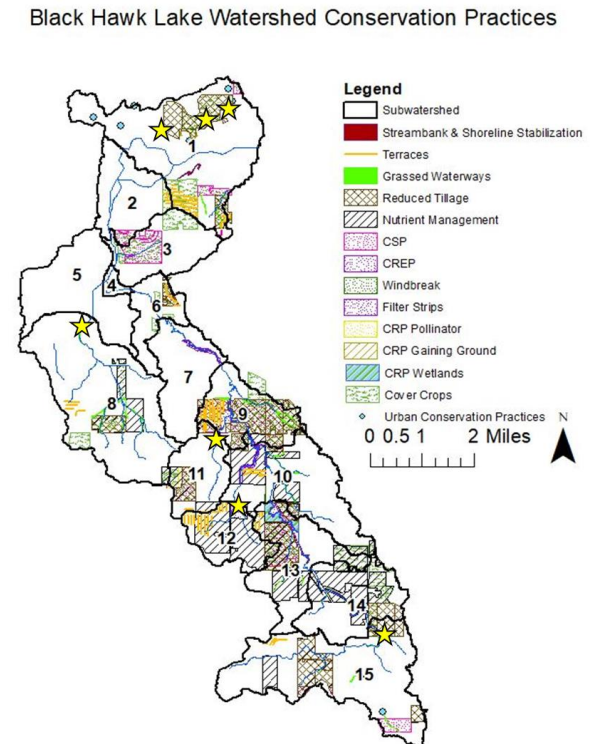
## Manure Application



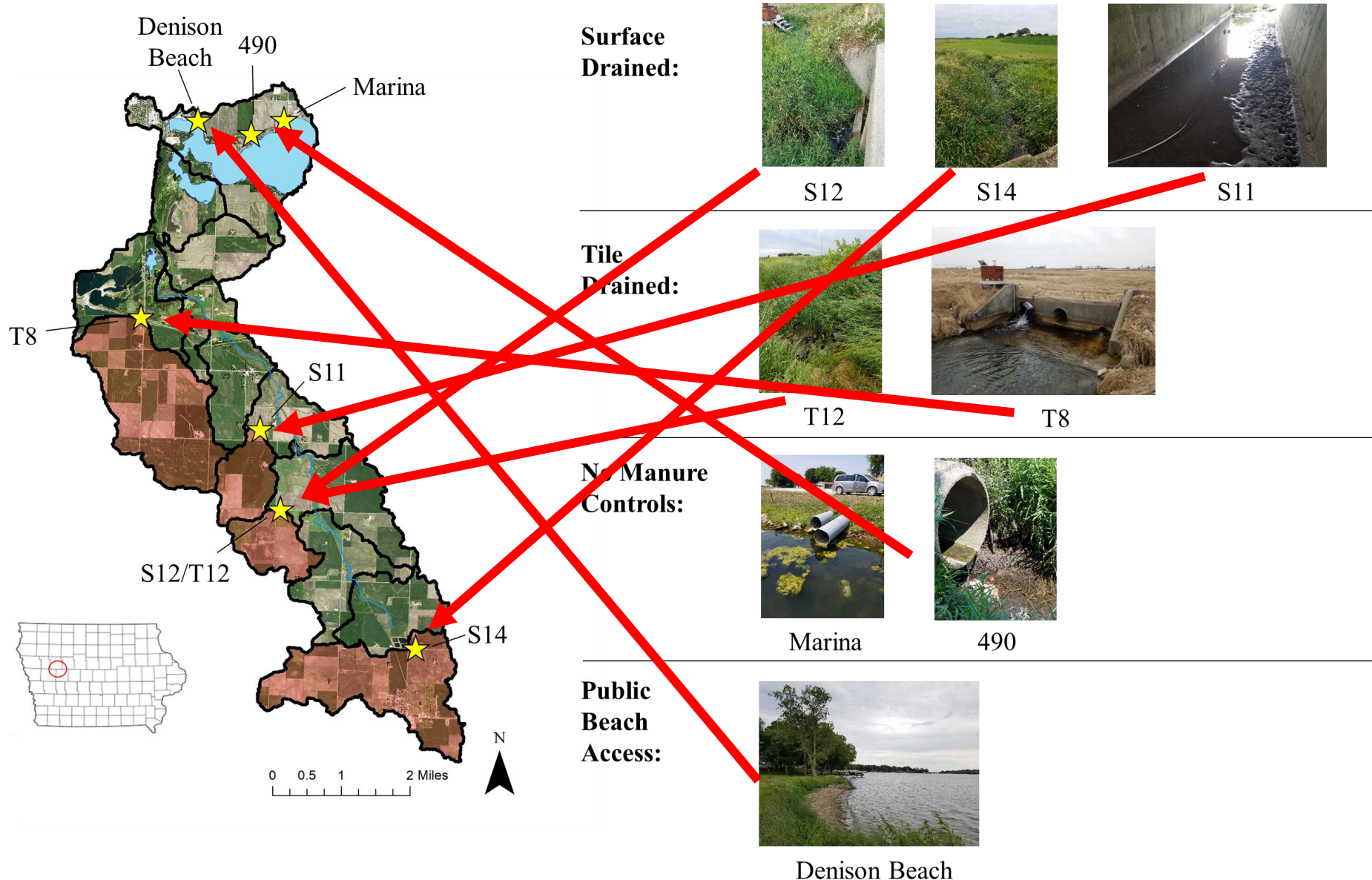
## Tile and Surface drainage



## Best Management Practices



BHL monitoring includes three surface locations, two tile drain outlets, two potential no manure controls, and a public beach access location

