MISSISSIPPI STATE UNIVERSITY

DECENTRALIZED AND ONSITE WASTEWATER MANAGEMENT ISSUES OF SMALL COMMUNITIES IN THE JOURDAN RIVER WATERSHED, MISSISSIPPI

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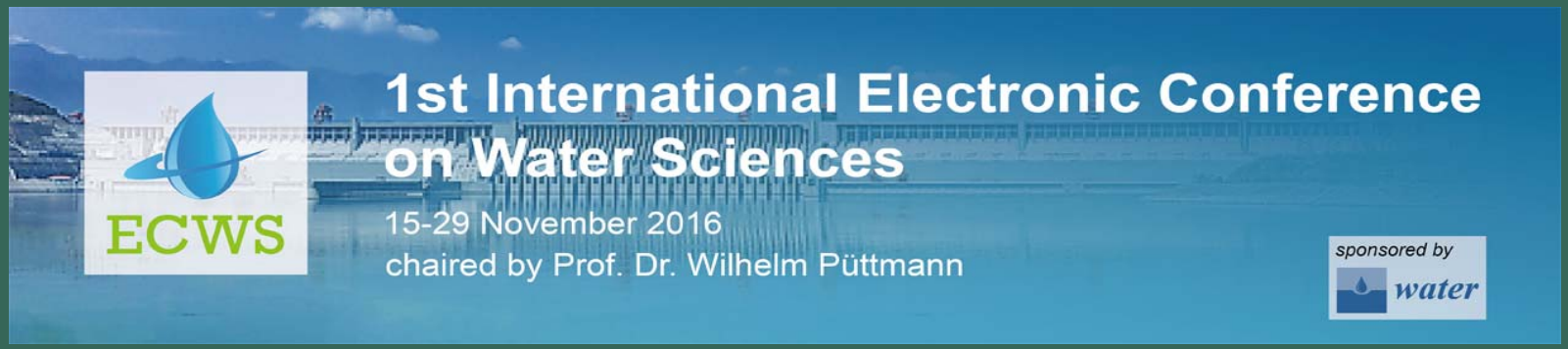

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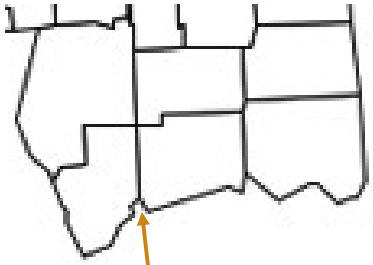
JAMES WORTH BAGLEY COLLEGE OF ENGINEERING

OVERVIEW

- Area of Interest – Jourdan River Watershed
- Nutrient issues in Mississippi's coastal waters and their implications
- What is causing these issues?
- Septic systems – conventional and alternative
- Identify decentralized communities in the Jourdan River watershed

