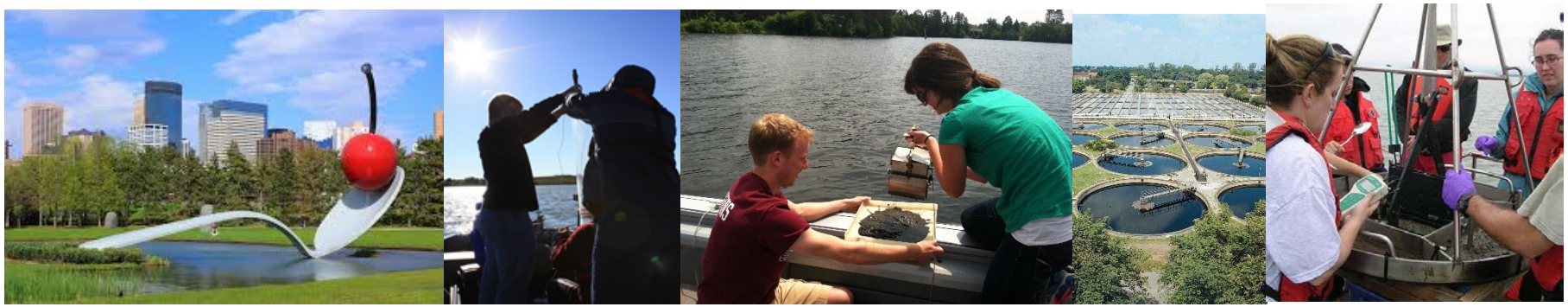


Detection of Antibiotic Metabolites

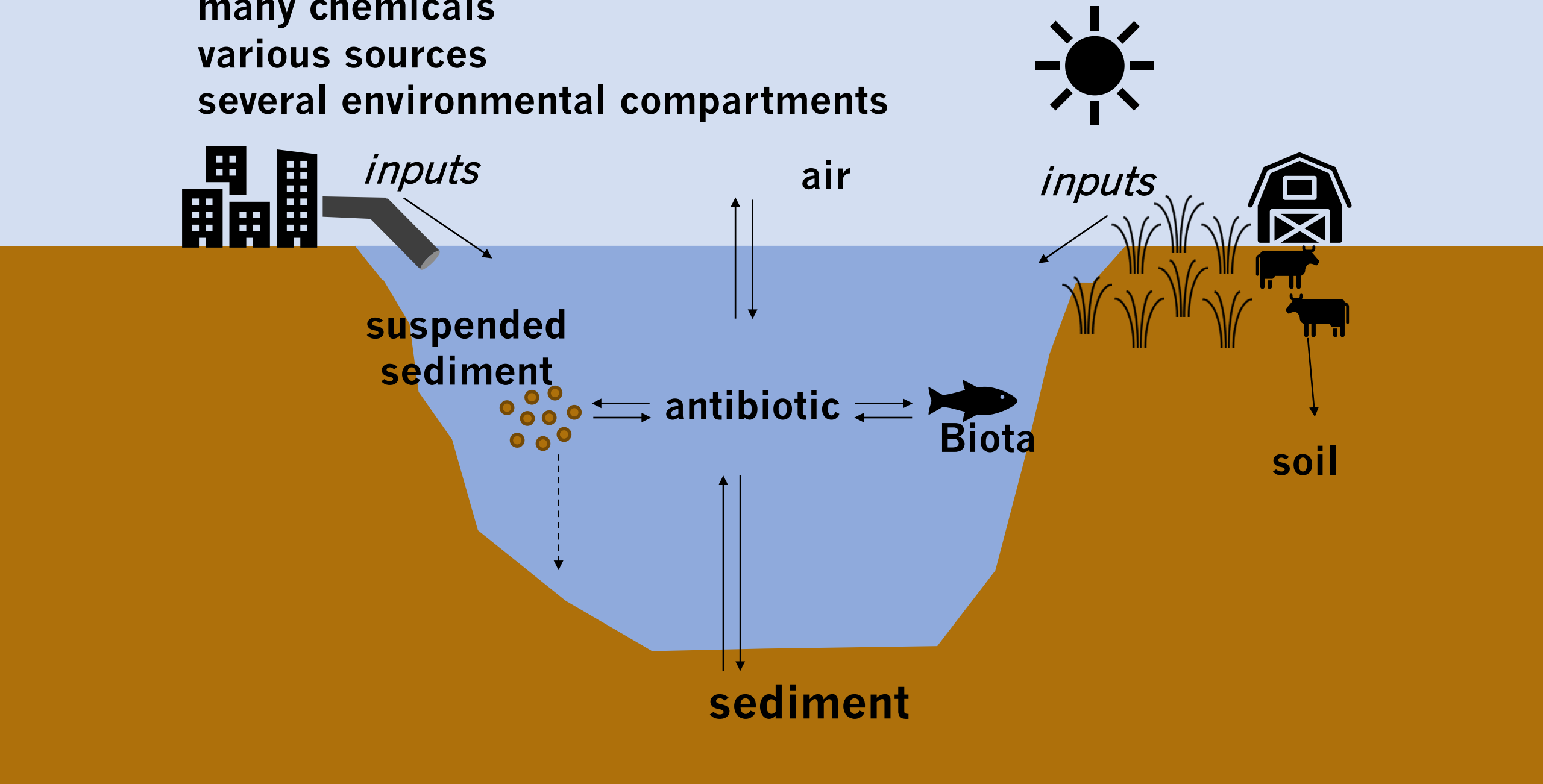
William Arnold

Department of Civil, Environmental, and Geo- Engineering
College of Science and Engineering