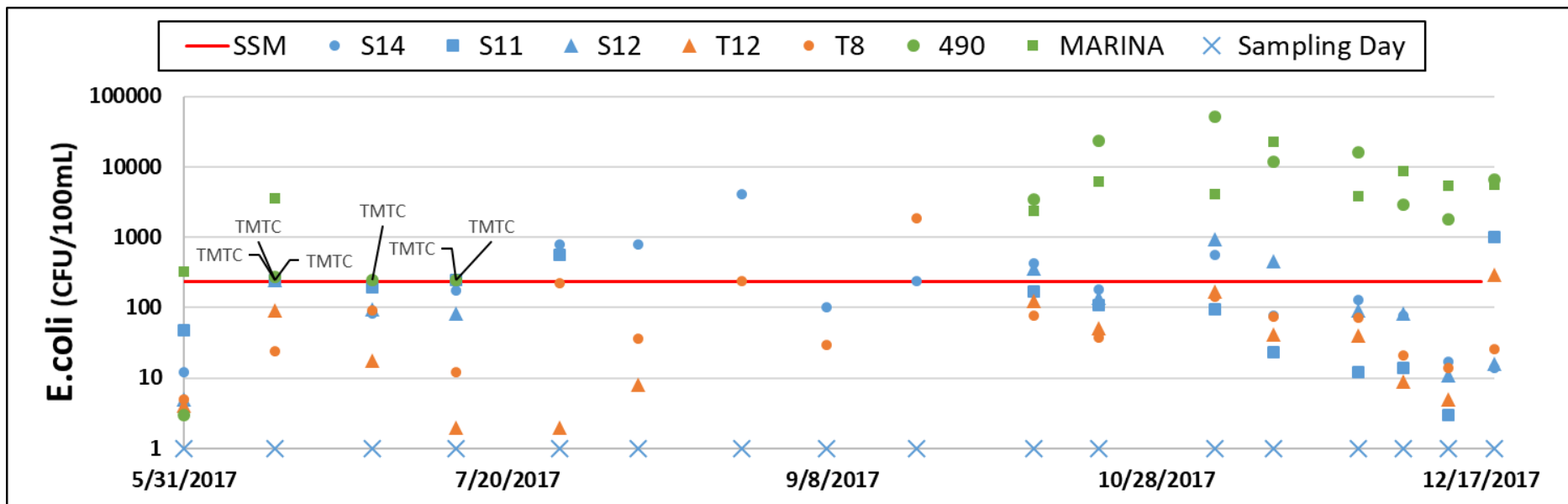
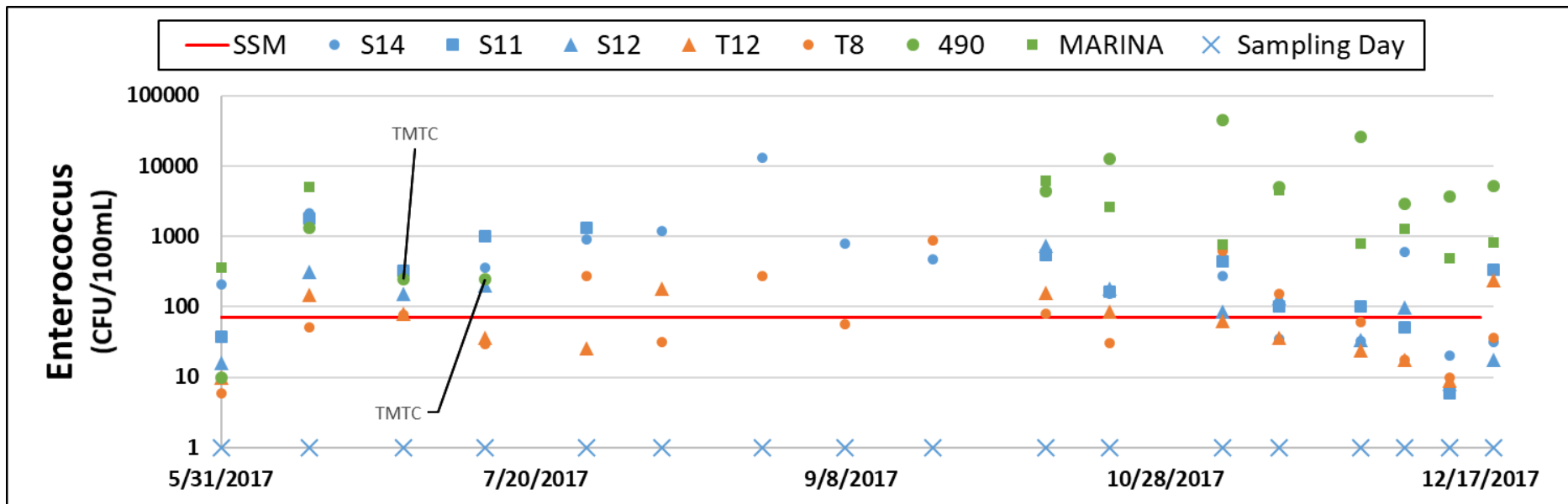


# Methods and Analysis

- Grab samples every two weeks
- Samples preserved on ice during transportation
- Process samples within 24 hours
- Membrane filtration
  - Plated on selective agar for:
    - Total enterococci
    - Tylosin resistant enterococci
    - Tetracycline resistant enterococci
    - Total *E.coli*