JOURDAN RIVER WATERSHED

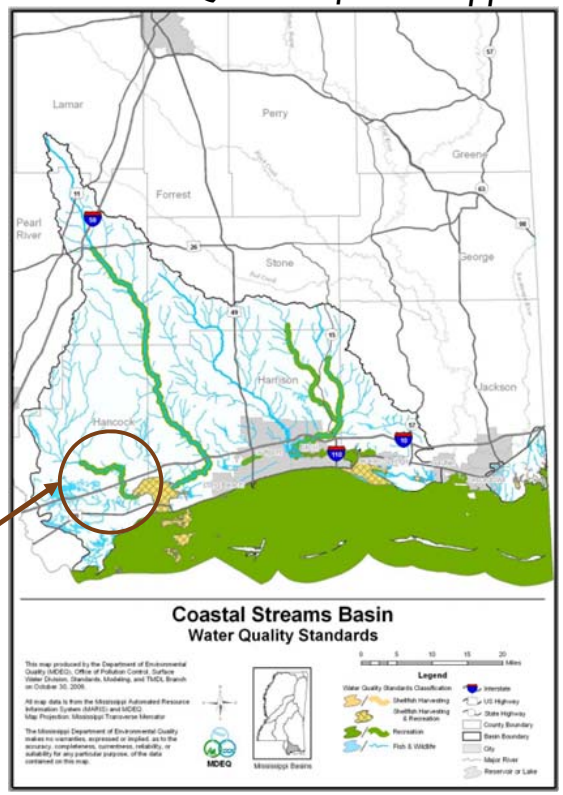


Bay St. Louis

- Discharges into Bay St. Louis
- Falls within Hancock County, MS
- Classified as Recreational Waters
- Part of the Citronelle Aquifer

COASTAL RECREATIONAL WATERS

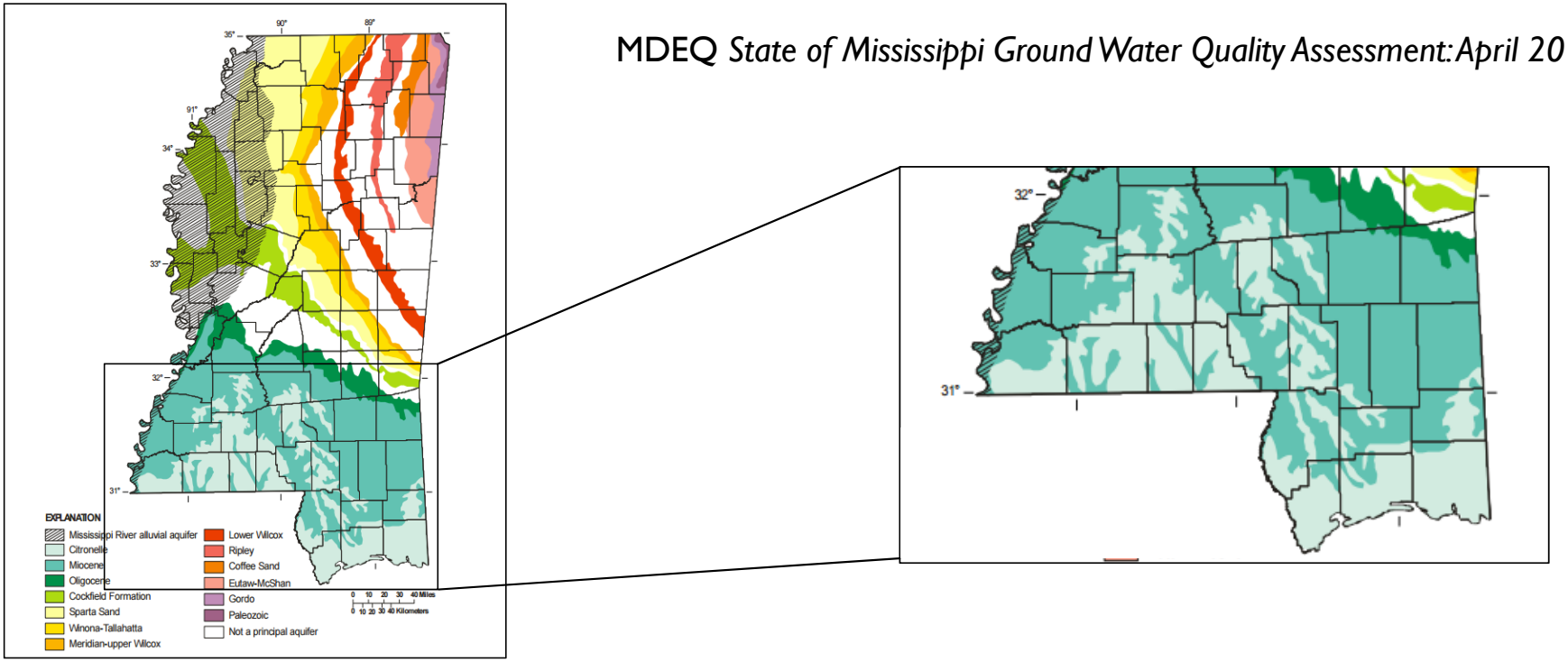
MDEQ *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*



