# Water Rally: Deep Dive into using State Revolving Funds (SRFs) to Tackle Wastewater Issues

Organized by: Victoria Miller (ARA Director of Advocacy Research)

Jillian Maxcy-Brown (UA Engineering Postdoc, ARA Water Fellow)

Madelyn Cantu (UGA Research Professional, ARA Water Fellow)

# Session Outline

- Opening Interactive Discussion
- Background on Wastewater Management in AL and U.S. (Jillian)
- Ongoing Efforts to Address Wastewater Issues in AL (Jillian)
- **Break**
- Alabama's State Revolving Fund Program (Victoria)
- **Break**
- Online Resource Depot (Madelyn)
- Closing Group Activity



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# Ground Rules & Reminders

- Ask questions at any time!
- **Jargon** - Raise two fingers if you need a definition
- Refreshments available in the back
- Bathroom locations



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# Overview of Water and Wastewater Management

# Introduction

- B.S. in Engineering (Civil Concentration), LeTourneau University
- Ph.D. in Civil Engineering, The University of Alabama
- Postdoctoral Researcher, The University of Alabama
- Consultant for Alabama Rivers Alliance


Alabama Rivers Alliance


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

SUSTAINABLE DEVELOPMENT GOALS


By 2030,

"ensure availability and sustainable management of water and sanitation for all"

# Joint Monitoring Programme (JMP) Service Ladder for Global Monitoring in Households

## Drinking Water

| SERVICE LEVEL | DEFINITION |
|---|---|
| SAFELY MANAGED | [illegible] from faecal and priority chemical contamination |
| BASIC | Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing |
| LIMITED | Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing |
| UNIMPROVED | [illegible] |
| SURFACE WATER | [illegible] |

Note: [illegible] protected dug well, protected spring or rainwater.

For all people by 2030

6.2 million residents lack access to limited water services in high-income countries

9 million residents lack piped water

## Sanitation (Wastewater)

| SERVICE LEVEL | DEFINITION |
|---|---|
| SAFELY MANAGED | [illegible] |
| BASIC | Use of improved facilities that are not shared with other households |
| LIMITED | Use [illegible] |
| UNIMPROVED | Us [illegible] |
| OPEN DEFECATION | Di [illegible] |

*Note: improved facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs.*

For all people by 2030

8.4 million residents lack access to basic sanitation services in high-income countries

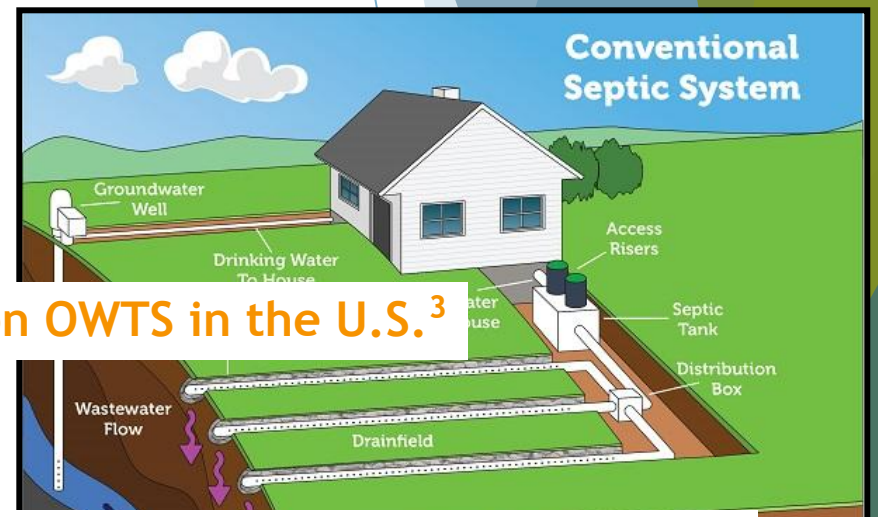
Estimates from Mattos et al., 2021. "Reaching those left behind: knowledge gaps, challenges, and approaches to achieving SDG 6 in high-income countries." *J. Water, Sanit. Hyg. Dev.* IWA Publishing. https://doi.org/10.2166/WASHDEV.2021.057.

# Water & Wastewater Management

**Water Distribution Systems**
**(85% of U.S)**
**(80% of AL)**
Regulated by Safe Drinking Water Act (SDWA)

**Centralized Wastewater Collection Systems**
**(75% of U.S.)**
**(65% of AL)**
Regulated by Clean Water Act (CWA)

**Private Water Wells**
**(15% of U.S.)**
**(20% of AL)**
***(800,000 AL residents[1])***
Lack regulatory protection

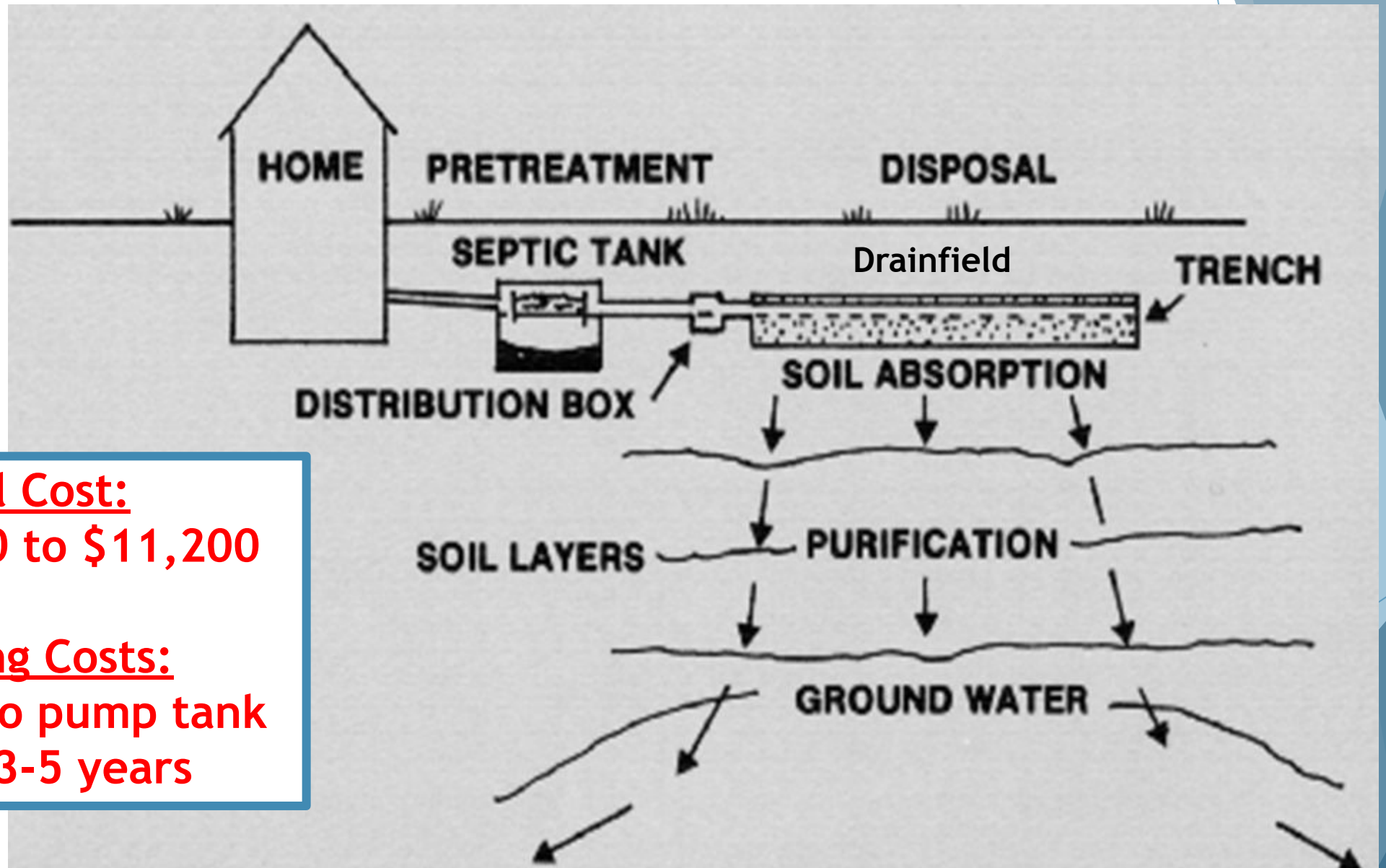



**32.2 million OWTS in the U.S.[3]**

**Onsite Wastewater Treatment Systems (OWTS)**
**(25% of U.S.)**
**(35% of AL[2])**
***(650,000 systems in AL[2])***
Typically regulated upon installation only

[1] ADPH 2023 https://www.alabamapublichealth.gov/environmental/well-water.html
[2] Maxcy-Brown et al. 2023 (Dissertation research, manuscript revisions under review)
[3] Maxcy-Brown et al. 2023. *Water Policy* https://doi.org/10.2166/wp.2023.147

# Conventional Septic Tank System

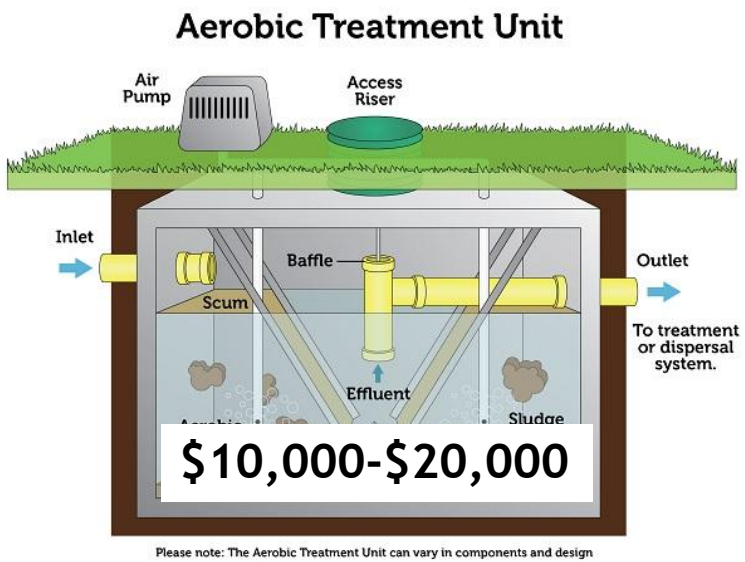



**Capital Cost:**
**$3,500 to $11,200**

**Ongoing Costs:**
**$500 to pump tank every 3-5 years**

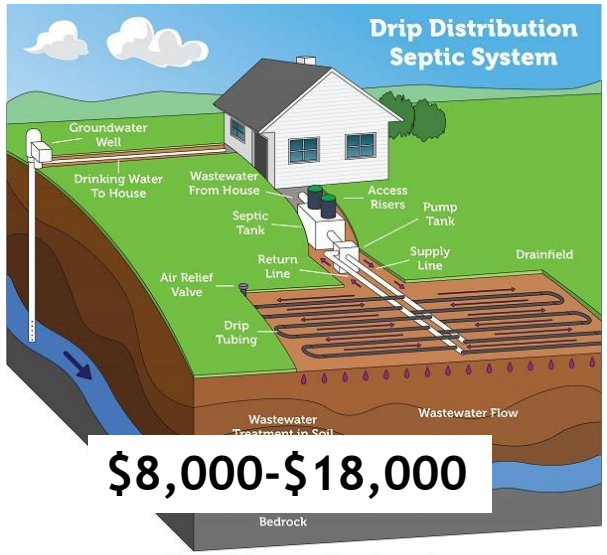
Source: Purdue Univ. Extension Service (Jones et al., 1990)

# Advanced Onsite Wastewater Treatment



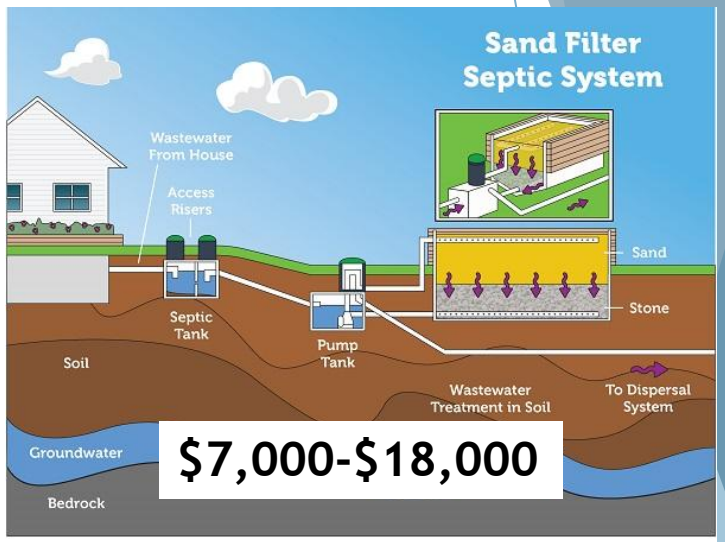

$10,000-$20,000

Please note: The Aerobic Treatment Unit can vary in components and design



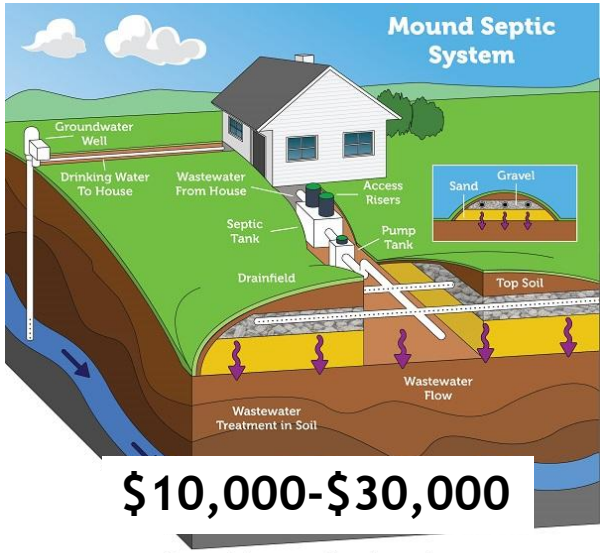

$8,000-$18,000

Please note: Septic systems vary. Diagram is not to scale.