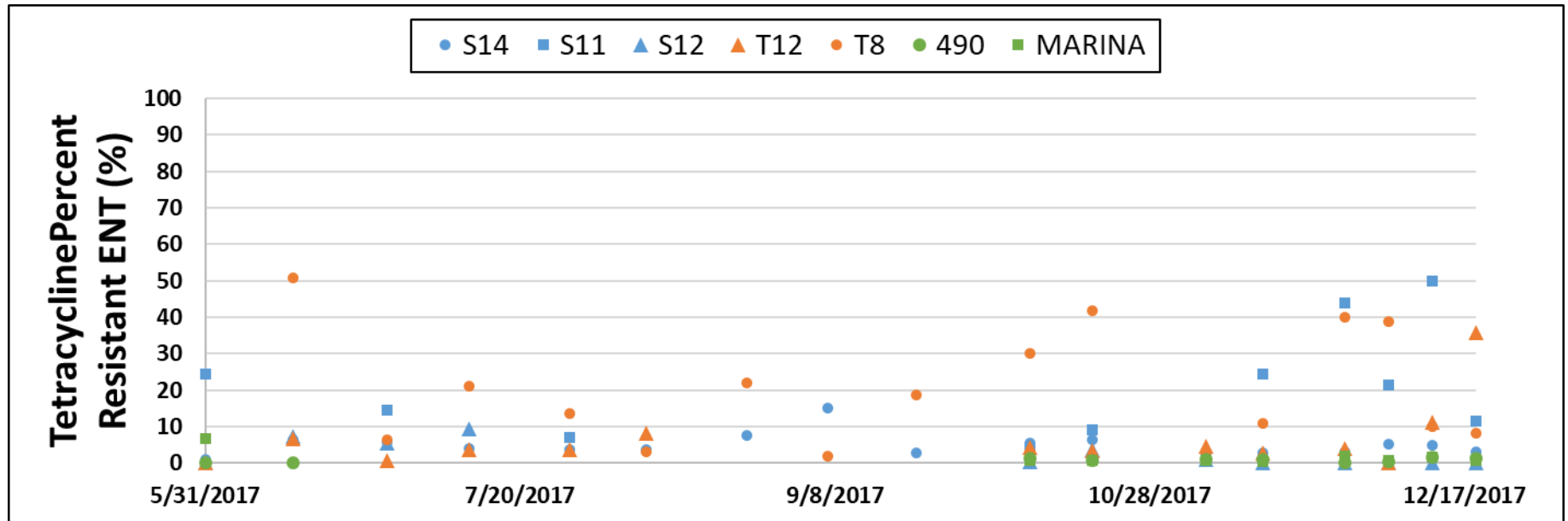
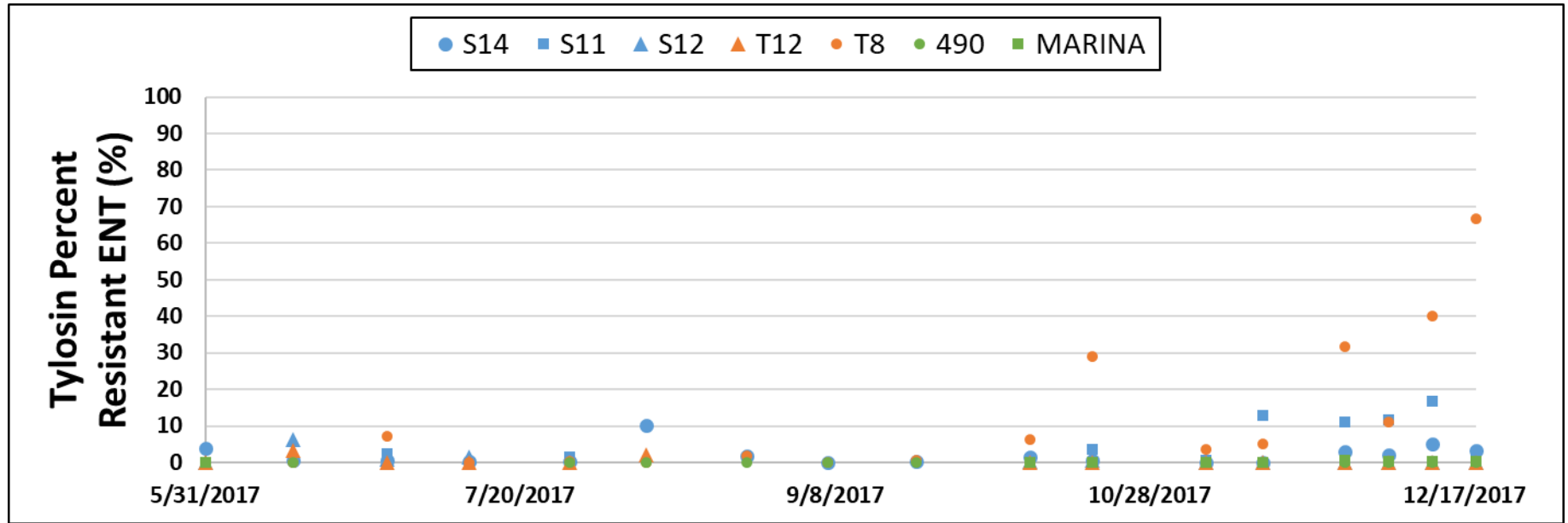