Jourdan River

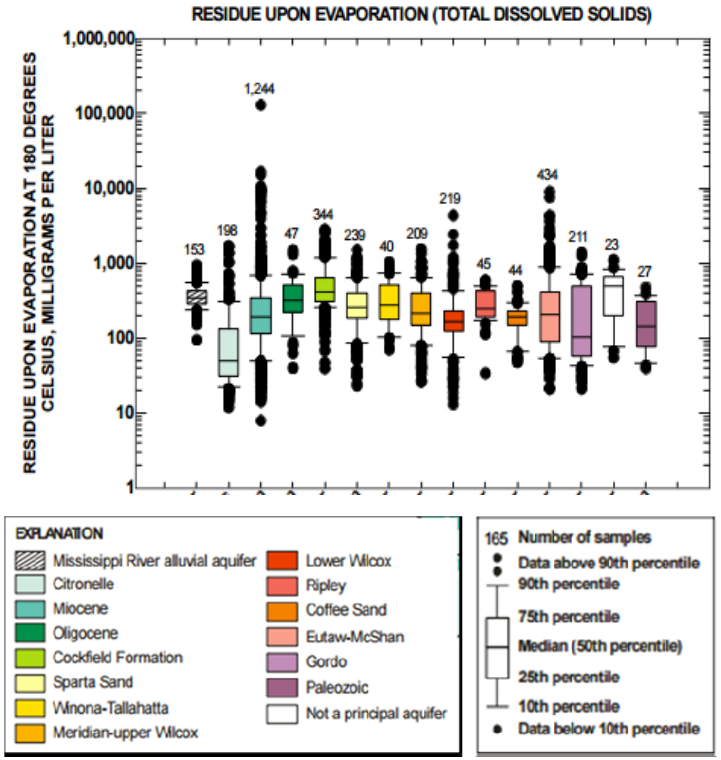
- EPA Standards
  - TDS = 1500 mg/L (freshwater streams)
  - Iron = 1 mg/L
  - pH = 6.5 – 9.0
  - Nitrate = 10 mg/L

CITRONELLE AQUIFER



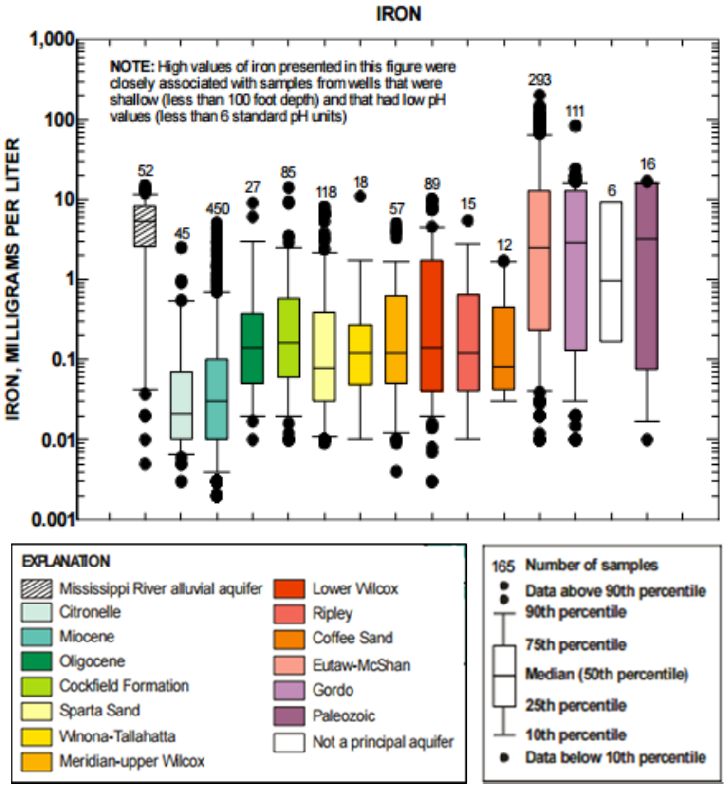
MDEQ *State of Mississippi Ground Water Quality Assessment: April 2013*