Twitter: @billarnold_mn
www.williamarnold.org

Challenges:

many chemicals
various sources
several environmental compartments



Sulfonamides

Sulfachloropyridazine

Sulfadiazine

Sulfadimethoxine

Sulfamethoxazole

Sulfamethazine

Sulfapyridine

Fluoroquinolones

Ofloxacin

Norfloxacin

Ciprofloxacin

Enrofloxacin

Tetracyclines

Tetracycline

Oxytetracycline

Chlortetracyline

Doxycycline

Macrolides

Erthyromycin

Tylosin

Roxithromycin

Others

Trimethoprim

Carbadox

Lincomycin

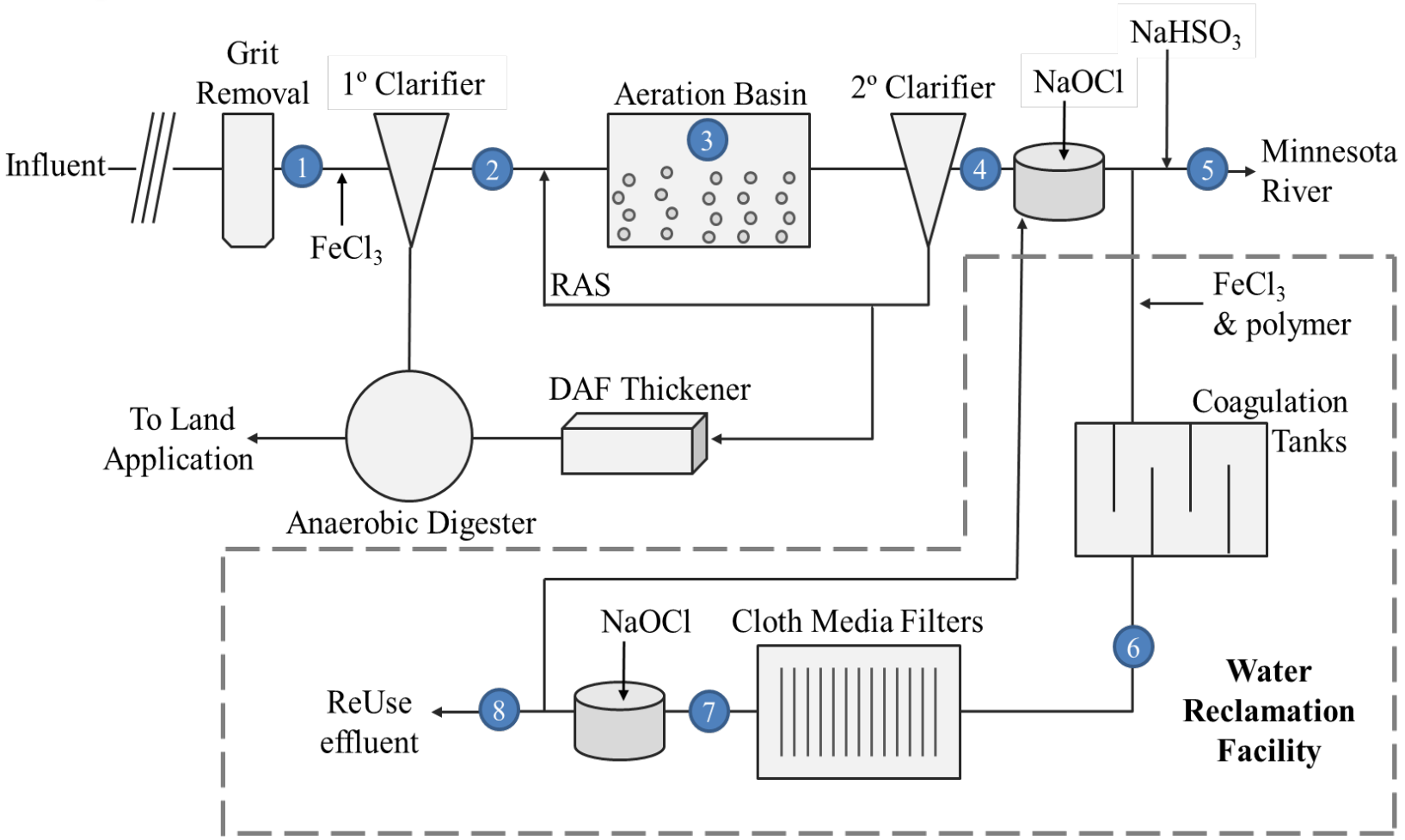
Extraction

water sample

Extraction/
Clean up

UPLC-MS/MS
Analysis

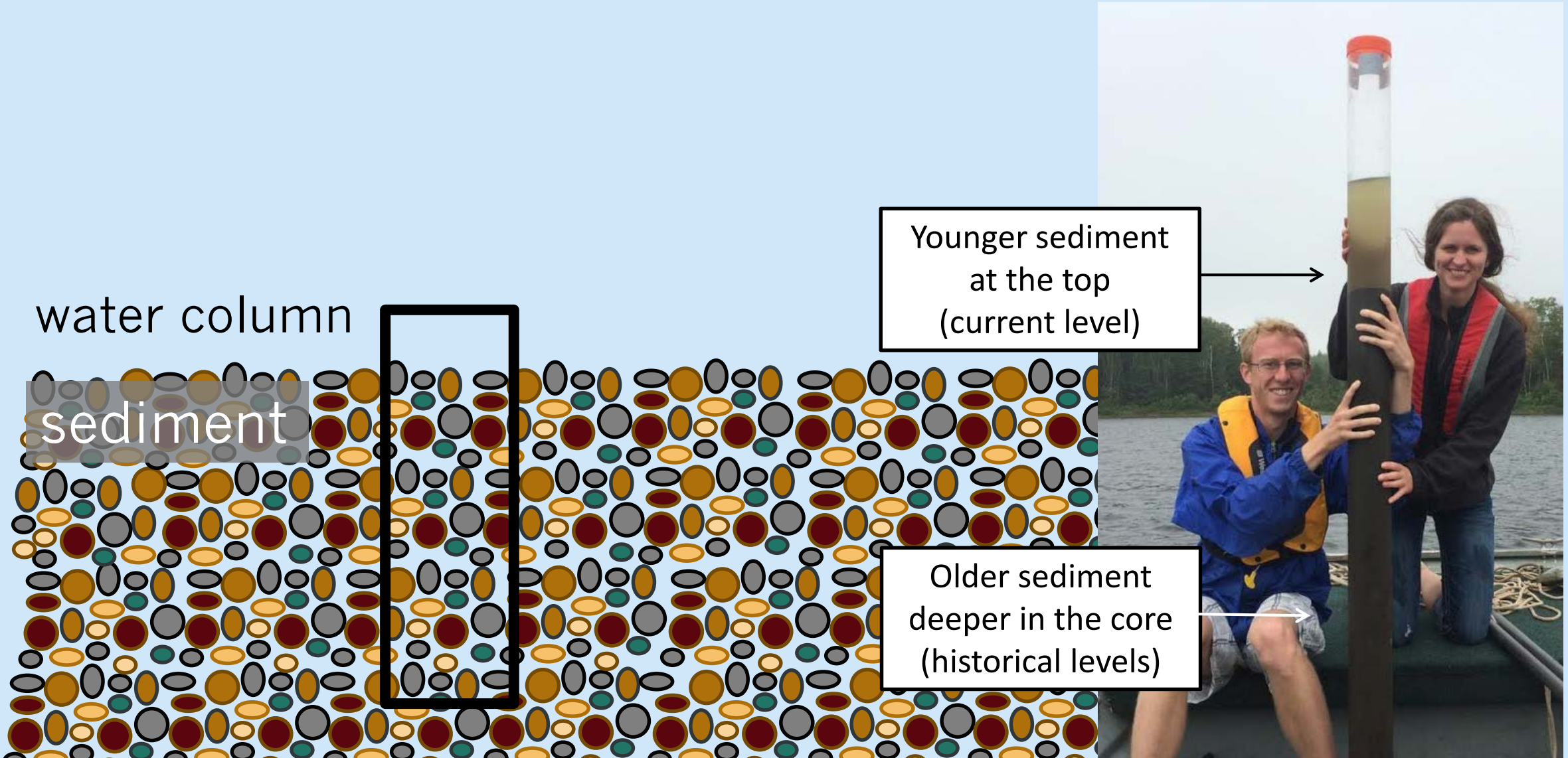
Inputs: Wastewater



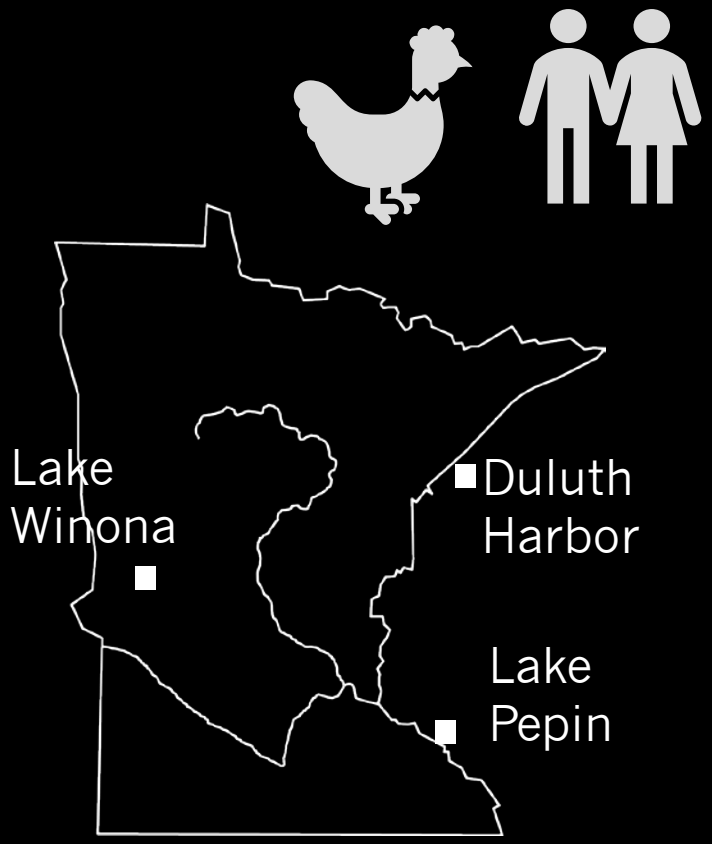
Total Fluoroquinolines (ng/L)