Single Sample Maximum (SSM) for waterbody class A2/A3-children's contact exceeded much of the time for enterococcus, less so for *E.coli*.



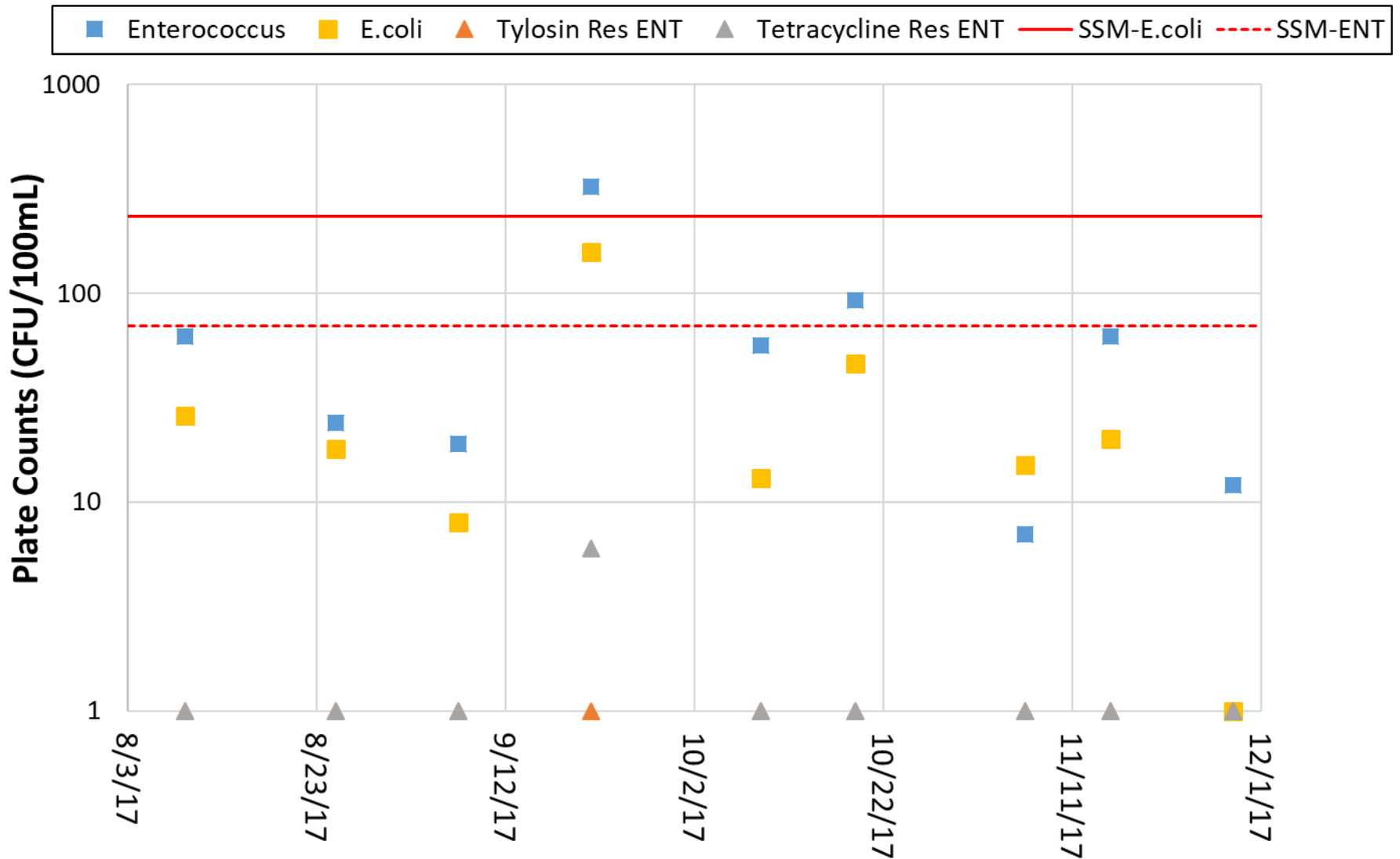


Tylosin and tetracycline antibiotic resistant enterococci were found in both surface and tile-drained water



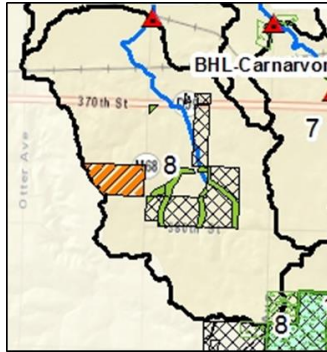
# Denison Beach

Bacteria observed in the watershed do not reflect the bacteria observed in the lake