NUTRIENT ISSUES IN THE COASTAL WATERS
Total Dissolved Solids



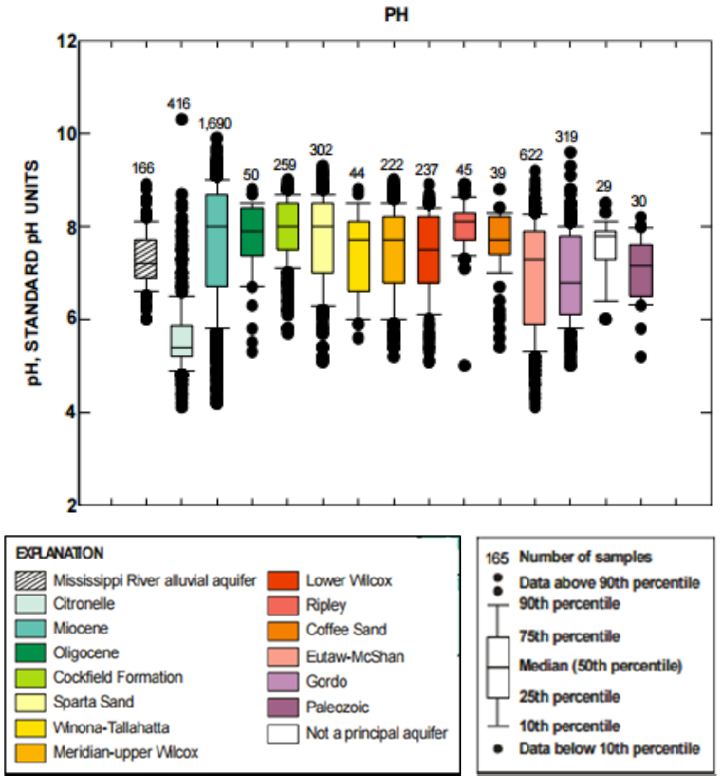
- Standard = 1500 mg/L
- Range = 12 mg/L to 1690 mg/L
- Median value = 50 mg/L

NUTRIENT ISSUES IN THE COASTAL WATERS
Iron



- Standard = 1mg/L
- Range = <0.010 mg/L to 2.5 mg/L
- Median value = 0.020 mg/L
- **Determine source**

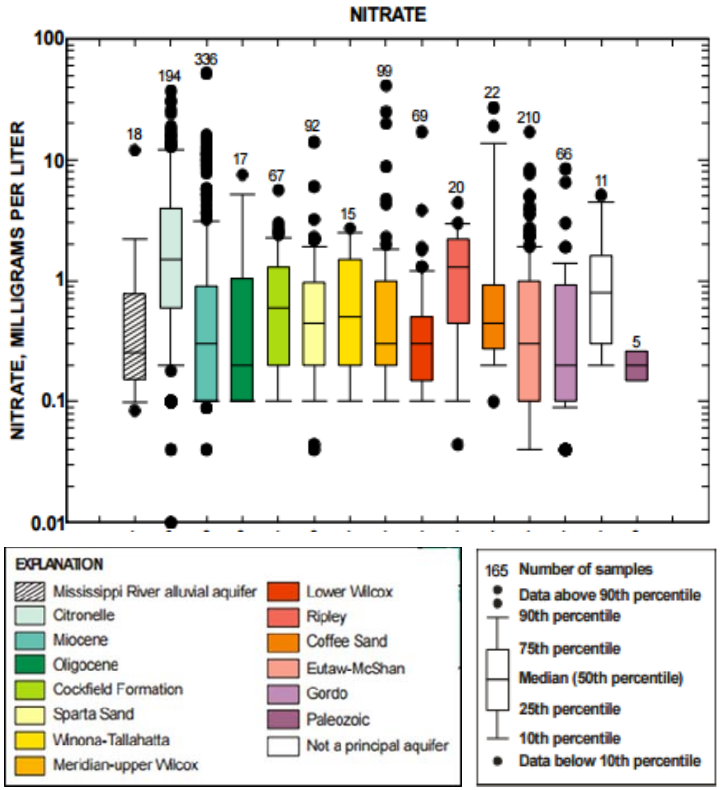
NUTRIENT ISSUES IN THE COASTAL WATERS
pH