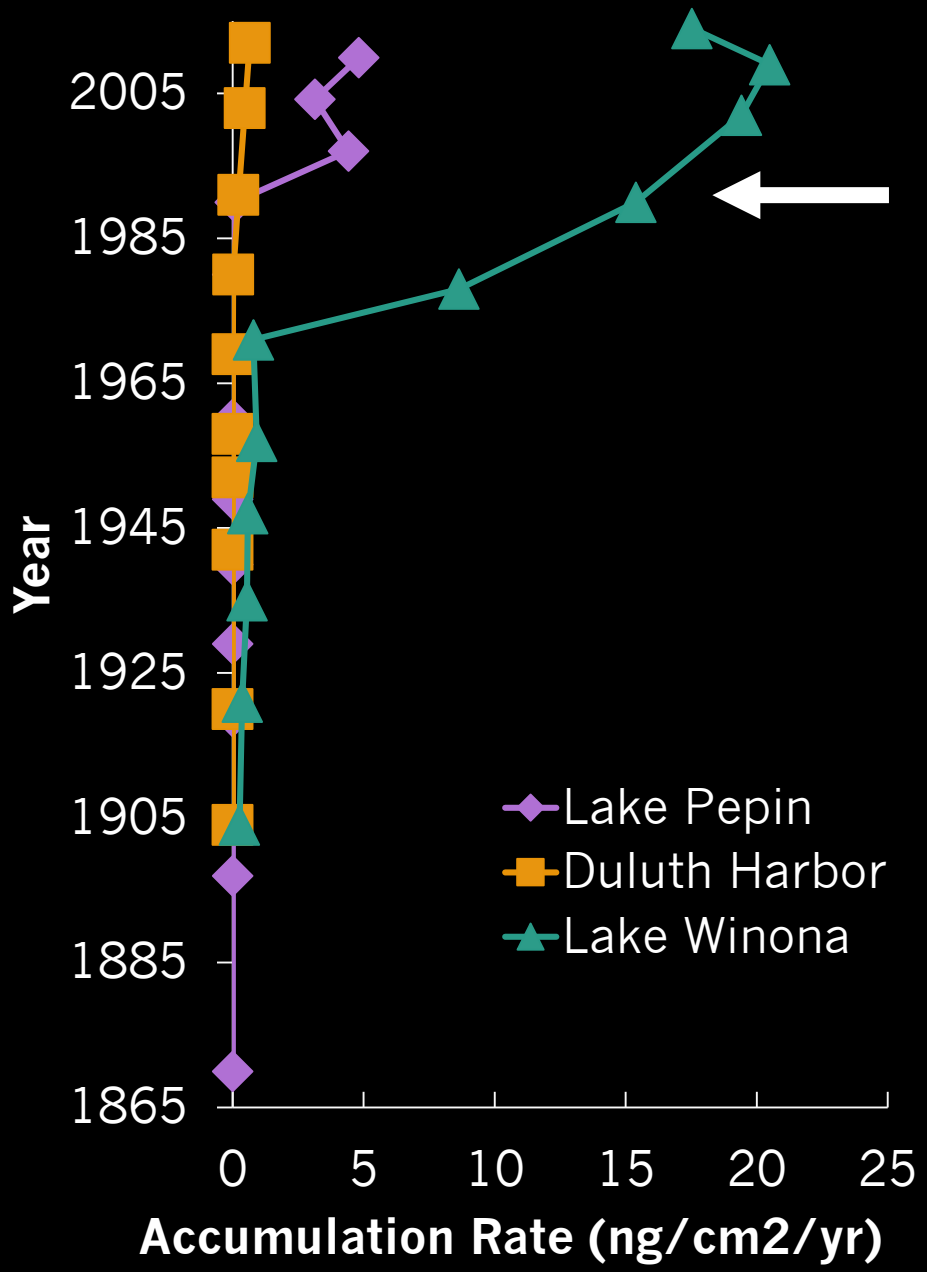
1:	**744**
2:	**831**
3:	**755**
4:	**615**
5:	**80**
8:	**0**

Sediment cores can be used to determine historical trends of antibiotics in a water body