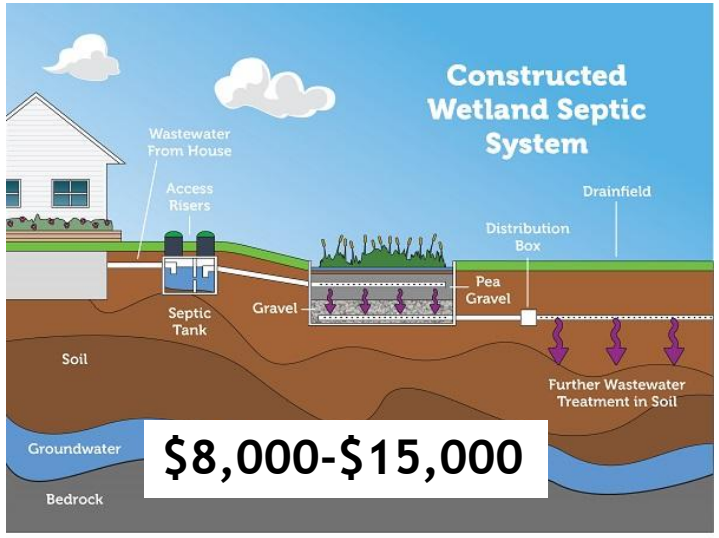

$7,000-$18,000

Please note: Septic systems vary. Diagram is not to scale.



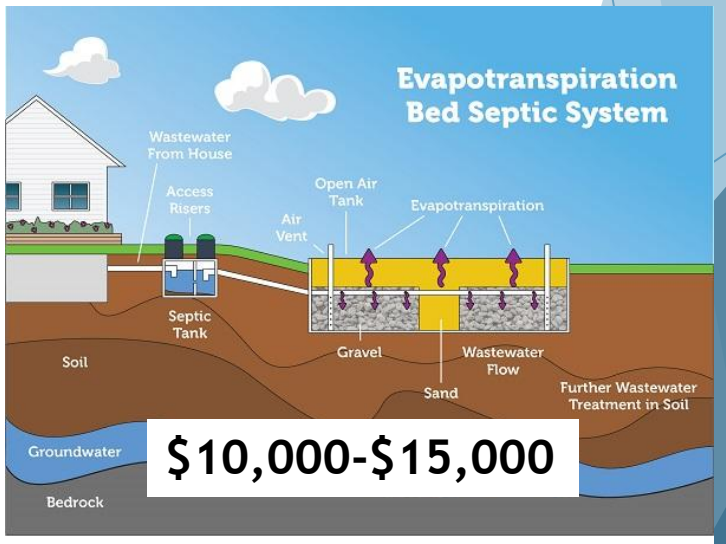

$10,000-$30,000

Please note: Septic systems vary. Diagram is not to scale.



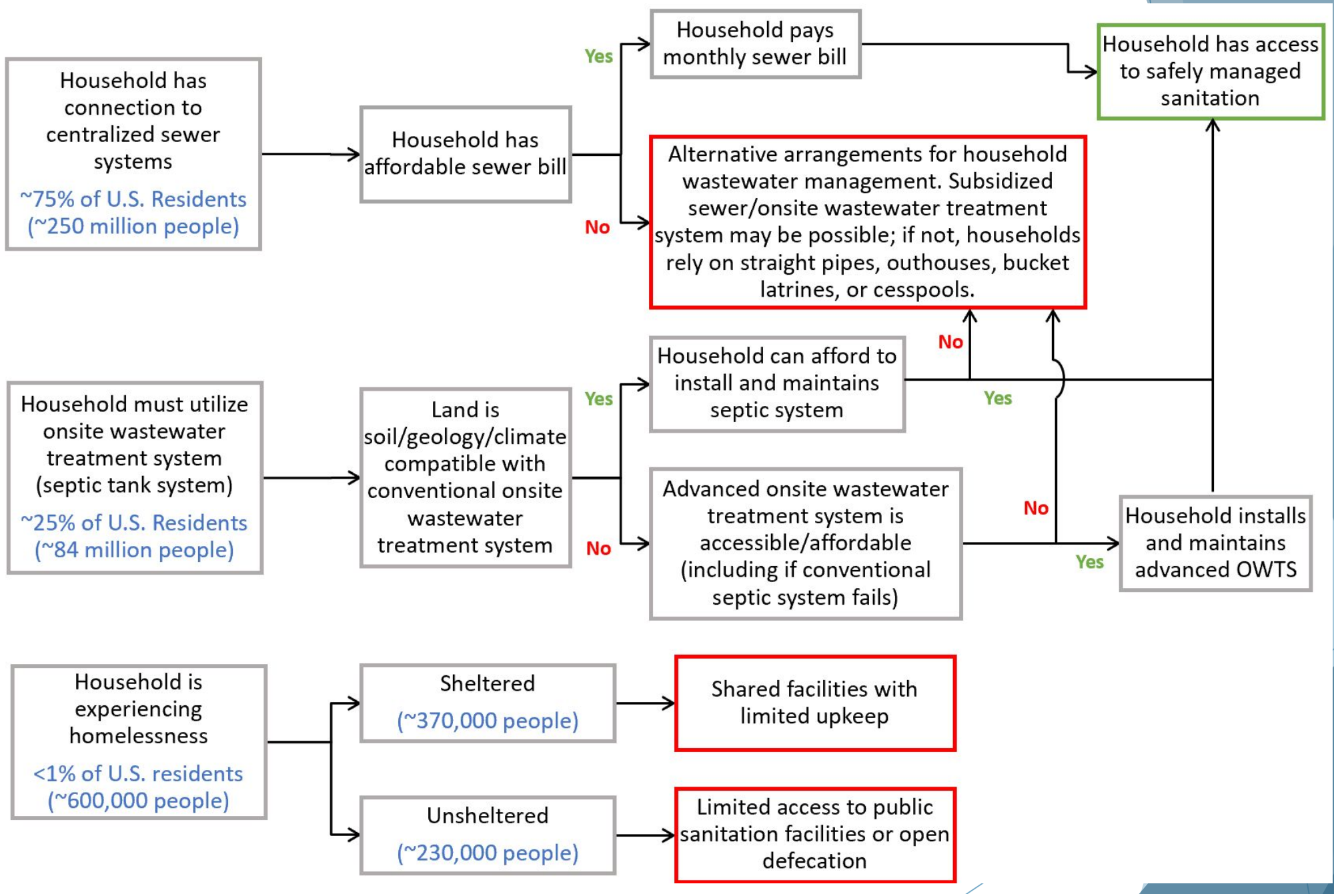

$8,000-$15,000

Please note: Septic systems vary. Diagram is not to scale.




$10,000-$15,000

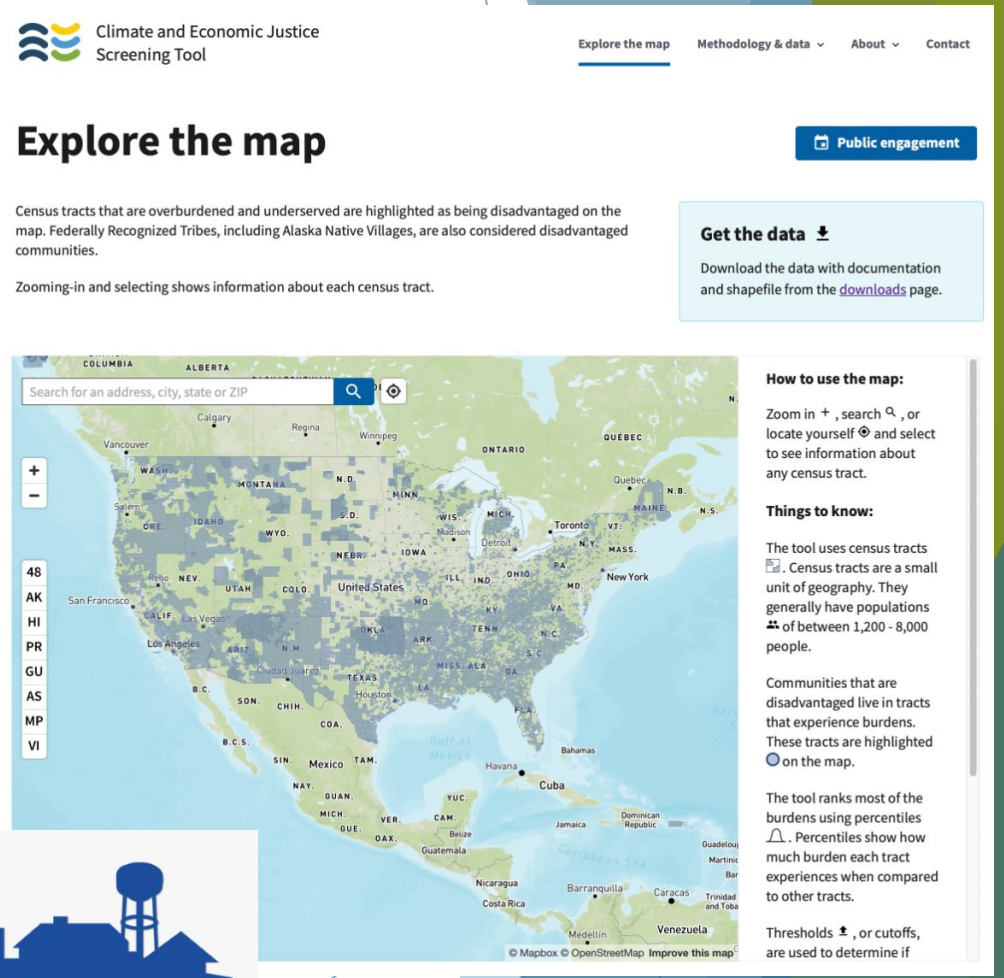
Please note: Septic systems vary. Diagram is not to scale.




**Simplified diagram of how most of the U.S. population accesses safely managed sanitation** (Maxcy-Brown et al., 2023)

# Federal Government Initiatives

- **Justice40 Initiative**
- **U.S. EPA's Strategic Plan**
  - Goal 2: "take decisive action to advance environmental justice and civil rights"
- **USDA Rural Development: Key Priorities**
  - provide economic support to improve infrastructure in underserved communities
- **Closing America's Wastewater Access Gap Community Initiative**

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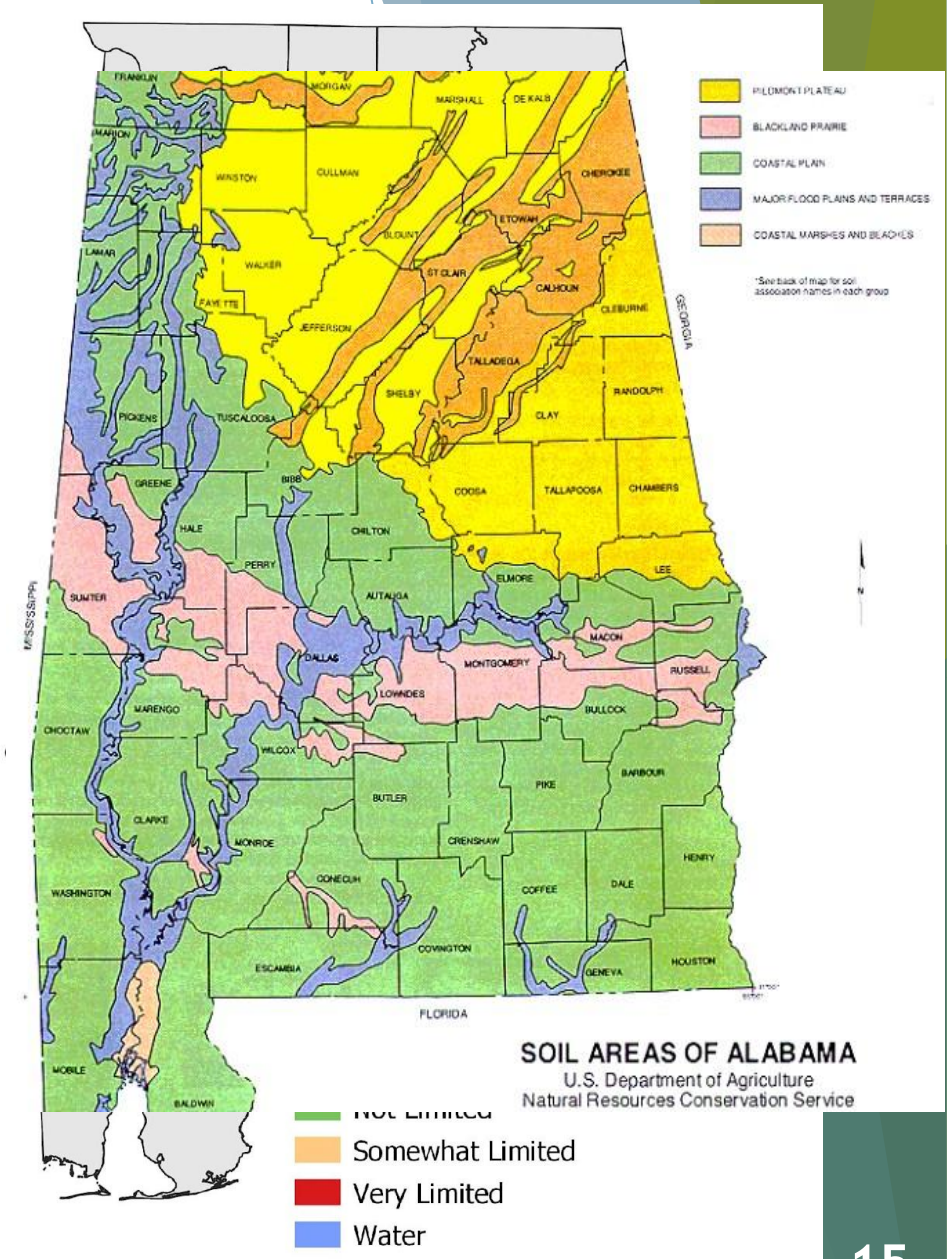
# Wastewater Challenges in the U.S.