- Standard = 6.5 – 9.0
- The pH levels in the Citronelle Aquifer rarely exceed 5.5.
- Range = 4.1 to 10.3
- Median value = 5.4
- **Determine source/reprocussions**

NUTRIENT ISSUES IN THE COASTAL WATERS

Nitrate



- Standard = 10 mg/L
- Range = 0.01 mg/L to 37 mg/L
- Median value =1.5 mg/L
- Mostly coming from failing onsite systems
- Could contribute to hypoxia in the Gulf

ON-SITE TREATMENT UNITS WITHIN THE GULF REGION

County	No. of Housing Units	No. of On-Site Treatment Units	Estimated Failing Units	Percentage of Total Failing Units	Estimated Flow from Failing Units (MGD)
George	7649	6597	990	2.67%	0.196
Hancock	22363	12020	7212	19.45%	1.428
Harrison	83631	24019	9608	25.91%	1.902
Jackson	54035	22664	11332	30.56%	2.244
Pearl River	21457	15953	6381	17.21%	1.263
Stone	5445	3899	1560	4.21%	0.309

WHY ARE THEY FAILING?

- Improper maintenance
- Unsuitable soil
  - "Approximately two-thirds of all land area in the U.S. is estimated to be unsuitable for the installation of septic systems."

WHAT DOES THIS MEAN?

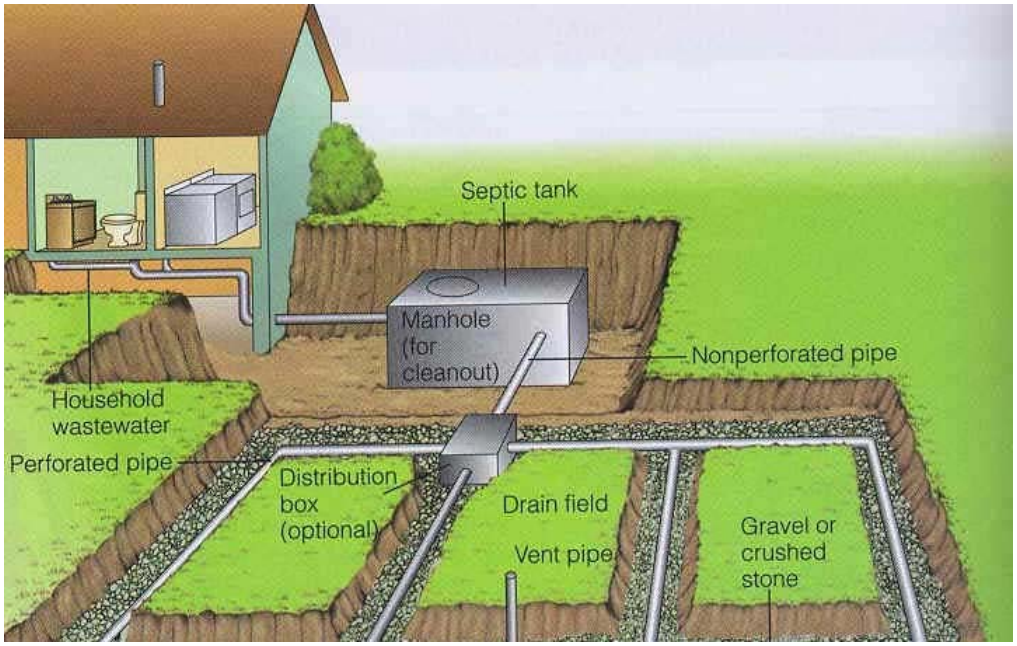
- Untreated, or improperly treated, sewage is being discharged into groundwater and streams.
  - Water quality issues
  - Health issues