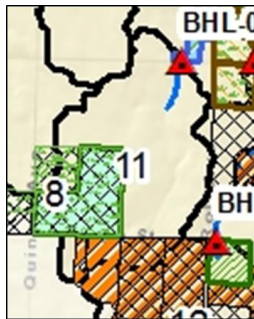


Higher percent resistance observed from watersheds with less BMP coverage

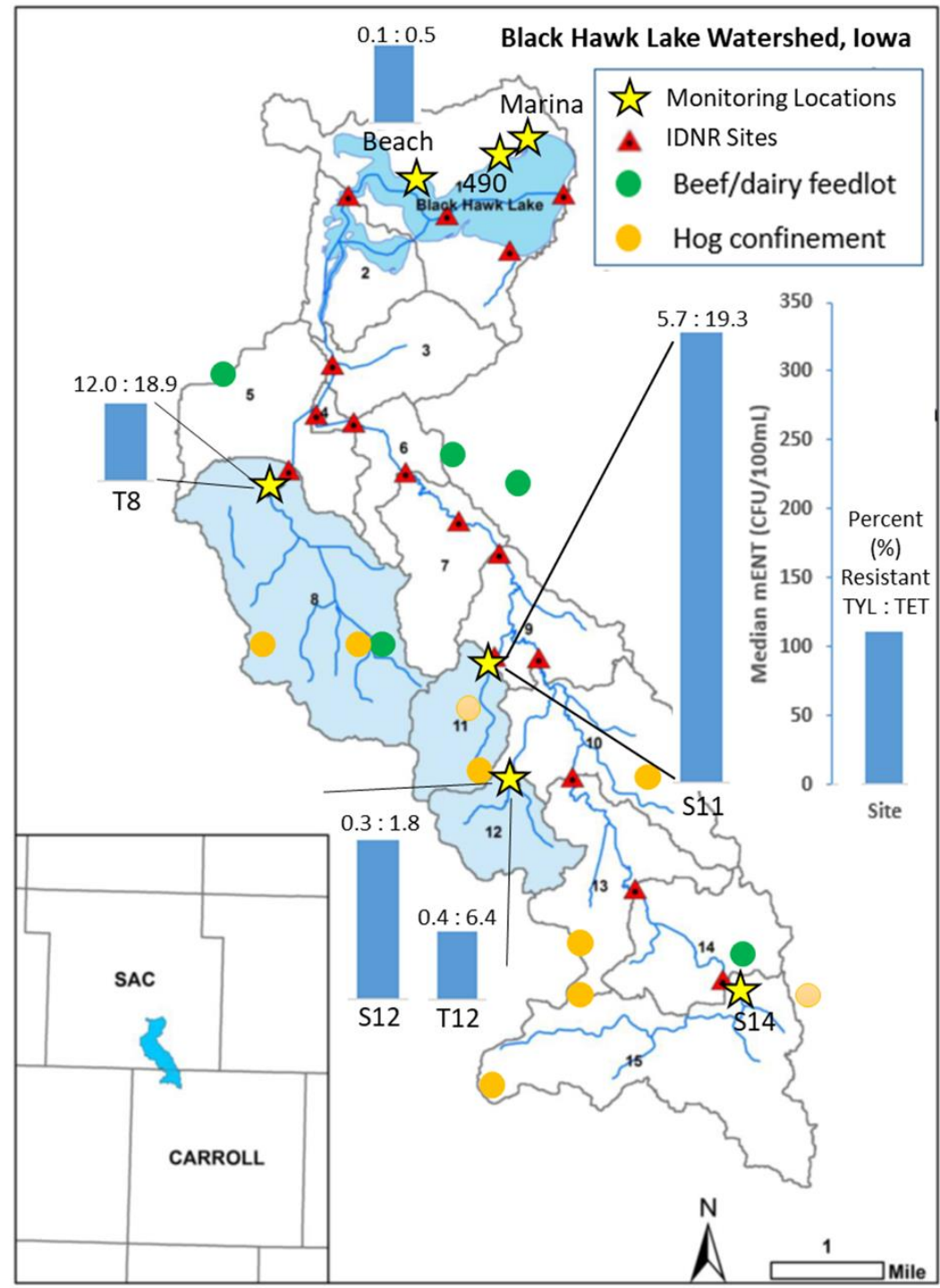
Tile 8 →



Surface 11 →



Tile 12  
Surface 12 →



# Initial Conclusions

- Observed lower percent resistance in subwatershed with higher best management practice coverage
- Observed antibiotic resistant fecal indicator bacteria in tile-drained water
- Beach bacteria levels below the single sample maximum and antibiotic resistance is below the limit of detection