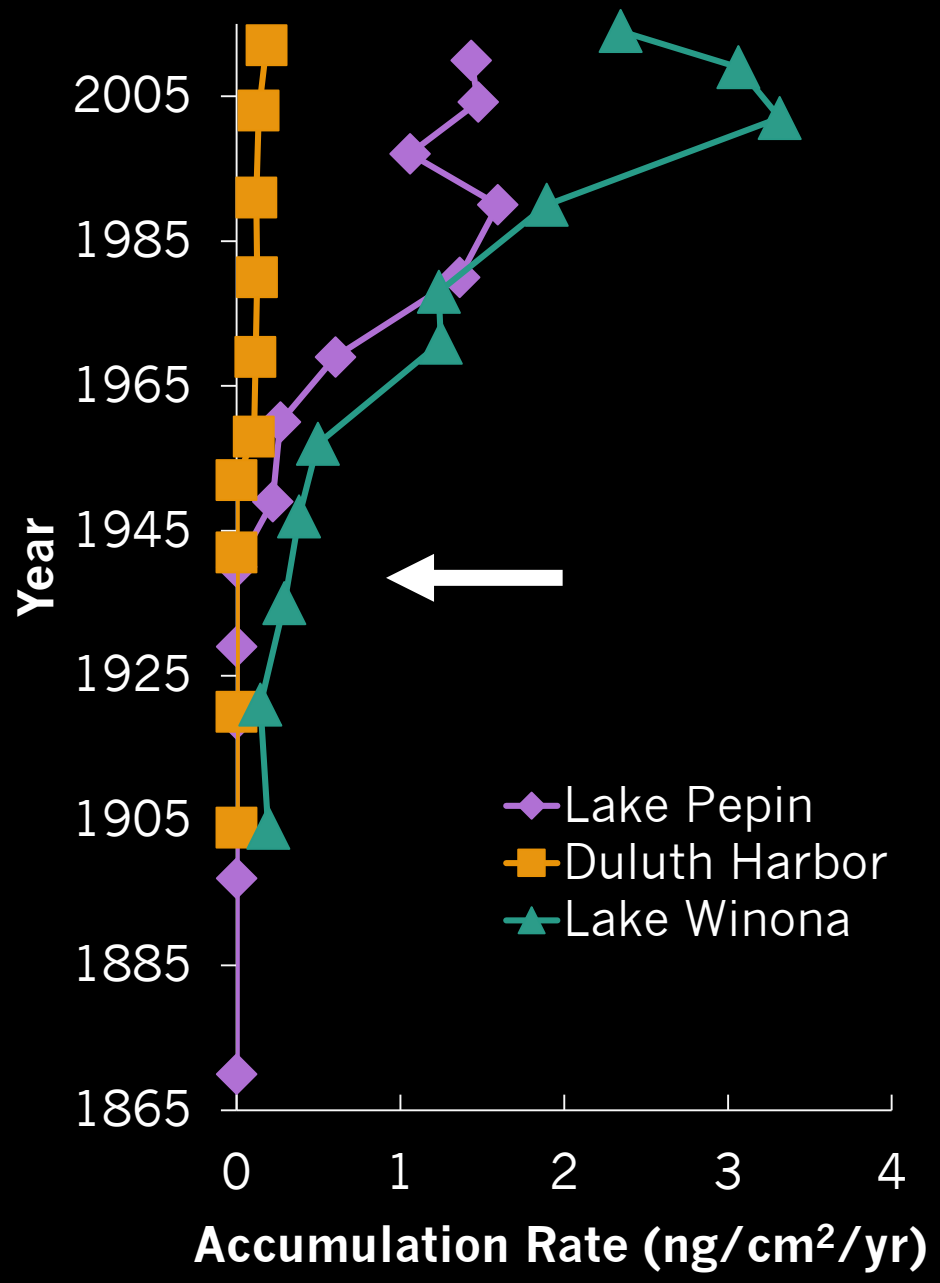


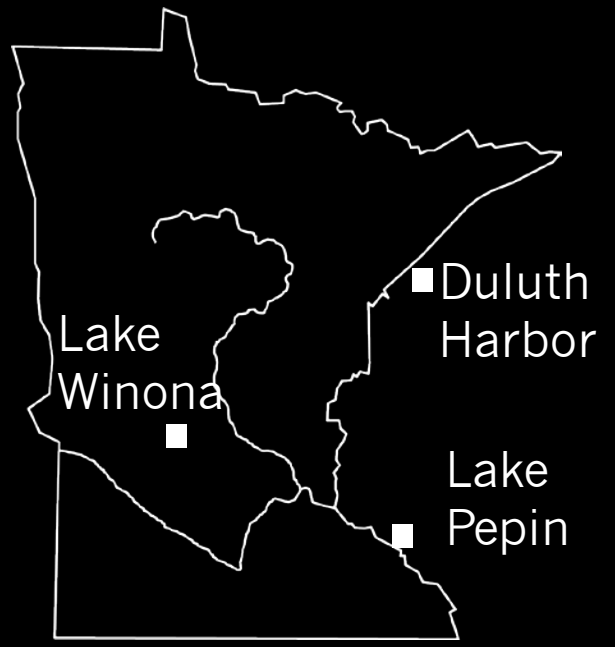
Ofloxacin (new)