ON-SITE TREATMENT SYSTEMS

- Conventional Septic System
  - Gravity System
  - Pressure Distribution System
- Alternative Septic Systems
  - Aerobic Treatment Systems
    - Intermittent Sand Filter Systems
    - Recirculating Sand Filter Systems

CONVENTIONAL SEPTIC SYSTEM
with Absorption Field

- Typical treatment levels
  - BOD5 = 10 mg/L
  - TSS = 10 mg/L
  - Fecal coliforms = usually less than 200 per 100mL
  - Doesn't allow for nitrogen removal without additional treatment
- Cost
  - System and installation: $1,500 - $4,000
  - Operation and maintenance: $250 - $550 per year



AEROBIC TREATMENT SYSTEMS*****

- Mirror many of the steps and activities performed by municipal sewage plants
- Similar to a conventional septic treatment system, but aerobic systems inject oxygen into the tank
- Oxygen increases bacterial growth and consumption of waste
- Most systems include a pretreatment tank and a final treatment tank where chlorine is used instead of sending the effluent to a drainfield for the soil to filter.
- After the final treatment tank, the effluent can acceptably be directly discharged via sprinklers over the drainfield.
  - Good option for landowners who don't want to clear trees
  - Good alternative for homeowners on lots close to a body of water that might be polluted through the use of a conventional septic system with a drainfield

SAND FILTER SYSTEMS

Intermittent Sand Filters

- Typical treatment levels
  - BOD_5 = 95% removal
  - TSS = 85% removal
  - Nitrification of 80%+ of the applied ammonia

Recirculating Sand Filters

- Typical treatment levels
  - BOD_5 = 95% removal
  - TSS = 95% removal
  - Almost complete nitrification is achieved
  - Denitrification has also been shown to occur
    - "Depending on modifications in design and operation, 50% or more of the applied nitrogen can be removed."

SAND FILTER SYSTEMS

Intermittent Sand Filters

- After initial costs, yearly cost = $150 + Power

Item	Cost ($)
Capital Costs	
Construction costs, 1,500-gallon single compartment septic/pump tank @ 57 cents/gallon	850
ISF complete equipment package (includes dual simplex panel, pump pkg., tank risers, lids, liner, lateral kit, orifice shields, etc.)	3,200
Non-component costs	750
Engineering (includes soils evaluation, siting, design submittal, and construction inspections)	2,000
Contingencies (includes permit fees)	1,000
Land	May vary
Total Capital Costs	**10,800**
Annual O&M Costs	
Labor @ $65/hr. (2 hrs./yr.)	130/yr.
Power @10 cents/kWh	May vary
Sludge disposal	*25/yr.

Recirculating Sand Filters

- After initial costs, yearly cost = $300 + Power

	Cost ($)	
Item	Sand[1]	Black Beauty Sand[2]
Capital Costs		
Construction costs		
Pretreatment	May vary	May vary
Recirculation tank and pumping system	10,000	9,000
Sand filter	10,000[a]	43,100
Non-component costs	May vary	May vary
Engineering	3,000	7,800
Contingencies	3,000	7,800
Land	May vary	May vary
Total Capital Costs	26,000	67,700
Annual O&M Costs		
Labor	20/hr	20/hr
Power	May vary	May vary
Sludge disposal @ 10 cents/gal	50/yr[b]	50/yr[b]

CONTINUING THE STUDY

- What is causing the failures of these on-site systems?
- We are looking more into this.
- Find specific small communities with failing systems contributing to the issues in the Jourdan River Watershed
- Help them come up with unique solutions
- Find data specific to the Jourdan River Watershed
- Can you help us?