# Black Belt Region of Alabama

- Approximately 550,000 residents
- Named for rich, dark topsoil
- In many places underlain by impermeable shrink/swell clay (vertisol)
- Few centralized wastewater management systems
- High poverty rates: 25-40% live below poverty line
- Median Household Income: $36,985 (54% of U.S. average)

dry

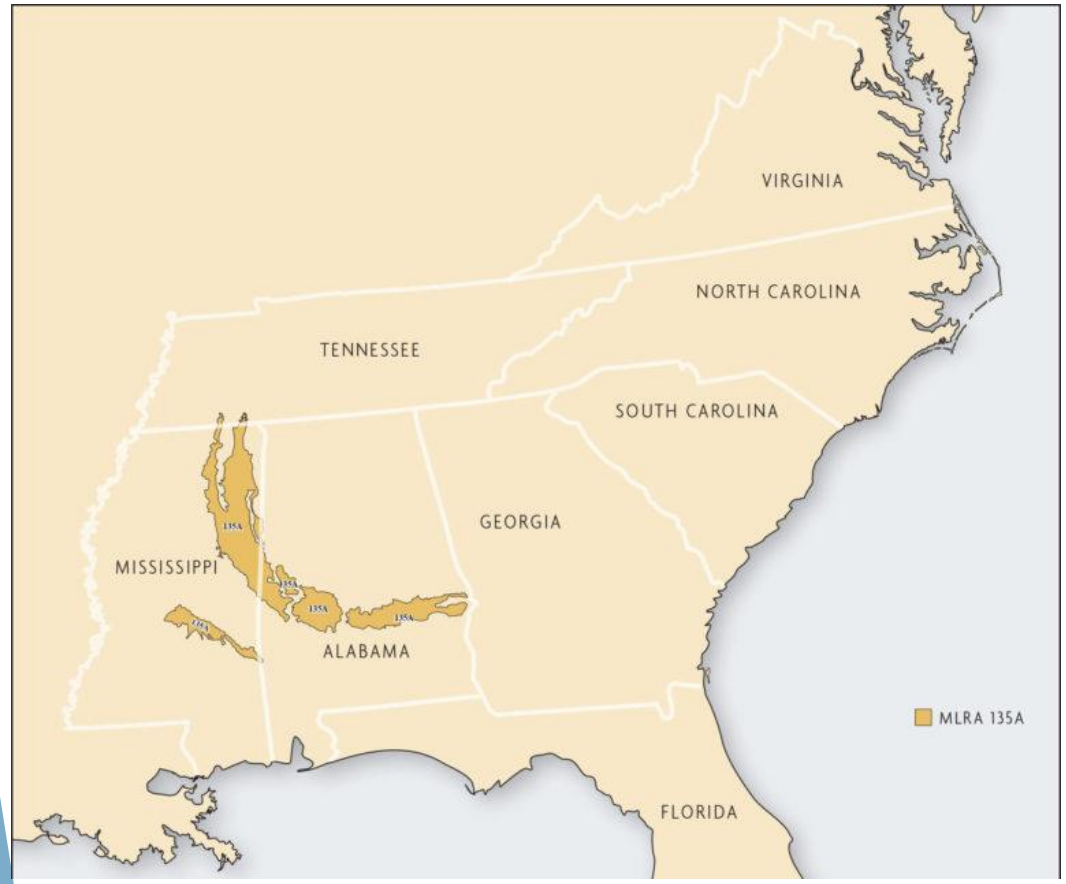
wet

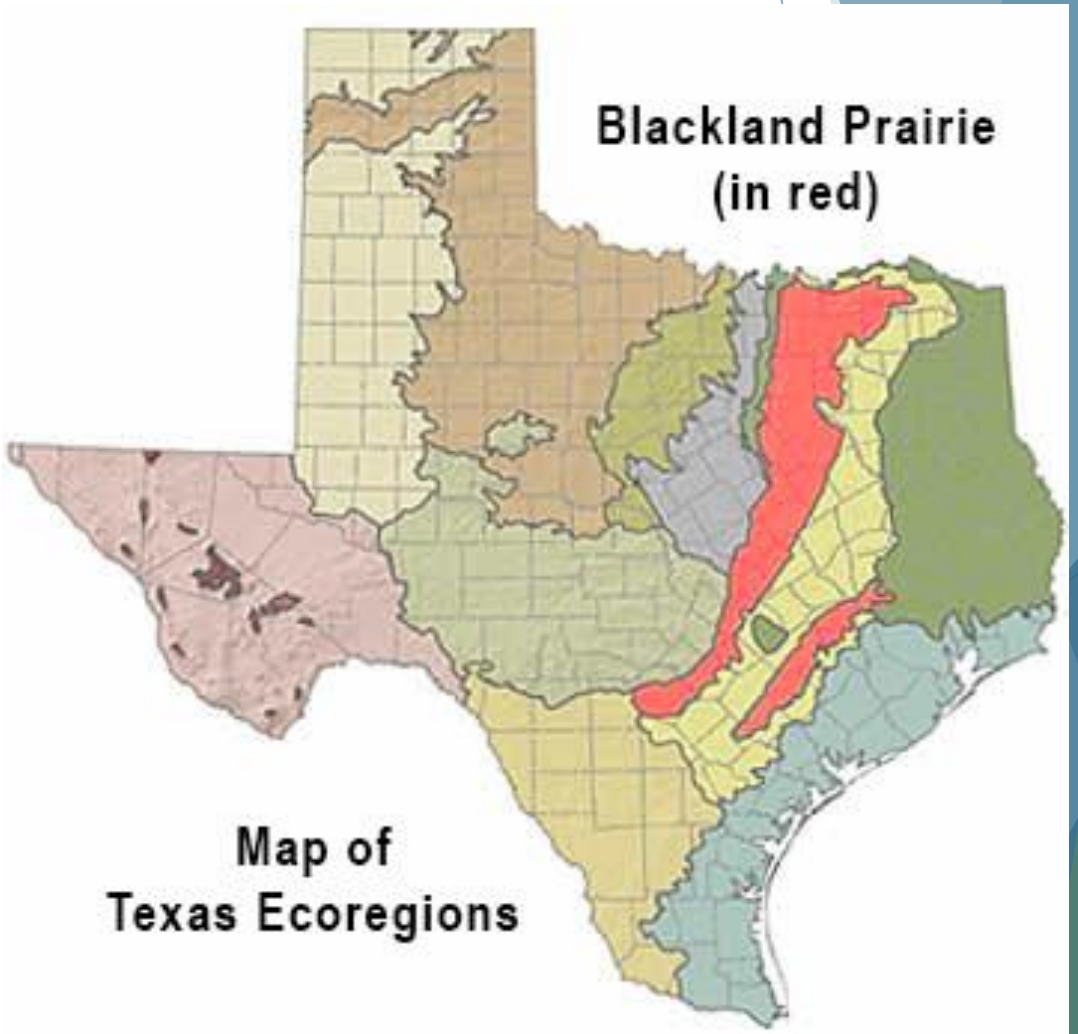



*Slide adapted from Dr Mark Elliott, Department of Civil Engineering, The University of Alabama*

Figure Developed by Lacey Christian, University of South Alabama

# Blackland Prairie Soil in the U.S.



# Centralized Wastewater Management in Alabama Black Belt

**Thesis Research from Tristan Wilson, Auburn University** https://etd.auburn.edu/handle/10415/8705

- 59 treatment plants serving residential areas in the 17 counties (72 total plants)
- Serve approximately 50% of households in Black Belt
  - Excluding Montgomery County which is 87.7% sewered
- Analysis of quarterly non-compliance records from Oct. 2018 to Sept. 2021 (12 quarters)

- 37.3% non-compliance rate
  - ~65% of the BB facilities were above the state average
- 12.4% significant non-compliance rate (recurring violations)
  - ~40% of BB facilities were above the state average

- Significant predictors of compliance issues were (1) Type of treatment system and (2) Percent of service population below the poverty line
  - Other variables were not significant predictors (e.g., median household income, race, education, household income, type of discharge, bypasses/sanitary sewer overflows, annual design capacity, method of discharge, size of system, population, and average annual flow)
- Key data limitation: staff reported non-compliance

# Centralized Wastewater Management

## Thesis Research from Carey Clark, Auburn University

https://etd.auburn.edu/handle/10415/8956

- Analyzed Spray Field in Uniontown using MODFlow
- Different simulations based on the permitted discharge rate (500,000 gallons/day)
  - Ponding predicted to occur by Day 158
- ↑ soil hydraulic conductivity until no ponding
  - Only function w/ fine sand (~100x actual m/s)
- Recommendations: increase spray area, plant vegetation, add sand trenches, limit spray flow rate

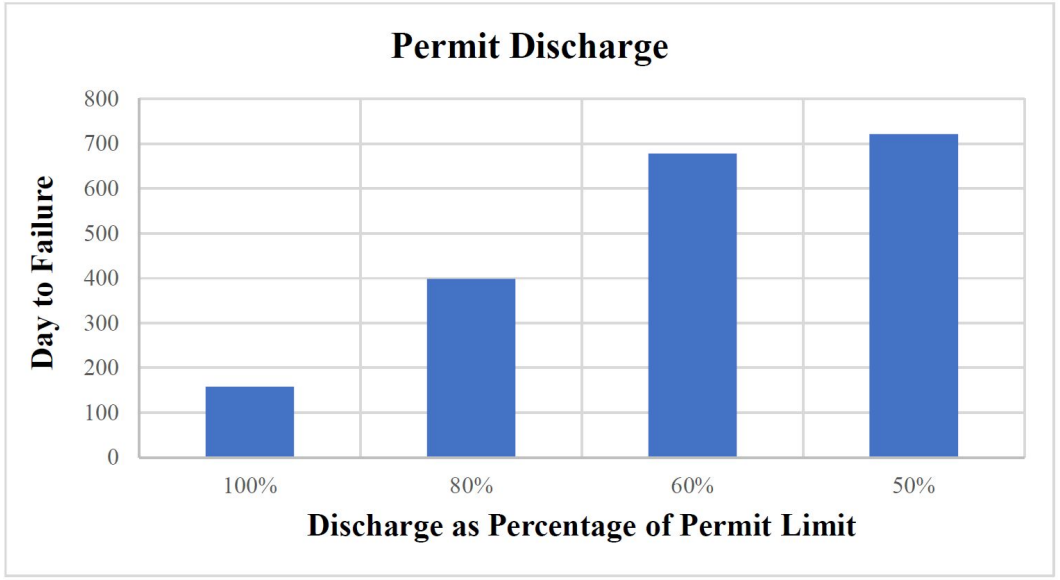



Figure 3-9: Time to Failure Versus Percentage of Permitted Discharge

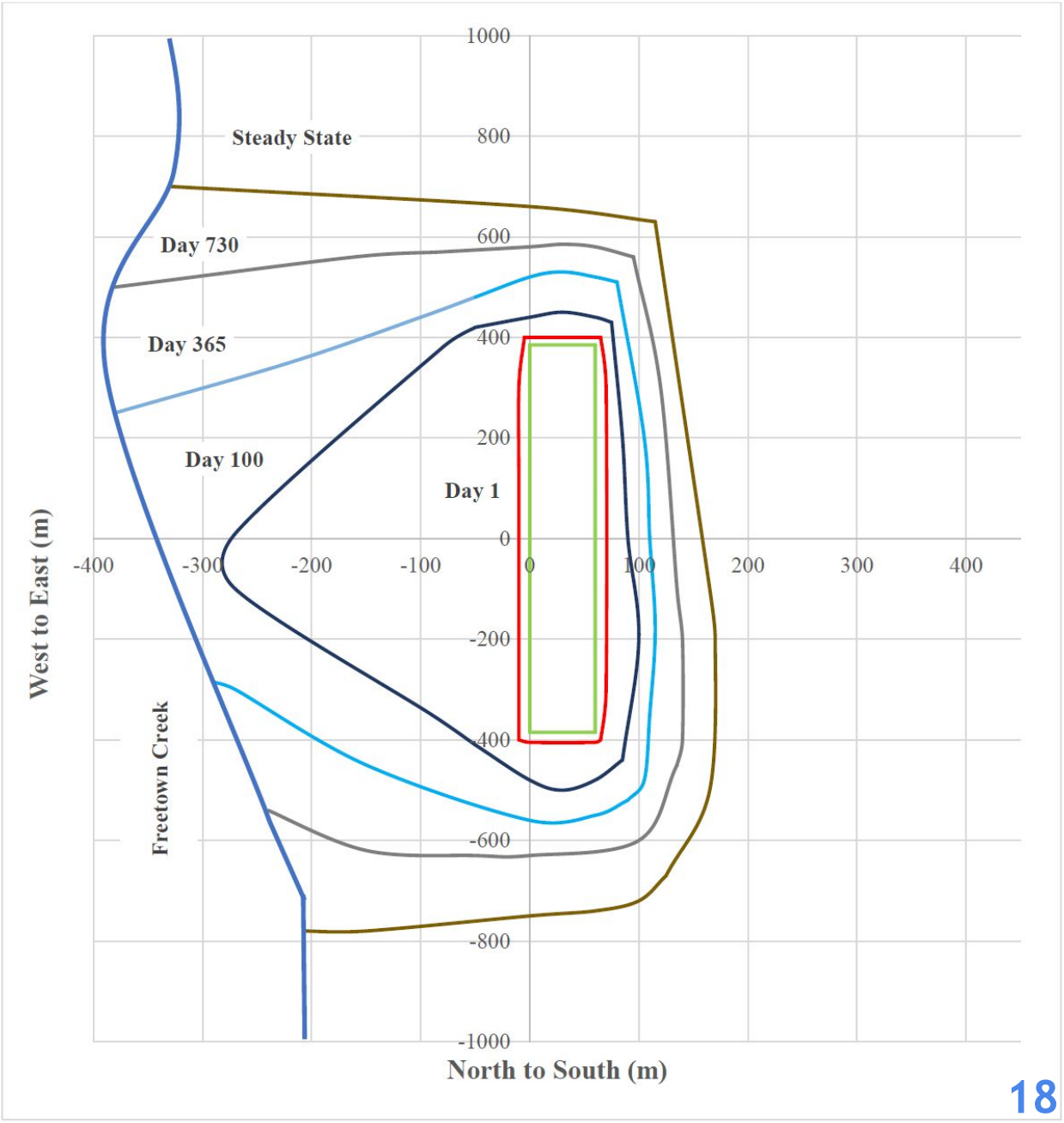



Figure 3-7: Travel of Wastewater Effluent Over Time with Sand as Upper Soil Layer, Lines Represent where Wastewater Effluent Stopped at the End of Day