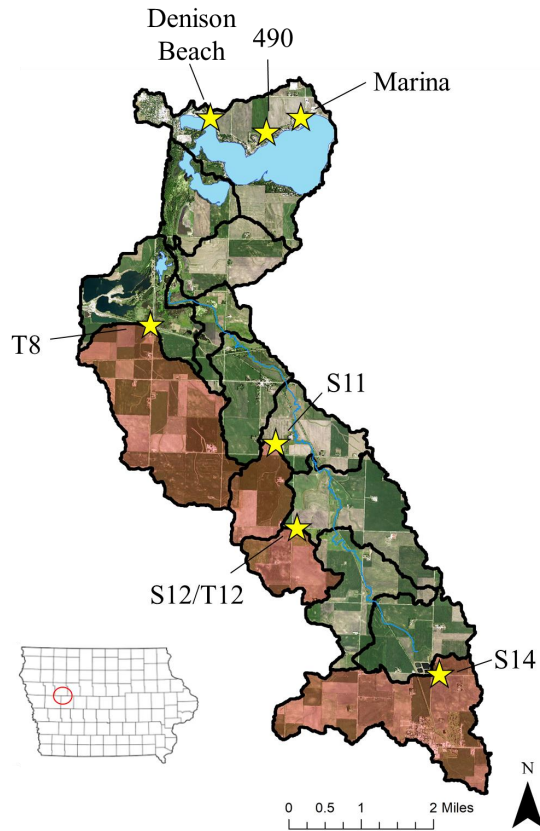
# Acknowledgements

Funding: USDA

- Technical support: Leigh ann Long, Katherine van der Woude, Megan Lukas, Kyle Werning
- T.J. Lynn; watershed coordinator, Black Hawk Lake Watershed Project



# Questions?



## Surface Drained:



S12



S14



S11

## Tile Drained:

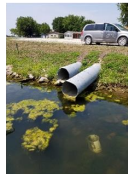


T12



T8

## No Manure Controls:



Marina



490

## Public Beach Access:



Denison Beach

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