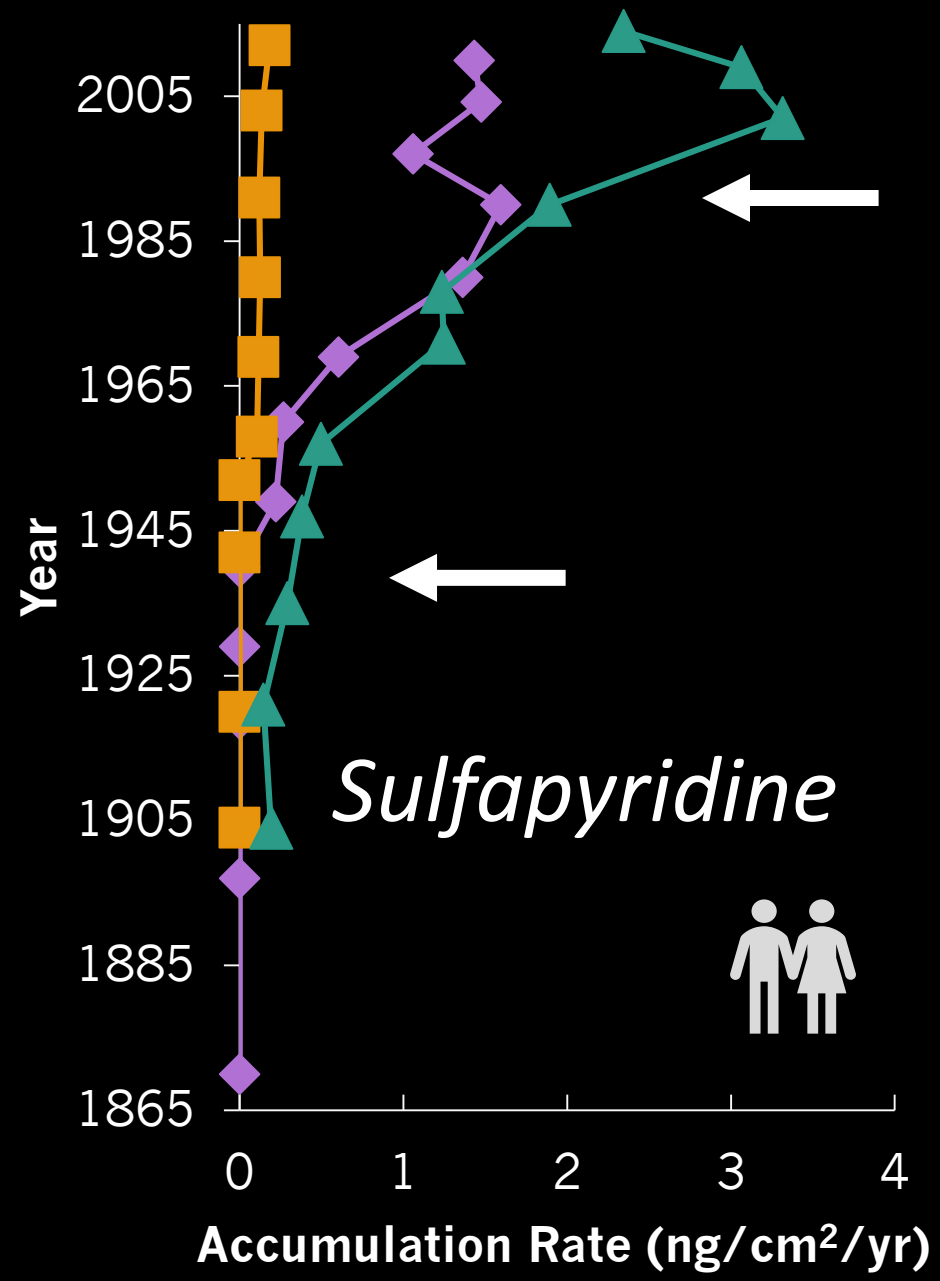


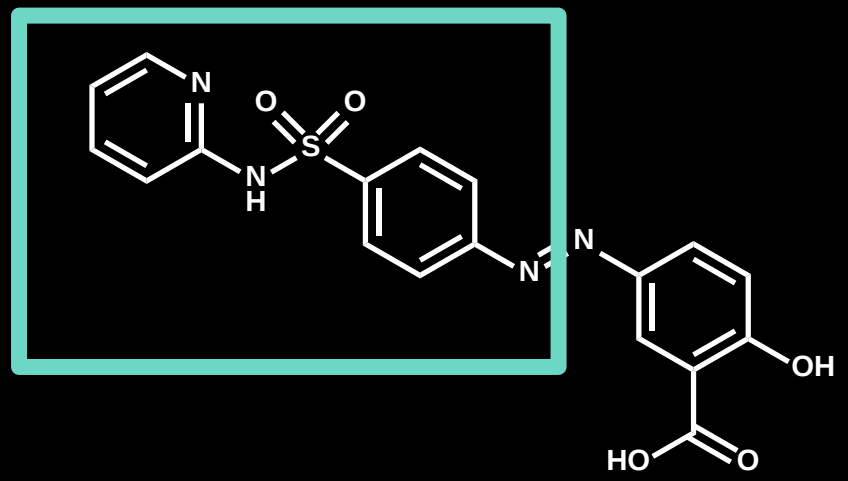
Sulfapyridine (old)