# What are “Straight Pipes”?

With no sewer access, poverty and unsuitable soil: many have ‘straight pipe’ raw sewage discharge

**Straight pipes:** discharge untreated wastewater from a home to the surface, typically piped into adjacent woods, a trench or a stream

“community line” connects multiple homes to a central large straight pipe

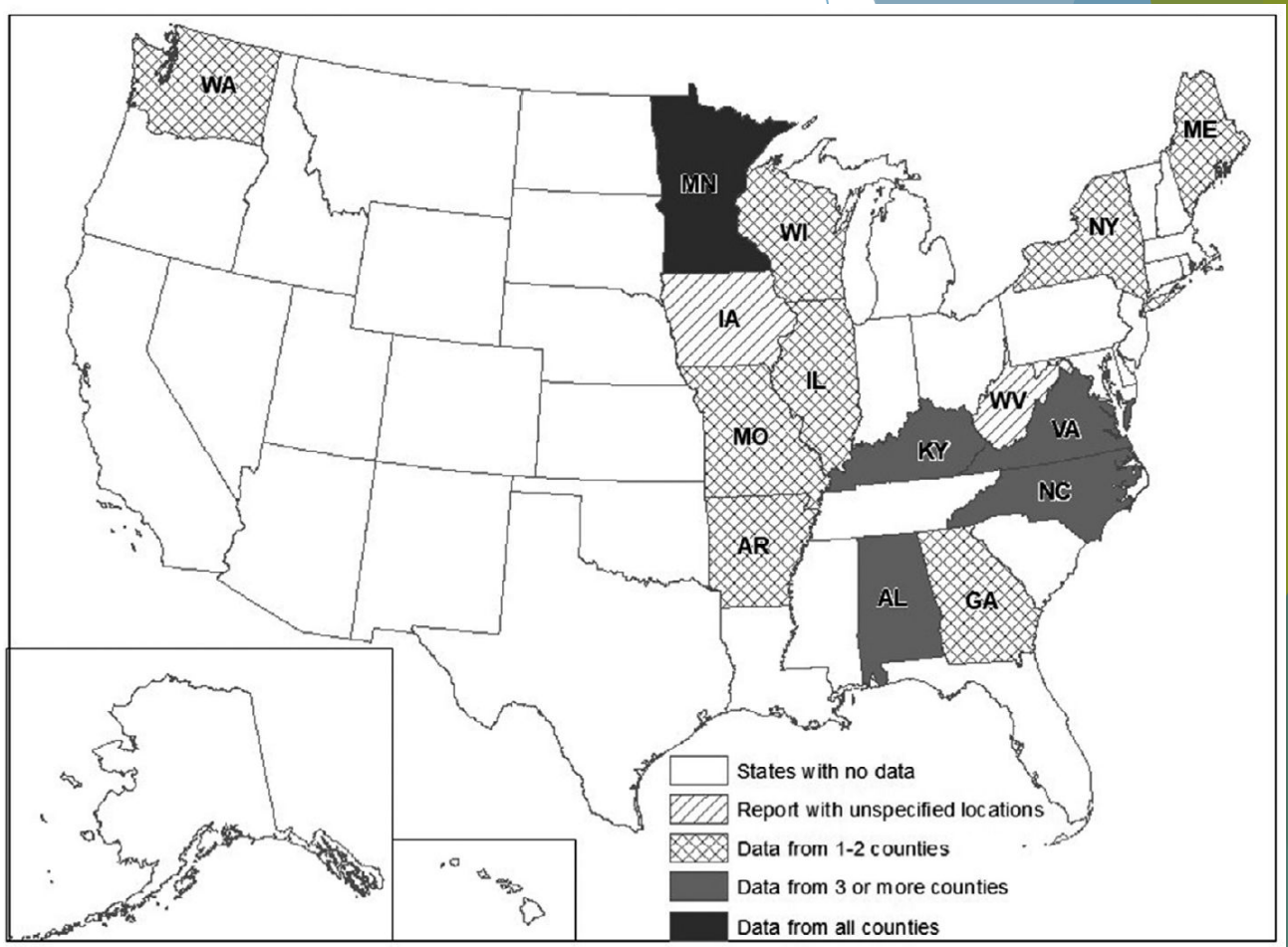
# Alabama Straight Pipe Data

| County | Bibb | Wilcox | Hale |
|---|---|---|---|
| **Year of Data** | 2005 | 2016 | 2016 |
| **Sample Size (homes)** | 2000 | 289 | 411 |
| **Permitted Systems** | | 7% | 35% |
| **Straight Pipe System** | 15% | 60% | 6% |
| **Unpermitted System *but no visible Straight Pipe*** | | 33% | 59% |
| **Septic Tank/Drainfield with Hydraulic Failure** | 35% | | |


Source: The University of Alabama Center for Economic Development (UACED)

# Straight Pipes in the U.S.

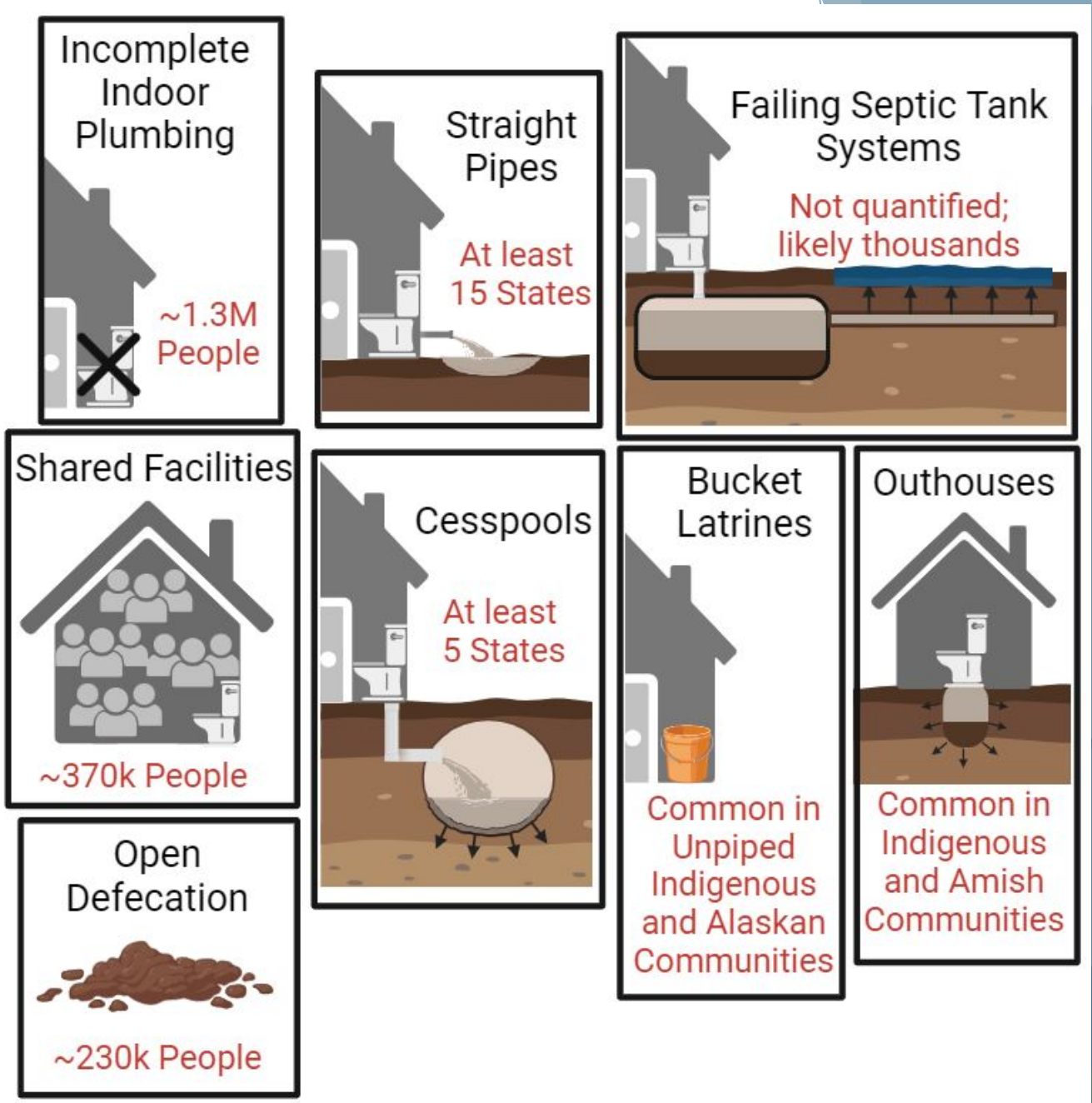
- *Pipes discharge untreated wastewater from a home to the surface, typically piped into adjacent woods, a trench or a stream*
- Documentation of straight pipes in 15 states
  - May be additional instances that are not publicized




**Documented Straight Pipes in the U.S.**

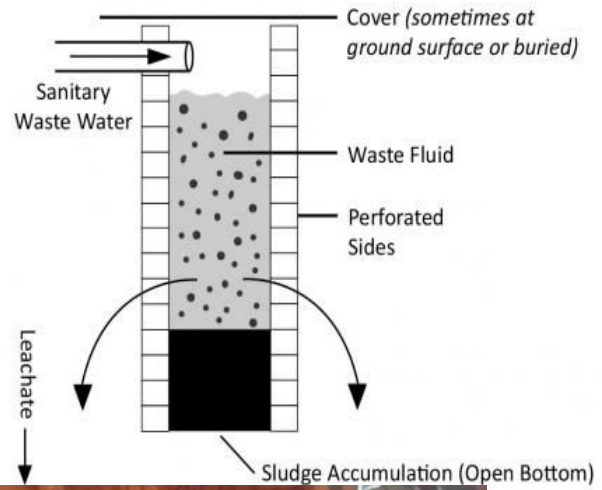
Maxcy-Brown, J., M. A. Elliott, L. A. Krometis, K. D. White, J. Brown, and U. Lall. 2021. "Making Waves: Right in our backyard- surface discharge of untreated wastewater from homes in the United States." *Water Res.*, 190: 116647. https://doi.org/10.1016/j.watres.2020.116647.

# Gaps in Safely Managed Sanitation in the U.S.



# Inadequate Onsite Wastewater Treatment in U.S.

- **Incomplete Indoor Plumbing**
  - Estimated to impact at least 1.3 million U.S. residents
- **Failing Septic Systems**
  - Estimated 20 million or more systems with low repair/replacement rates
- **Cesspools**
  - In at least 5 states (53-55 Mgal/day untreated sewage discharged in Hawaii)
- **Failing Outhouses**
  - Communities without access to piped water
  - Common sight in Navajo Nation, Texas Colonias, Amish communities, and parts of Alaska
- **Bucket Latrines**
  - Unpiped communities in Alaska
- **Open Defecation and Shared Facilities**
  - 600,000 people experiencing homelessness in the U.S.
  - 230,000 unsheltered; 370,000 sheltered




# Joint Monitoring Programme (JMP) Service Ladder for Global Monitoring of Sanitation in Households

**Open defecation**
Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste

**Unimproved**
Use of pit latrines without a slab or platform, hanging latrines or bucket latrines

- Straight pipes
- Failing outhouses
- Bucket latrines

**Limited**
(previously shared)
Use of improved facilities that are shared with other households

- Failing outhouses

**Basic**
(previously improved)
Use of improved facilities that are not shared with other households

- Incomplete Plumbing
- Failing Septic Systems
- Straight Pipes
- Cesspools
- Failing Outhouses

**Millennium Development Goals (MDG): 1990- 2015**

**Sustainable Development Goals (SDG): 2016- 2030**

**Safely managed**
Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated off-site

Note: Improved facilities include flush/pour to piped sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, composting toilets or pit latrines with slabs

Maxcy-Brown, J., D. Capone, and M. A. Elliott. 2023. "Characterizing the nature and extent of access to unsafely managed sanitation in the United States." *Nat. Water*, 1 (11): 915–928. Nature Publishing Group. https://doi.org/10.1038/s44221-023-00157-7.

# Barriers to Providing Safely Managed Sanitation to All in the U.S.

- **Lack of Comprehensive Data**
- **Challenges for Households and Small Communities**
  - Financial and Technical
- **Challenges for People Experiencing Homelessness**
  - Public toilets and permanent housing with reliable, affordable access
- **Lack of Accessible Funding**
  - Millions $$ needed to install systems
  - Funding is generally not available directly to homeowners
  - Limited access for unincorporated communities (37% of U.S.)
  - Limited operation & maintenance (O&M) funding

# Historical Challenges: Structural Racism

- Effects of underbounding
  - Exclusion of some communities from infrastructure investments
- Redlining prevents access to loans
- Legal issues associated with “heir property”
  - land is jointly owned by descendants of a deceased person whose estate did not clear probate
  - heirs have the right to use the property, but they do not have a clear or marketable title to the property
- Exploitative practices of contractors result in unpermitted systems

https://iwaponline.com/wp/article/25/9/927/97569/Household-level-wastewater-management-and-disposal

Official Journal of the World Water Council

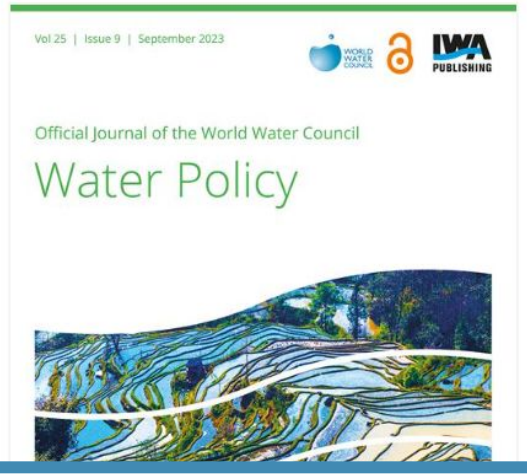
Water Policy

Open Access Publication



**Volume 25, Issue 9**

1 September 2023




RESEARCH ARTICLE | SEPTEMBER 16 2023

# Household level wastewater management and disposal data collection in the U.S.: the history, shortcomings, and future policy implications

Jillian Maxcy-Brown; Mark A. Elliott; Bennett Bearden

Check for updates

Water Policy (2023) 25 (9): 927–947.

https://doi.org/10.2166/wp.2023.147 **Article history**

# U.S. Wastewater Data

- U.S. Decennial Census
- American Community Survey (ACS)
- American Housing Survey (AHS)

"In general, the existing data sources do not provide the information necessary to accurately characterize use of decentralized systems nationally."

– U.S. EPA Report to Congress in July 2021

# U.S. Decennial Census

- Removed wastewater question after 1990
- Question phrasing and instruction issues
- Ongoing work to re-introduce question

**1990 Decennial U.S. Census Questions on Sewage Disposal and Plumbing**
*(U.S. Census Bureau)*

| Is this building connected to a public sewer? | Do you have COMPLETE plumbing facilities in this house, apartment, or mobile home; that is, 1) hot and cold piped water, 2) a flush toilet, and 3) a bathtub or shower? |
|---|---|
| •Yes, connected to public sewer<br>•No, connected to septic tank or cesspool<br>•No, use other means | •Yes, have all three facilities<br>•No |

| American Community Survey (ACS) | American Housing Survey (AHS) |
|---|---|
| Administered annually<br><br>Aims for 3.5 million households<br><br>2021: 1.95 million completed surveys | Administered in odd-numbered years<br><br>2021: 64,141 completed surveys (69% response rate)<br><br>Each housing unit represents 21 to 27,654 other housing units |
| Questions on Plumbing Fixtures and Cost of Water/Sewer Bill<br>• High non-response rate for plumbing question<br>• 2016: Removed “Flush toilet” | Questions on characteristics of housing units *(see next slide)* |
| Does not incorporate these questions for group quarters surveys | Does not survey group quarters |
| Determines how more than $675 billion of federal spending are allocated each year | Less comprehensive for rural areas |
| Work is underway to incorporate sewage disposal question on the 2025 ACS Questionnaire | |

# American Housing Survey (AHS) Questions

- Full and half baths
- Public sewer or Sewage Disposal:
  - 1. Septic tank
  - 2. Cesspool
  - 3. Chemical toilet
  - 4. Outhouse or privy
  - 5. Other; specify
  - 6. None
- Type of OWTS:
  - 1. Standard septic tank and subsurface leach field (most common type)
  - 2. Uses a pump to distribute wastewater
  - 3. Elevated above natural soil surface
  - 4. Applies treated wastewater
  - 5. Any type not listed above
- Number of residences connected to OWTS
- Plumbing Access
- Breakdowns (and frequency):
  - Running water
  - Toilet
  - Sewer System
- Utility Bills
- Shut-offs

# American Housing Survey (AHS) Data- 2021

| **Total (Households)** | **128,504,000** |
|---|---|
| Type of Sewage System | |
| Public sewer | 108,574,000 |
| Septic tank or cesspool | 19,489,000 |
| Standard septic tank and subsurface leach field | 18,371,000 |
| Pump used to distribute wastewater | 633,000 |
| Elevated above natural soil surface | 291,000 |
| Applied treated wastewater | 66,000 |
| Other | 128,000 |
| Other | 185,000 |
| None | 123,000 |
| Not reported | 132,000 |
| Number of Units Connected to Septic Tank or Cesspool | |
| 1 | 18,925,000 |
| 2 to 5 | 414,000 |
| 6 or more | 150,000 |

| Bathrooms | |
|---|---|
| At least 1 complete bathroom | 128,368,000 |
| 1 | 39,819,000 |
| 1 1/2 | 14,067,000 |
| 2 | 40,438,000 |
| 2 1/2 | 17,405,000 |
| 3 | 13,705,000 |
| More than 3 | 2,933,000 |
| No complete bathroom | 136,000 |
| Sink and tub present | S |
| Sink and toilet present | S |
| Tub and toilet present | S |
| Sink only present | . |
| Tub only present | . |
| Toilet only present | S |
| No sink, bathtub, shower, or toilet present | 116,000 |
| Note: "S represents estimates that did not meet publication standards or withheld to avoid disclosure" | |

**2021 National Estimates for All Occupied Housing Units based on AHS - Plumbing, Water, and Sewage Disposal** (U.S. Census Bureau, 2021)

# American Housing Survey (AHS) Data- 2021

| **Total (Households)** | **128,504,000** |
|---|---|
| Housing Adequacy | |
| Severely inadequate | 1,833,000 |
| Plumbing | 411,000 |
| Heating | 1,086,000 |
| Electric or wiring | 166,000 |
| Upkeep | 284,000 |
| Moderately inadequate | 4,853,000 |
| Upkeep | 2,480,000 |
| Other | 2,533,000 |
| Adequate | 121,818,000 |

| Flush Toilet Breakdowns | |
|---|---|
| With one or more flush toilets | 128,383,000 |
| With at least one toilet working at all times in last 3 months | 125,838,000 |
| None working some time in last 3 months | 2,545,000 |
| No breakdown lasting 6 hours or more | 514,000 |
| Number of breakdowns that lasted 6 hours or more: | |
| 1 | 1,226,000 |
| 2 | 334,000 |
| 3 | 98,000 |
| 4 or more | 373,000 |
| Sewage Disposal Breakdowns | |
| With public sewer (or 6+ units sharing septic tank or cesspool) | 108,725,000 |
| No breakdowns in last 3 months | 107,146,000 |
| With breakdowns(s) in last 3 months | 1,579,000 |
| No breakdowns lasting 6 hours or more | 226,000 |
| Number of breakdowns that lasted 6 hours or more: | |
| 1 | 782,000 |
| 2 or more | 571,000 |
| With septic tank or cesspool | 19,489,000 |
| No breakdowns in last 3 months | 19,169,000 |
| With breakdowns(s) in last 3 months | 320,000 |
| No breakdowns lasting 6 hours or more | 61,000 |
| Number of breakdowns that lasted 6 hours or more: | |
| 1 | 204,000 |
| 2 or more | 55,000 |

Severely inadequate: w/o piped water, full bath or sharing a bathroom with non-household members

Moderately inadequate: at least 3 occasions in last 3 months without any flush toilet for 6+ hours

# Ongoing Efforts in Alabama

# The Consortium for Alabama Rural Water and Wastewater Management

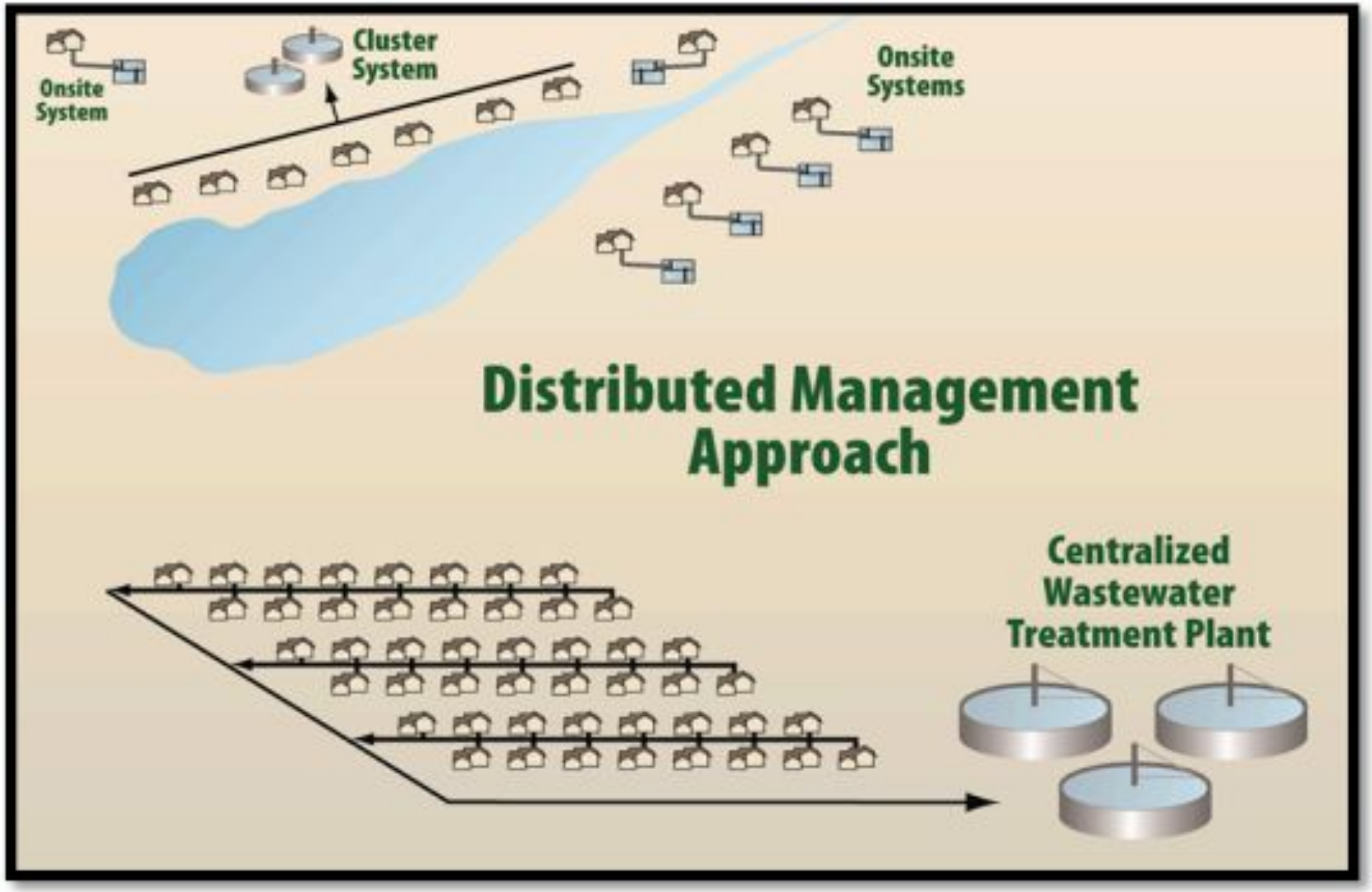
CARWW
Consortium for Alabama Rural Water and Wastewater Management

https://ruralwastewater.southalabama.edu/

Established in 2018 to address the water/wastewater issues in the Alabama Black Belt

University of South Alabama
The University of Alabama
Auburn University
Rural Studio
USDA Rural Development
UAB The University of Alabama at Birmingham
Alabama Department of Public Health
ADEM Alabama Department of Environmental Management
UWA The University of West Alabama
IAPMO International Association of Plumbing and Mechanical Officials
Alabama Rivers Alliance
WFX Water Finance Exchange — No Community Left Behind
BBUWP Black Belt Unincorporated Wastewater Program
Office of the Governor State of Alabama
Alabama Association of Regional Councils
LIXIL
Fifty-Twenty Engineering 50 20 Engineering
KATIE BRITT U.S. Senator for Alabama
ARWA Alabama Rural Water Association — Dedicated to improving the quality of life for rural Alabamians
Infiltrator water technologies
Congresswoman Terri Sewell — Representing Alabama's 7th District
Black Belt Community Foundation — Taking What We Have To Make What We Need