Metabolism Matters



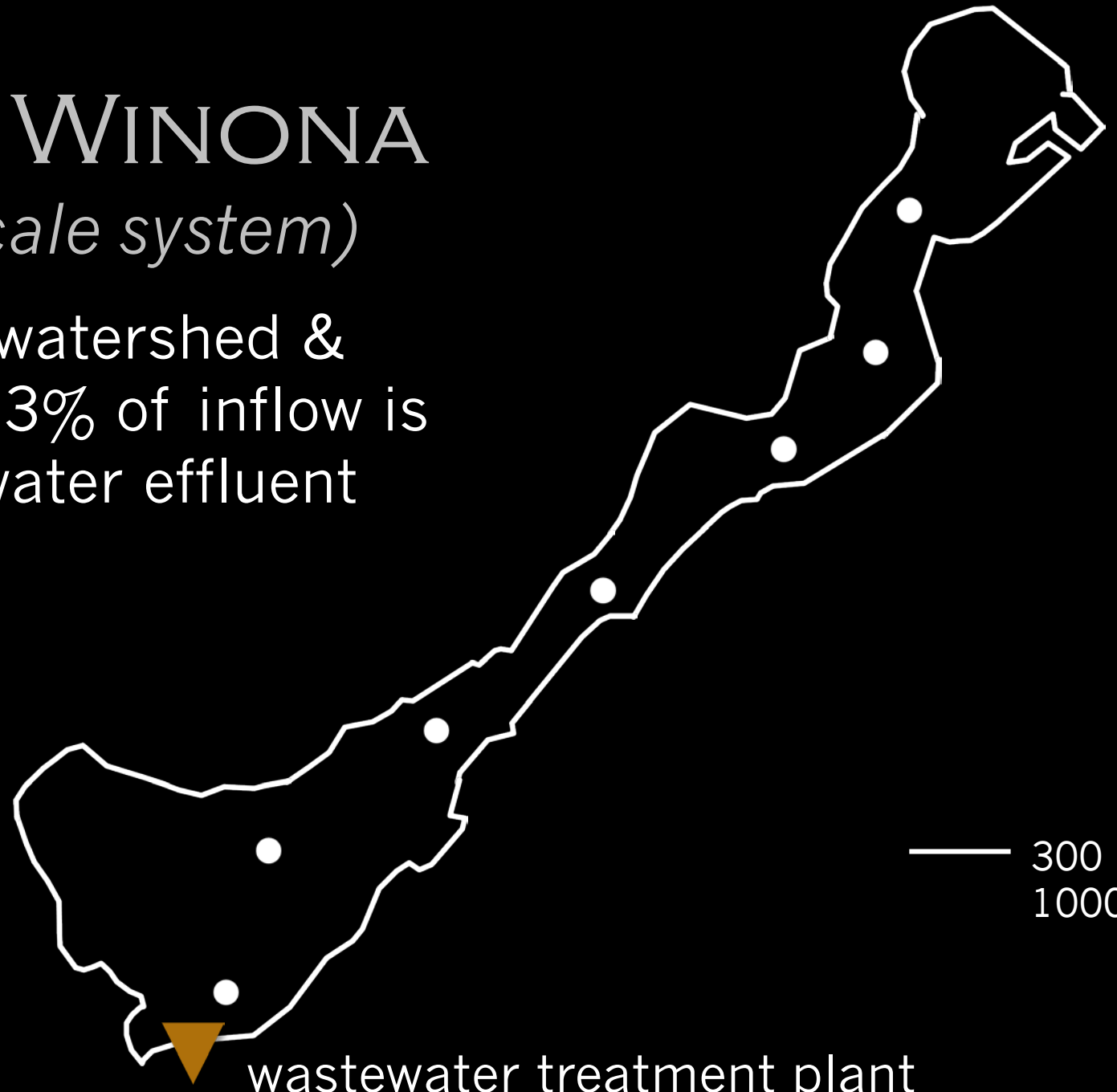


Sulfasalazine

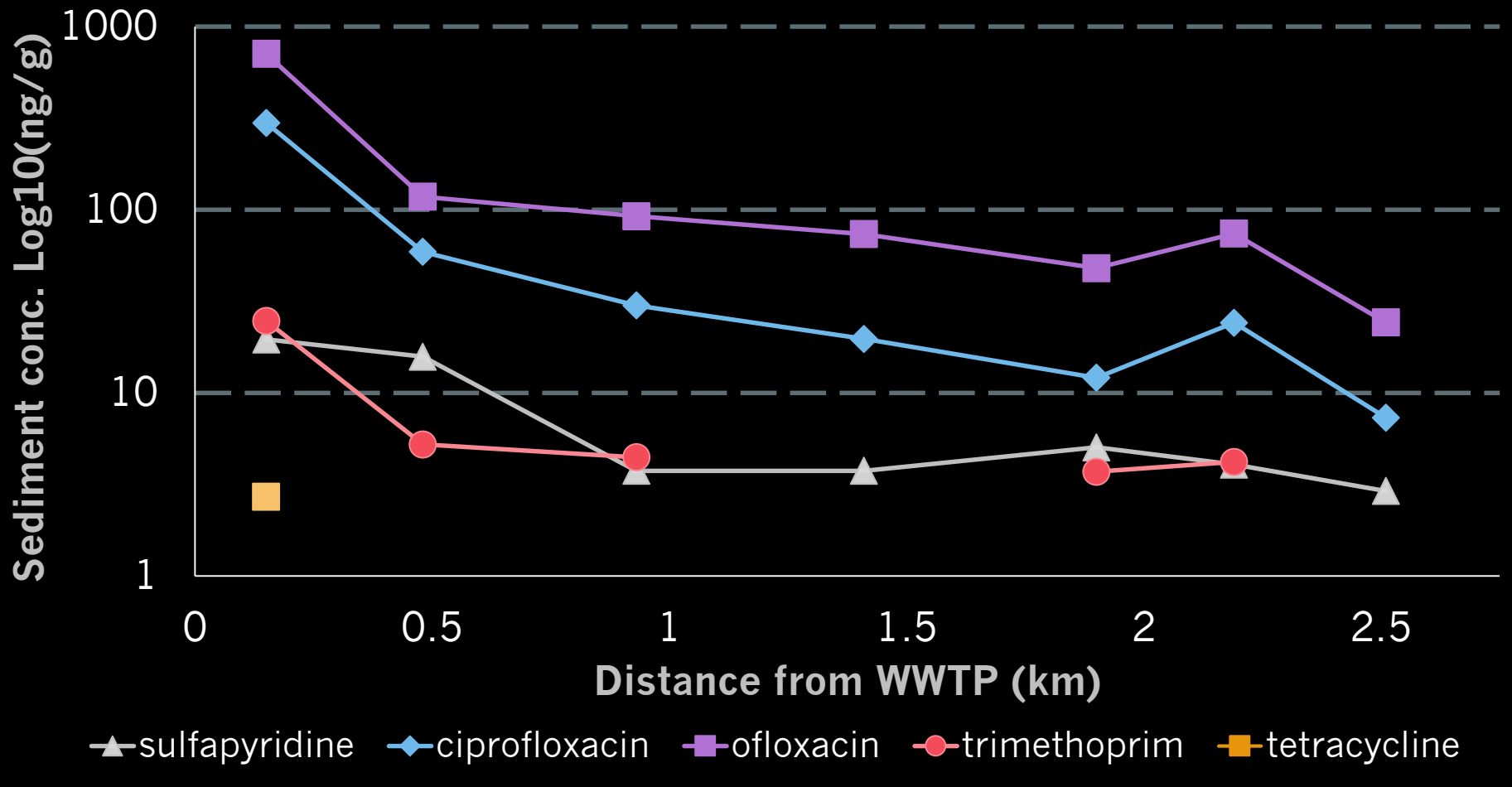
Lake Winona

(small-scale system)