# "3-Legged Stool Approach" to Wastewater Management



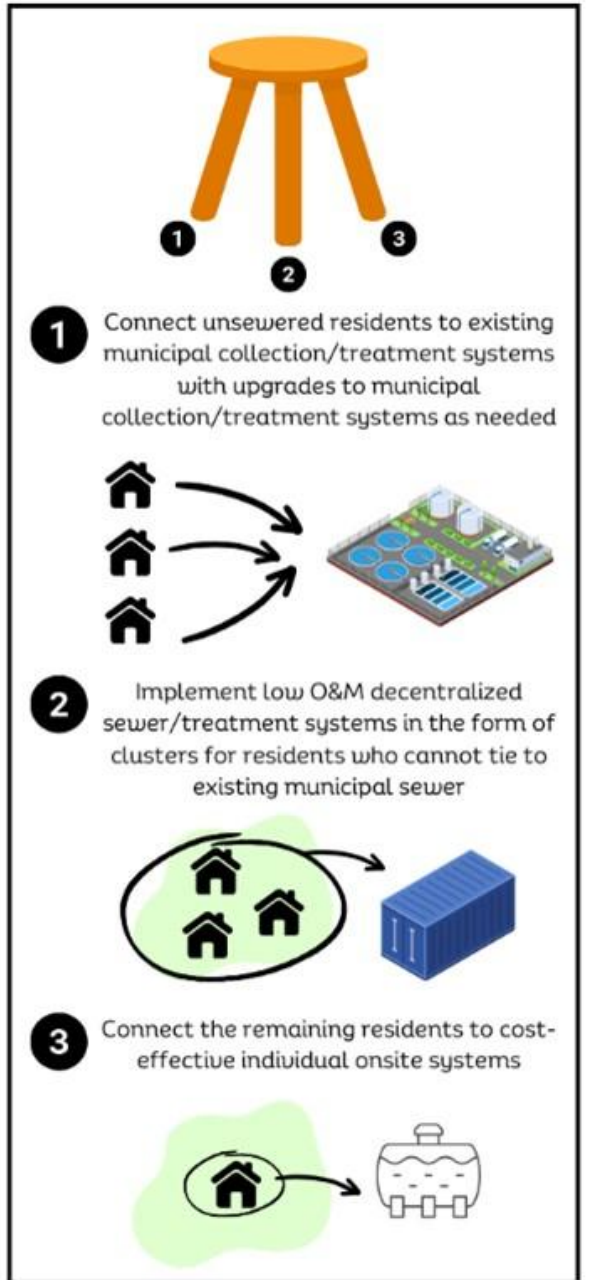
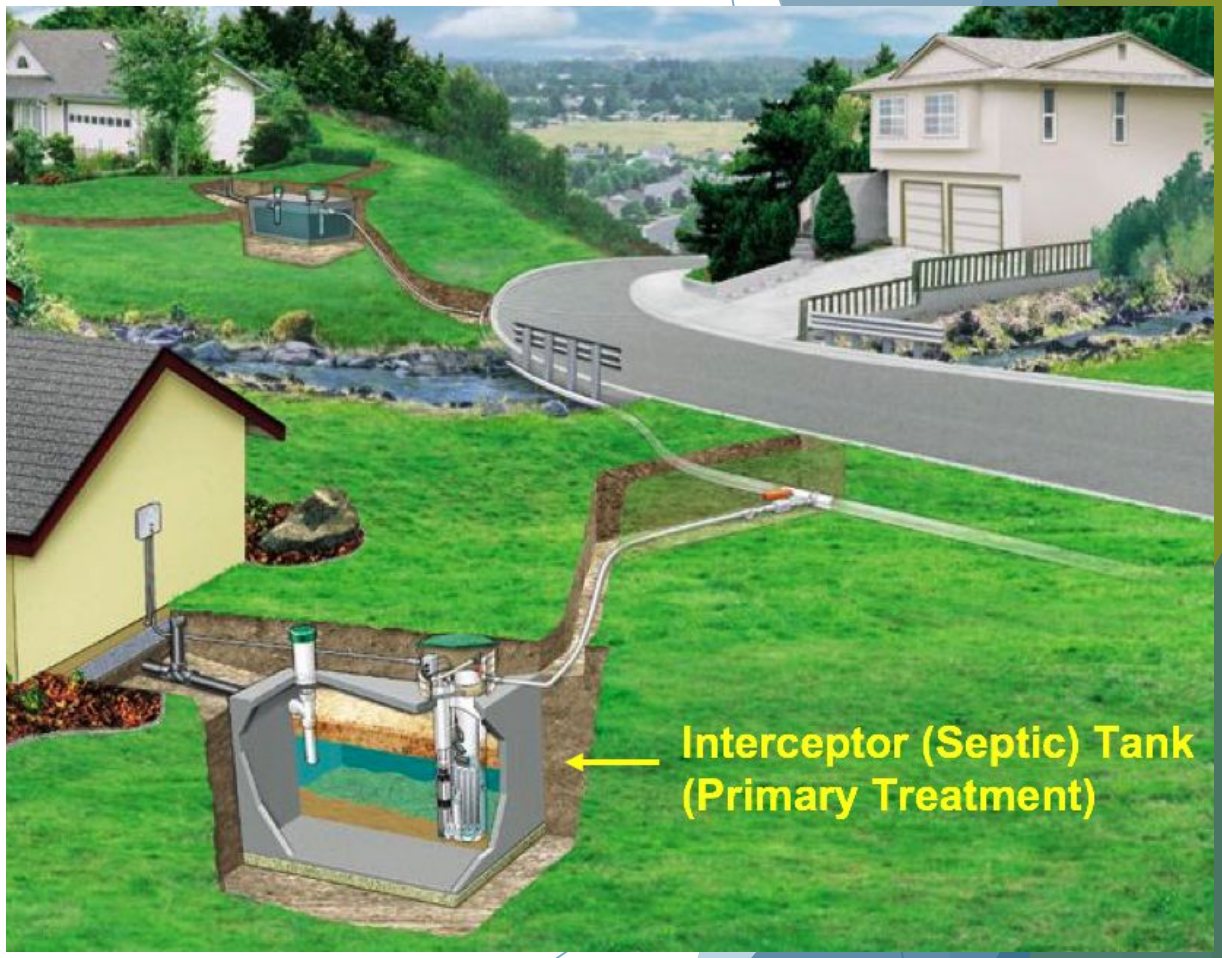




Figure Developed by Rachel Chai, University of South Alabama

# Potential Solution: Decentralized/Cluster Wastewater Treatment Systems

- Connect multiple houses to one treatment system
- Septic Tank Effluent Pump or Pressure (STEP) or Gravity (STEG)
  - Liquid Only
- Treated Effluent discharges into
  - irrigating forests
  - nearby sewer system
  - water body
  - subsurface






*Slide adapted from Dr Mark Elliott, Department of Civil Engineering, The University of Alabama*

# Clustered System Approach
# STEP/STEG (Septic Tank Effluent Pump/Gravity)

Trencher to dig 2-3 feet deep; insulated line for cold climates (on right). Or directional boring. Source: Siegrist, 2017

Smaller diameter pipe than traditional sewer and no need for deep excavation; MUCH less expensive per mile

Estimates around $310k per mile

Compared to Gravity Sewer ~$3M per mile:

*Slide adapted from Dr Mark Elliott, Department of Civil Engineering, The University of Alabama*

# Demonstrating Replicable Decentralized Wastewater Model for Rural Communities: Newbern, AL (Auburn Rural Studio)

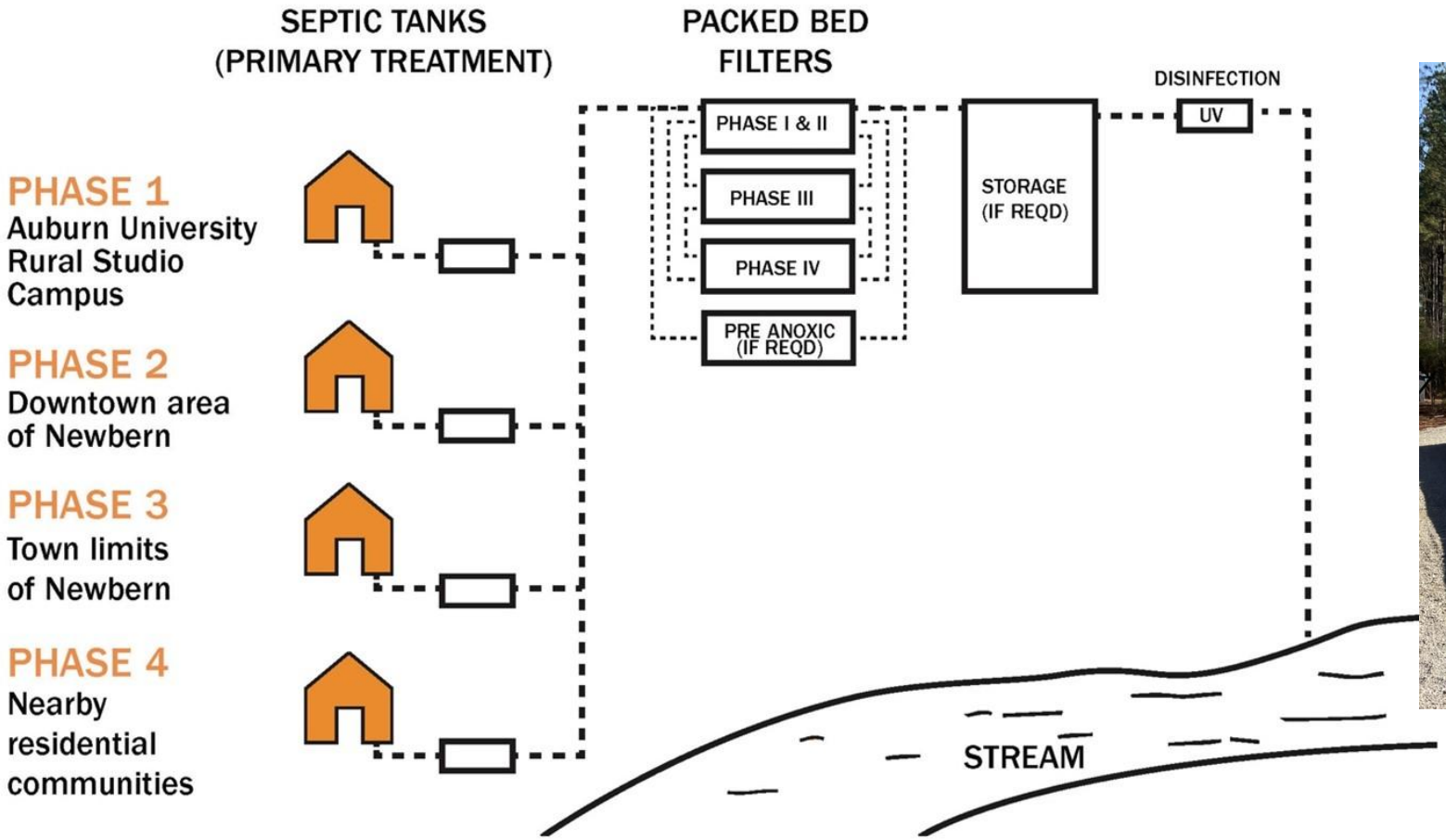



Figure Developed by Emily McGlohn, Rural Studio, Auburn University

# Wastewater Needs Studies for Evaluating Solutions in the Black Belt Region

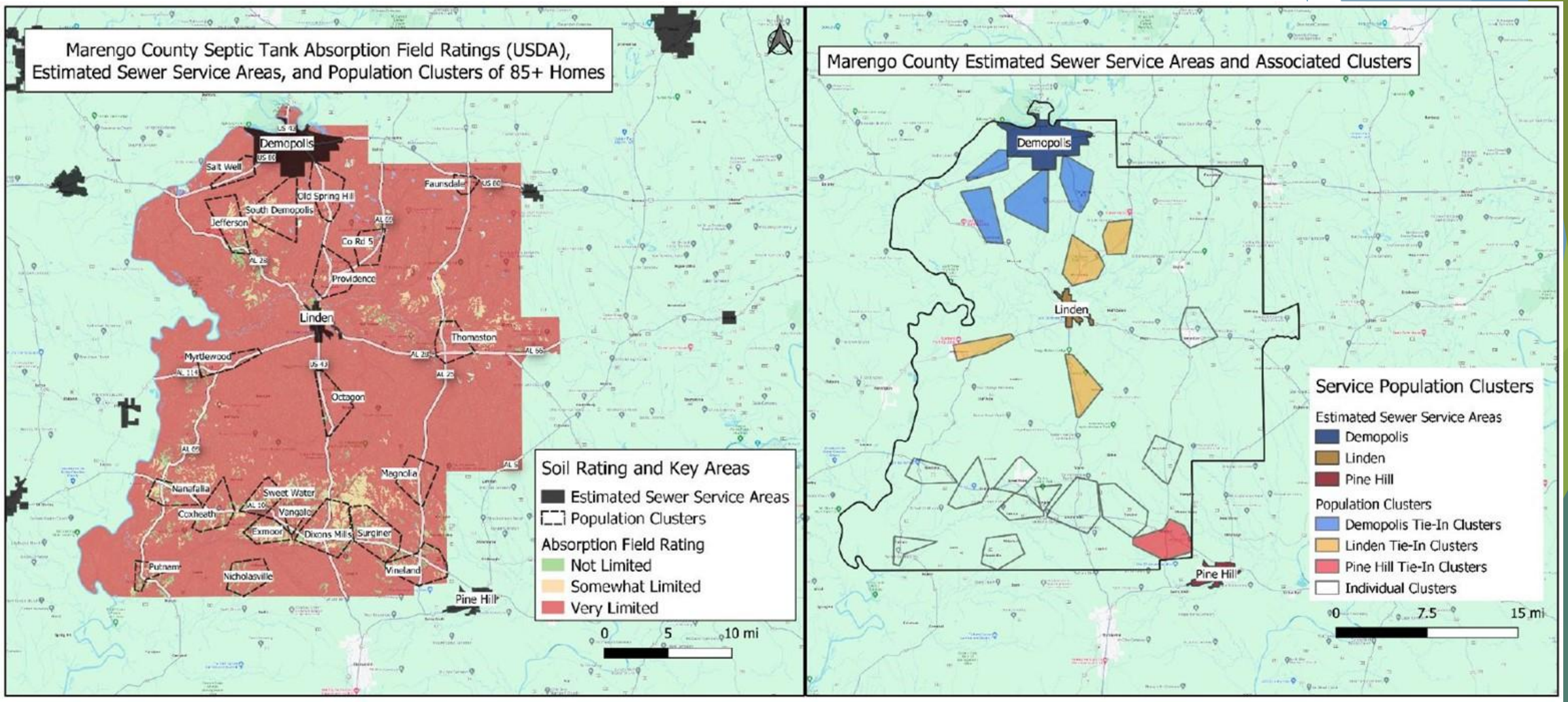



Figure Developed by Lacey Christian, University of South Alabama

# "How-To" Guide Outline

1. Executive Summary
2. Importance of Proper Wastewater Management
3. Types of Wastewater Management Systems
   - Traditional Municipal Network Systems
   - Onsite Individual Systems
   - Decentralized Cluster Systems
4. Management Options
5. Ordinances and Legal Considerations
6. Funding Sources
7. Community Education and Outreach
8. Contact Information

# Funding Sources

- **Report identifies more than 25 potential funding sources**
- **U.S. EPA**
  - Water Infrastructure Finance and Innovation Act (WIFIA)
  - Wastewater Technologies Clearinghouse
- **Alabama Department of Environmental Management**
  - State Revolving Fund
- **U.S. Department of Housing and Urban Development**
  - Title 1 Home and Property Improvement Loans
- **U.S. Department of Agriculture**
  - Single Family Housing Repair Loans & Grants
  - Community Development Block Grant
  - Community Facilities Direct Loan & Grant Program
  - Rural Utilities Service Water and Environmental Programs
- **Private**

# Next Steps

FINALIZE DRAFT

GATHER FEEDBACK FROM COMMUNITY PARTNERS

DISTRIBUTE TO LOCAL STAKEHOLDERS

SERVE AS AN EXAMPLE GUIDE FOR OTHER STATES

# Black Belt Unincorporated Wastewater Program (BBUWP)

- Began in 2018, led by Sherry Bradley and Perman Hardy
- Funding from USDA and ADEM-ARPA
- Provide 100 onsite systems in unincorporated areas of Lowndes
  - Expanding to 175 to 200 homes
- Plan to expand to other Black Belt Counties
- Residents pay $20 per month for system maintenance

https://www.bbuwp.org/

# Recent Public Health Studies


Emerg Infect Dis. 2023 Dec; 29(12): 2461–2470.
doi: 10.3201/eid2912.230751
PMCID: PMC10683802
PMID: 37987581

Cross-Sectional Study of Soil-Transmitted Helminthiases in Black Belt Region of Alabama, USA

Claudette Poole,✉ Troy Barker, Richard Bradbury, Drew Capone, Amy Hutson Chatham, Sukwan Handali, Eduardo Rodriguez, Yvonne Qvarnstrom, and Joe Brown

- 777 child participants (442 households)
- **94 (12%) living in homes with straight pipe**
- 227 participants submitted dried blood spot samples
- 704 participants submitted stool samples
- Stool testing for soil-transmitted helminthiases was negative
- 11 (5%) of dried blood spots were positive for *Toxocara* spp. (Roundworms)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10683802/


Emerg Infect Dis. 2023 Dec; 29(12): 2433–2441.
doi: 10.3201/eid2912.230780
PMCID: PMC10683812
PMID: 37987604

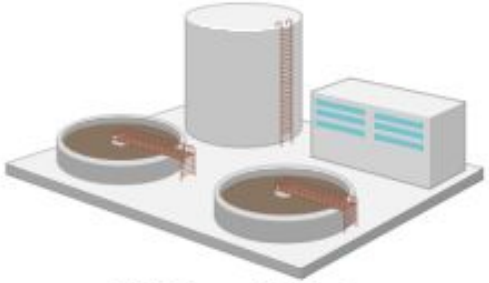
Risk Factors for Enteric Pathogen Exposure among Children in Black Belt Region of Alabama, USA

Drew Capone, Toheedat Bakare, Troy Barker, Amy Hutson Chatham, Ryan Clark, Lauren Copperthwaite, Abeoseh Flemister, Riley Geason, Emery Hoos, Elizabeth Kim, Alka Manoj, Sam Pomper, Christina Samodal, Simrill Smith, Claudette Poole, and Joe Brown✉

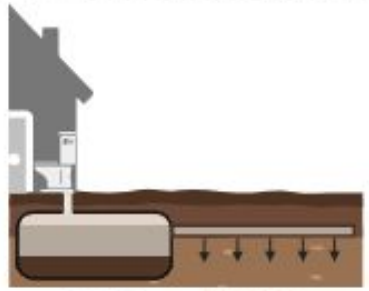
- 488 child participants (352 households)
- **39 (11%) living in home with straight pipes**
- **Found increased risk for pathogen detection among private well users**
- 26% combined prevalence of enteric pathogens
  - Lower than results in low- and middle-income countries
  - Higher than other studies in high-income countries
- Detected some individual pathogens less frequently than other studies in U.S.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10683812/

## Wastewater Access Affordability

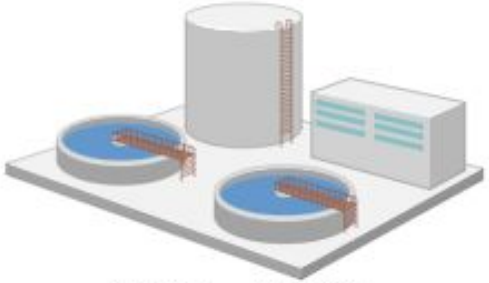


75% of U.S.
65% of AL

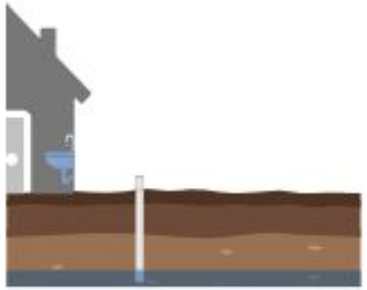


25% of U.S.
35% of AL

## Drinking Water Access Affordability



85% of U.S.
80% of AL



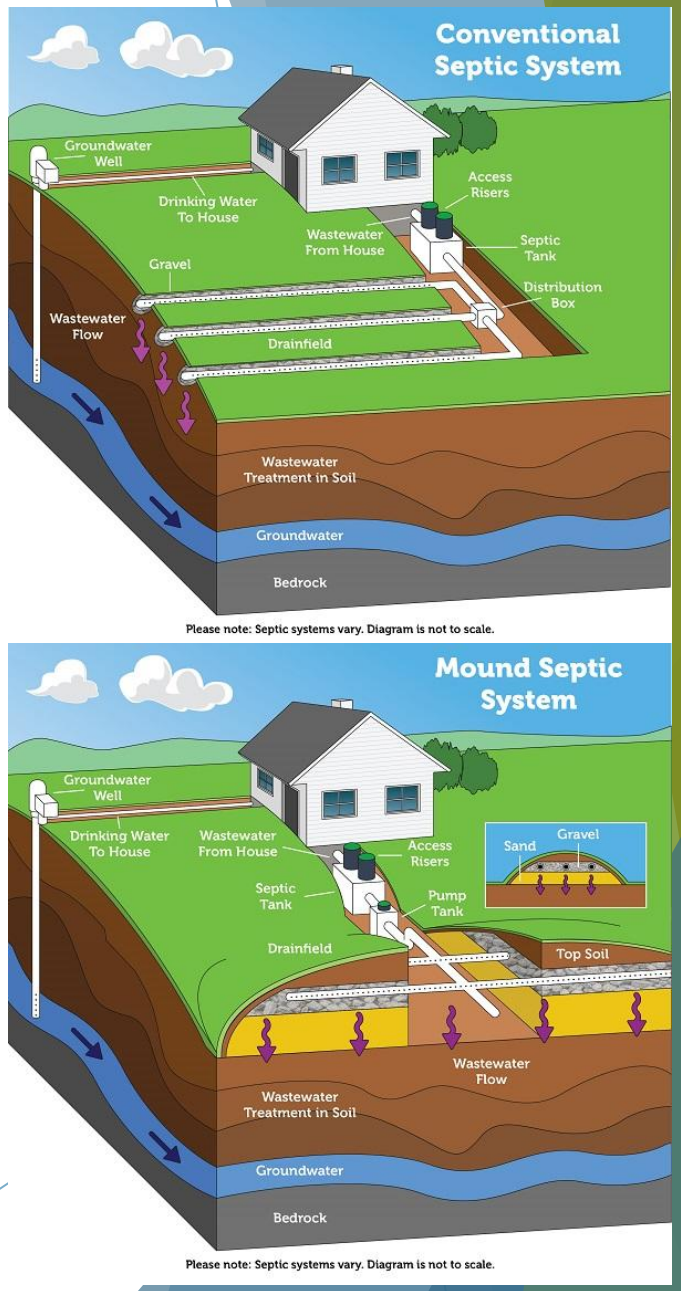
15% of U.S.
20% of AL

# History of Water and Wastewater Affordability in the U.S.

- Few studies on water and wastewater affordability in U.S.
  - Do not consider users of OWTS or private wells
- Federal infrastructure investments
  - Decreased after 1970s
  - Shifted from grants to loans
  - American Rescue Plan Act (ARPA) and Bipartisan Infrastructure Law (BIL) changed landscape

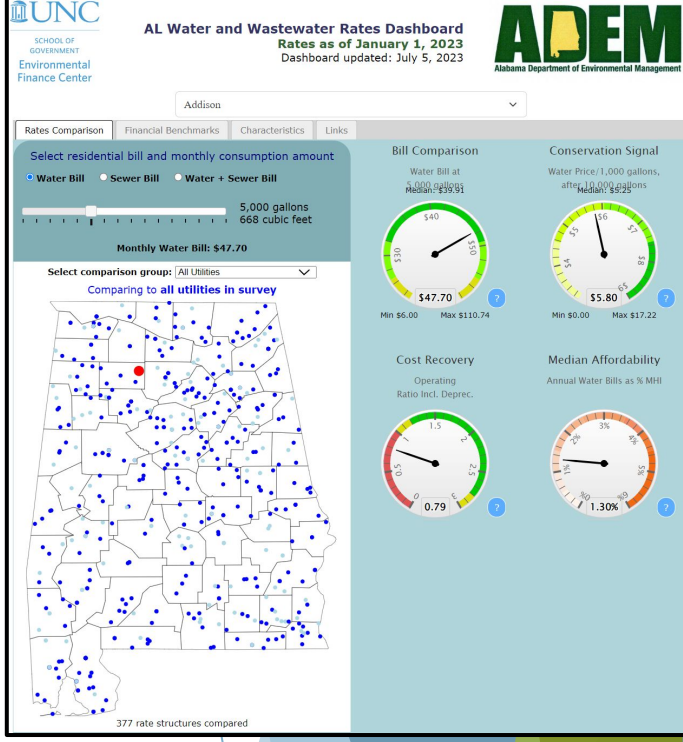
# Importance of Including OWTS

- Typically in areas with low population densities (rural)
  - Rural counties have higher rates of poverty
- Also found in areas where development rate exceeds the rate of sewer system extensions (suburban and rural)
- 70% of OWTS permits are issued for new installations
  - Potentially indicates increases in OWTS usage
- Households must pay capital and ongoing costs
  - Lump sums



# Overview of Affordability Analysis

- First State-Level Wastewater Affordability Analysis
  - Census tract level household Income Data from American Community Survey
- Use EPA's Affordability threshold
  - 2.5% of median household income
  - Public sewer bills based on water consumption
- Water Usage estimated as 6,000 gallons/month/household
  - USGS Estimates 74 gals/day/capital from public supply for domestic purposes in AL
  - Avg HH Size in AL 2.55
- Utility Rate Data for AL
  - Utility Financial Sustainability and Rates Dashboard
  - Published by Environmental Finance Center at the University of North Carolina
  - Provided by the Alabama Department of Environmental Management (ADEM)
  - https://dashboards.efc.sog.unc.edu/al




Maxcy-Brown, J., Elliott, M.A., Barnett, M.O., Christian, L., Krummen, K. (2023). Evaluating Statewide Wastewater Affordability for Users of Sewer Systems and Onsite Wastewater Treatment Systems based on Household Incomes at the Census Tract Level. *Journal of Water Resources Planning and Management.* (Manuscript revision under review).

# Estimated Monthly Loan Payments for OWTS

| | Conventional Septic System | Mound Septic System |
|---|---|---|
| Cost of System: | $5,000 | $20,000 |
| Loan Term: | 30 years | 30 years |
| **Monthly Loan Payment:** | | |
| Interest Rate: | | |
| 2.5% | $19.76 | $79.02 |
| 5.0% | $26.84 | $107.36 |
| 7.5% | $34.96 | $139.84 |
| 7.75% National Average 1971-2023 | $35.82 | $143.28 |
| 10.0% | $43.88 | $175.51 |
| **Monthly Expenses (loan payment + pumping costs):** | | |
| | $44.15 | $151.62 |

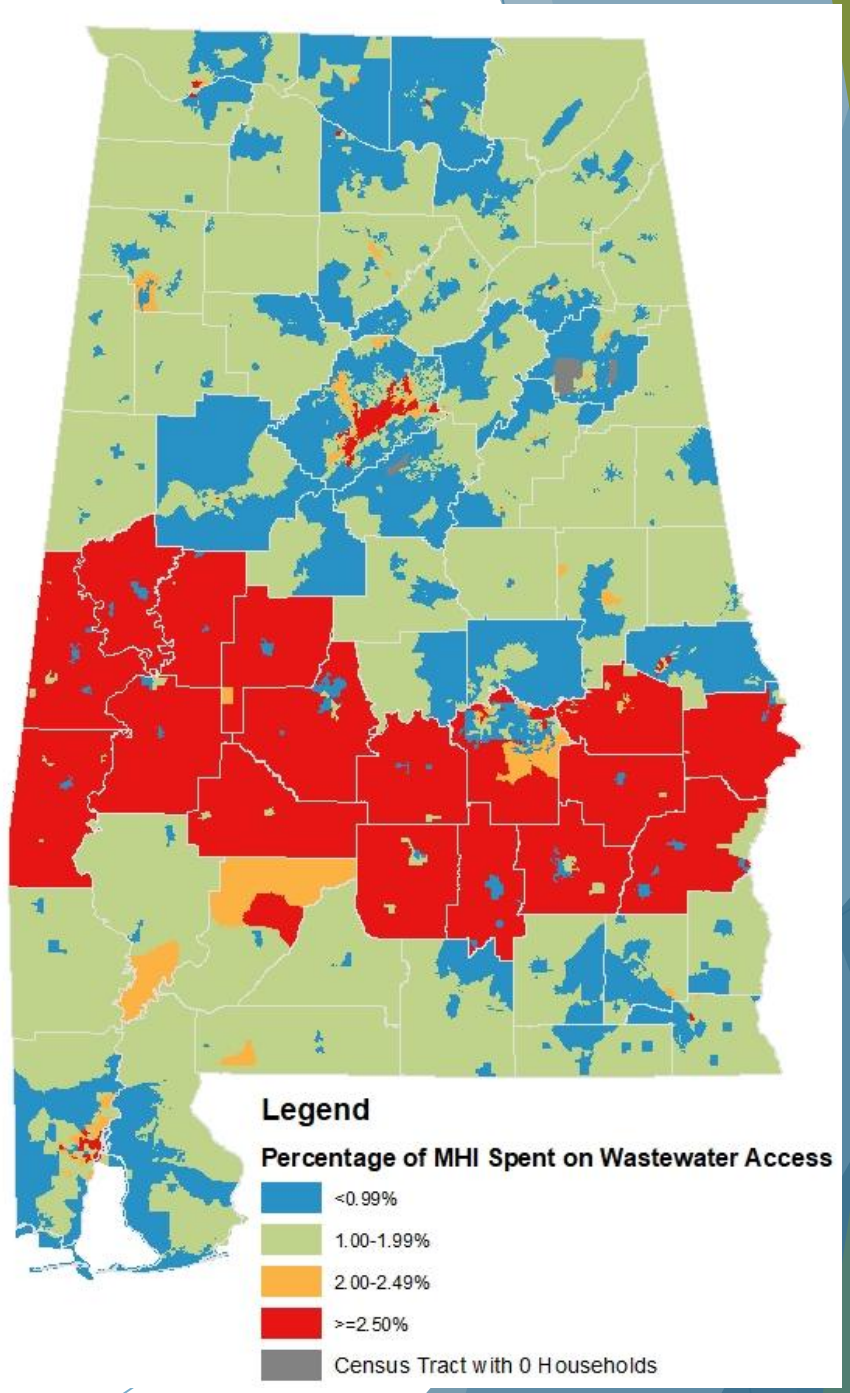
Please note: Septic systems vary. Diagram is not to scale.