small watershed &
approx. 63% of inflow is
wastewater effluent

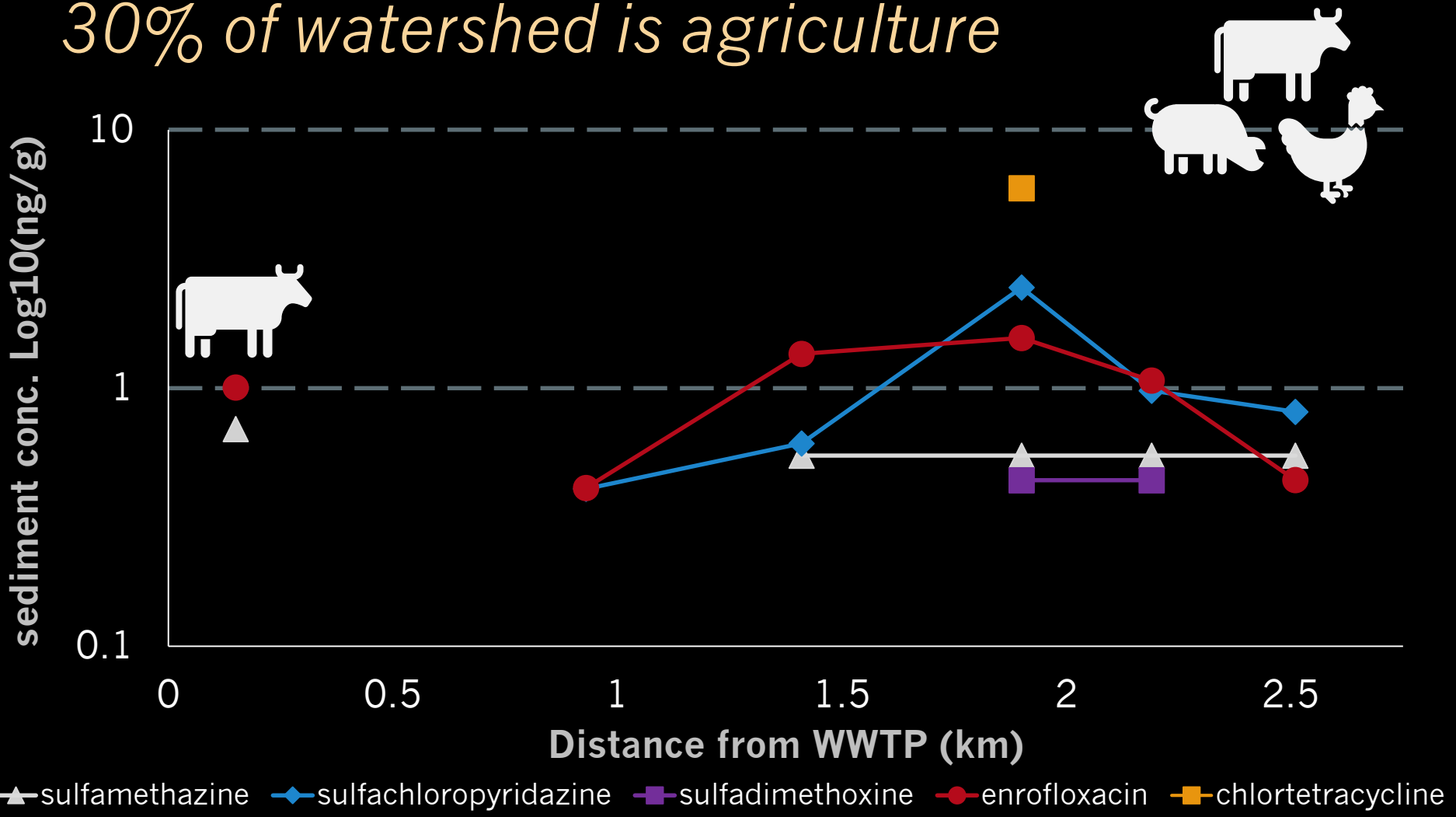


Highest concentration of human-use antibiotic was near WWTP outfall



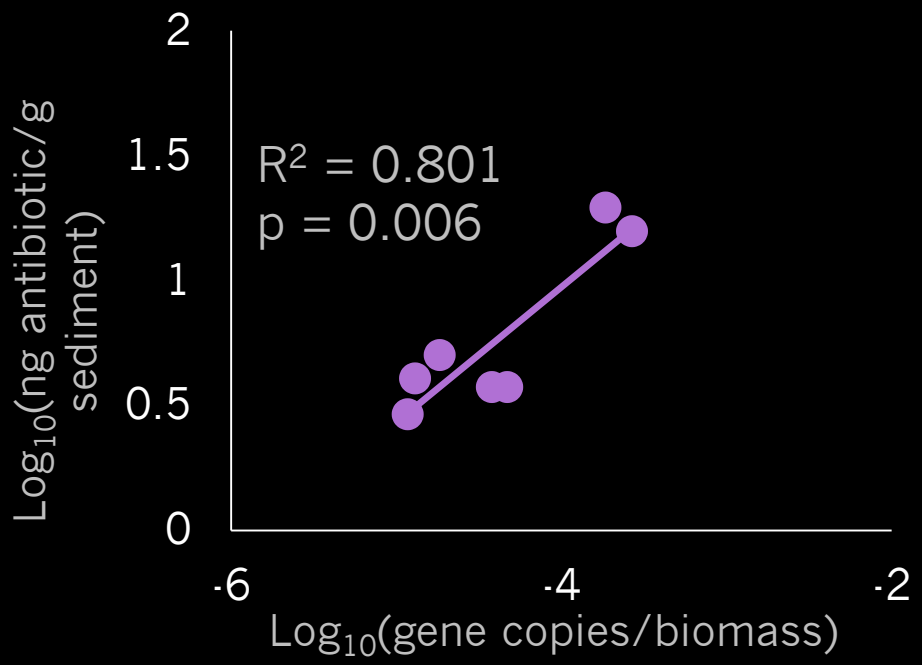
Appears to have input of agricultural antibiotics

30% of watershed is agriculture

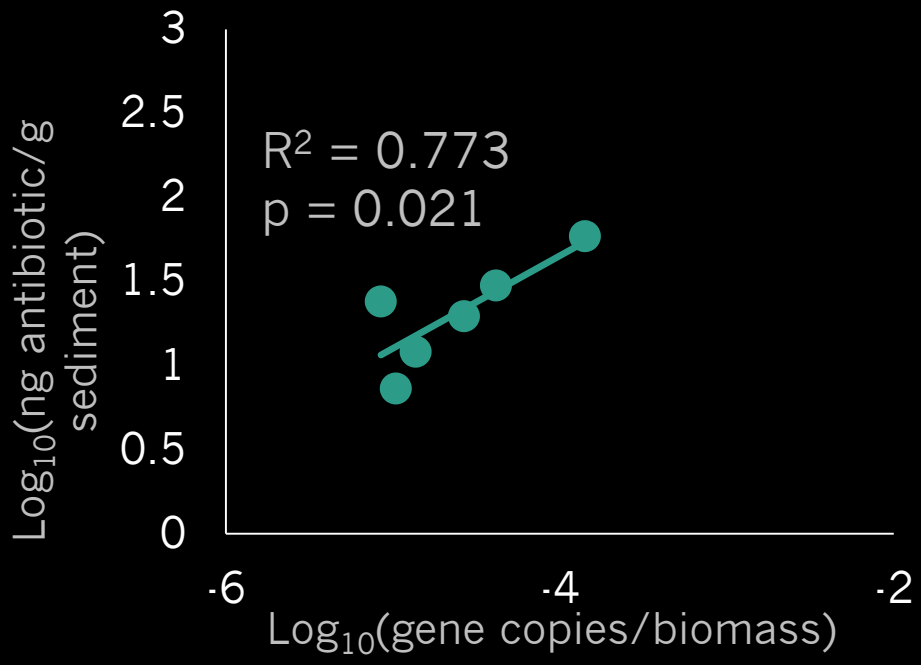


Correlated the presence of antibiotics to ARGs...

sulfapyridine vs sulfonamide resistance (sul1)



ciprofloxacin vs mercury resistance (merA)



some antibiotic resistance genes may have been discharged with **treated wastewater**

What did we learn?

- Wastewater treatment removal varies
- Sediments capture antibiotics
- Anthropogenic impact matters
  - Wastewater
  - Land use
  - ARGs
- Implications for
  - Engineering interventions
  - Policy decisions