Please note: Septic systems vary. Diagram is not to scale.

# Percentage of Median Household Income (MHI) Spent on Wastewater Access

Wastewater Access Expenses represented as:

- annual sewer bills
- annual OWTS loan payment and annualized pumping costs



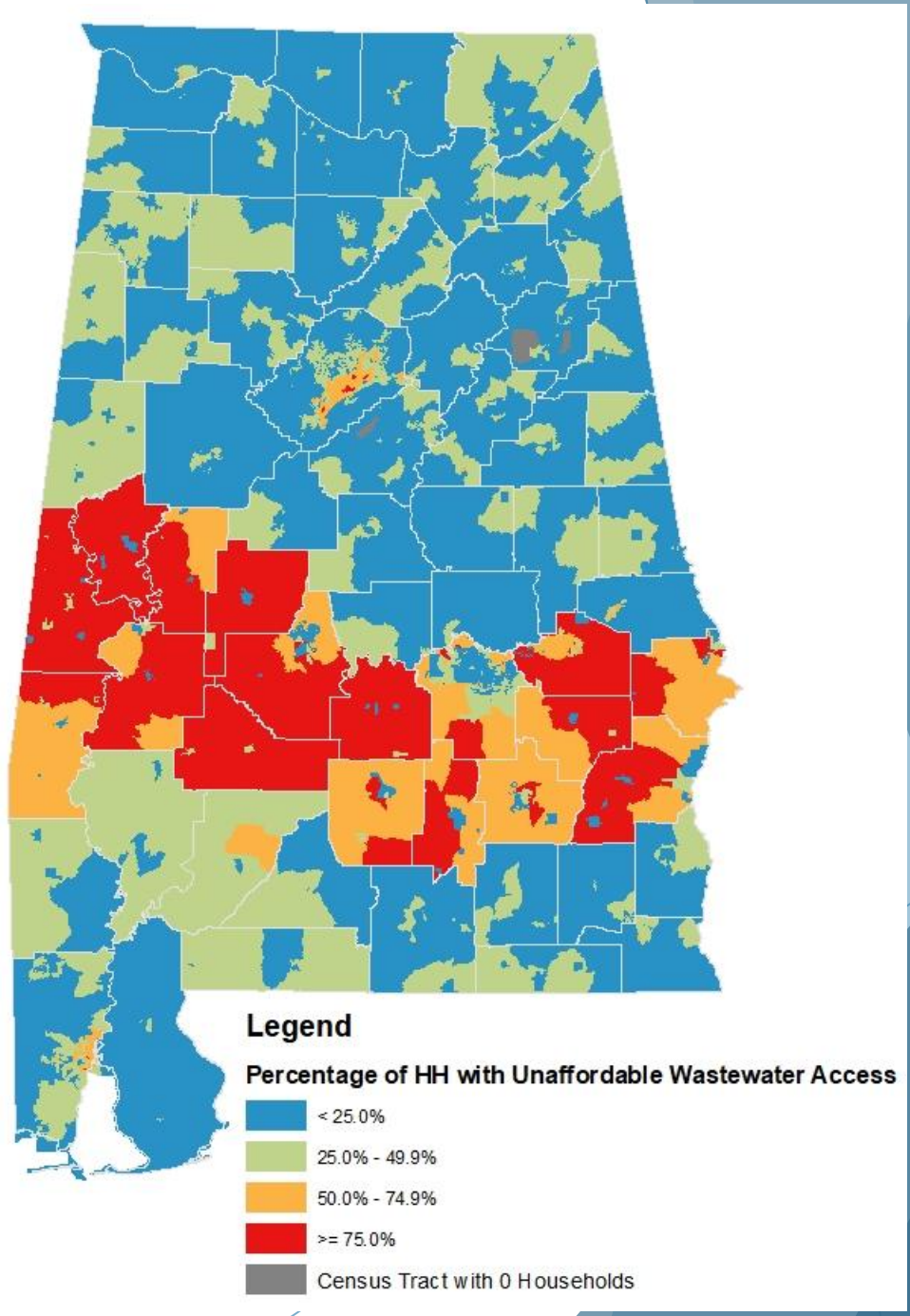
# *Novel Methodology:* Evaluating Affordability Based on Household Income Levels

- Use annual brackets instead of the census tract's average MHI
- Calculate income threshold of unaffordable access for each wastewater rate
- Sum % of households within the unaffordable income brackets:
  1) less than $10,000
  2) $10,000 to $14,999
  3) $15,000 to $24,999
  4) $25,000 to $34,999
  5) $35,000 to $49,999
  6) $50,000 to $74,999
  7) $75,000 to $99,999
  8) $100,000 to $149,999
  9) $150,000 to $199,999
  10) $200,000 or more

# Percentage of Households with Unaffordable Wastewater Access

Wastewater Access Expenses represented as:

- annual sewer bills
- annual OWTS loan payment and annualized pumping costs

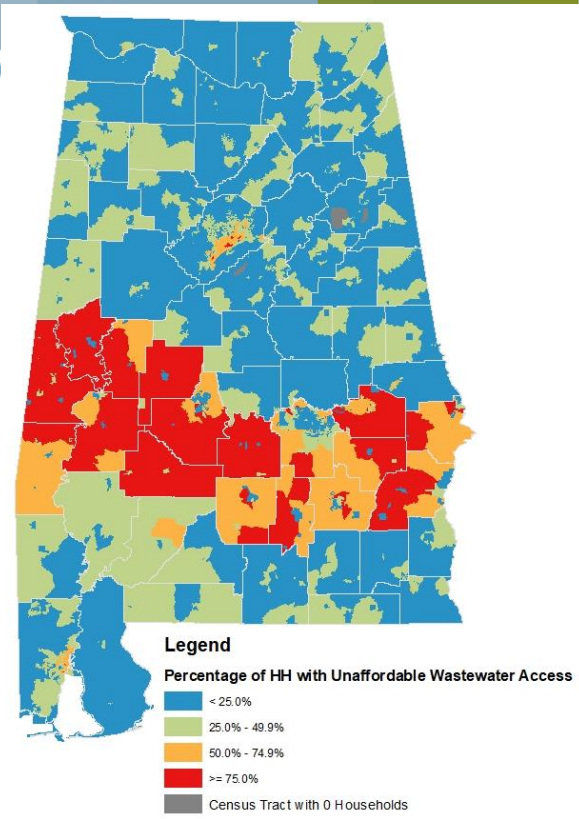


# Key Findings

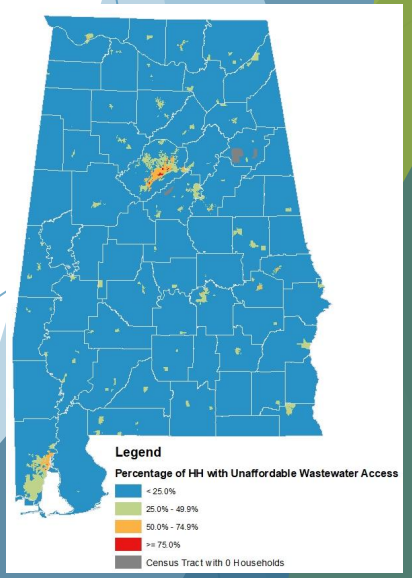
| | | |
|---|---|---|
| Total Households in Alabama | **1,867,893** | |
| Estimated Number of Households on Sewer | 1,223,659 | (65.5% of HH in AL) |
| Estimated Number of Households on OWTS | 644,234 | (34.5% of HH in AL) |

| | | |
|---|---|---|
| Households with Unaffordable Sewer Access | 278,086 | (14.9% of HH in AL) |

| Households with all OWTS expenses (capital and ongoing costs) | | |
|---|---|---|
| Household with Unaffordable OWTS Access | 165,151 | (8.8% of HH in AL) |
| Households with Conventional Systems | 116,168 | (6.2% of HH in AL) |
| Households with Mound Systems | 48,983 | (2.6% of HH in AL) |




| Households with only ongoing OWTS expenses (ongoing costs) | | |
|---|---|---|
| Household with Unaffordable OWTS Access | 20,109 | (1.1% of HH in AL) |
| Households with Conventional Systems | 16,767 | (0.9% of HH in AL) |
| Households with Mound Systems | 3,342 | (0.2% of HH in AL) |



# Cost of Living in Alabama

Sewer bills range from $2.00 to $87.87 per month (**average is $34.06**)
*0.6% of monthly expenses*

Conventional OWTS is $35.82 per month
*0.6% of monthly expenses*

Advanced OWTS is $143.28 per month *2.5% of monthly expenses*

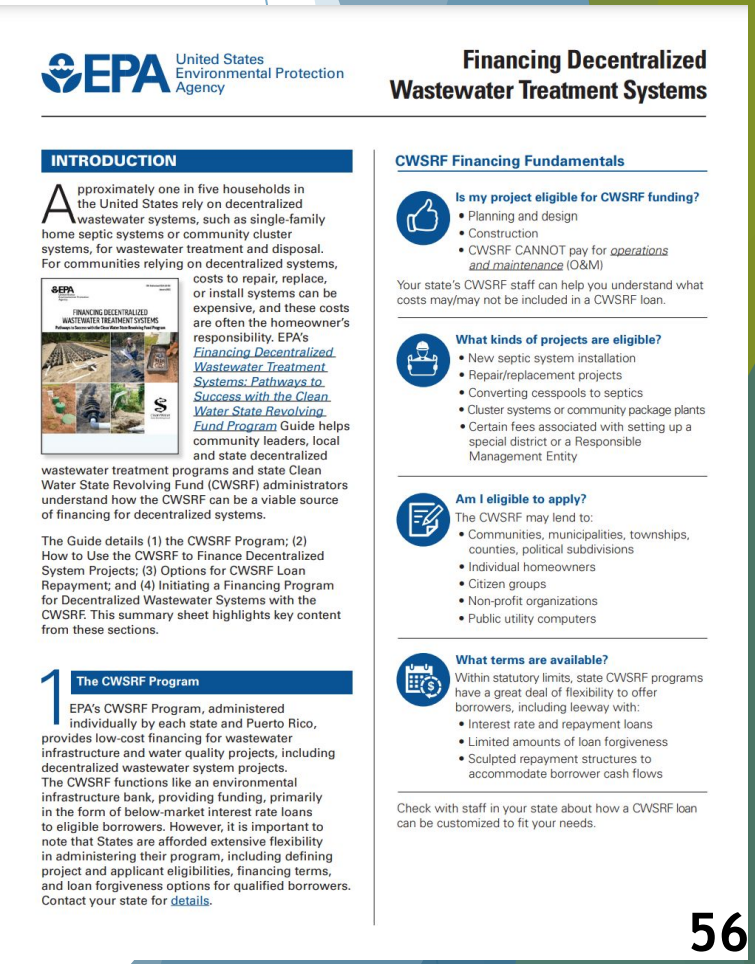
| Expense | Average Monthly Cost | Percentage of Total Monthly Expenses | Data Source |
|---|---|---|---|
| Rent *(2 bedroom apartment)* | $852 | 15.5% | (U.S. Census Bureau, 2021b) |
| Electricity | $161 | 2.9% | (Find Energy, 2021) |
| Internet | $65 | 1.2% | (AT&T, 2022) |
| Car Insurance | $108 | 2.0% | (Shinn et al., 2022) |
| Groceries | $610 | 11.1% | (Comen and Stebbins, 2021; Economic Policy Institute, 2020) |
| Health Care | $997 | 18.1% | (Comen and Stebbins, 2021) |
| Transportation | $1138 | 20.6% | (Comen and Stebbins, 2021; Economic Policy Institute, 2020) |
| Childcare *(for 1 child)* | $417 | 7.6% | (Comen and Stebbins, 2021; Economic Policy Institute, 2020) |
| Taxes | $507 | 9.2% | (Comen and Stebbins, 2021; Economic Policy Institute, 2020) |
| Miscellaneous | $500 | 9.1% | (Comen and Stebbins, 2021; Economic Policy Institute, 2020) |
| Cell Phone | $120 | 2.2% | (AT&T, 2023) |
| Water *(from a utility)* | $36 | 0.7% | (UNC Environmental Finance Center, 2019) |
| **Total** | **$5,511** | | |

$66,000 annually

Alabama Median Household Income is $54,943
National Median Household Income is $70,784
Federal Poverty Level (family of 3) is $24,860

# Recommendations

- Accessibility of Financial Assist for:
  - Utilities
  - Rate Payers
  - OWTS Users

EPA United States Environmental Protection Agency

**Financing Decentralized Wastewater Treatment Systems**

**INTRODUCTION**

Approximately one in five households in the United States rely on decentralized wastewater systems, such as single-family home septic systems or community cluster systems, for wastewater treatment and disposal. For communities relying on decentralized systems, costs to repair, replace, or install systems can be expensive, and these costs are often the homeowner's responsibility. EPA's *Financing Decentralized Wastewater Treatment Systems: Pathways to Success with the Clean Water State Revolving Fund Program* Guide helps community leaders, local and state decentralized wastewater treatment programs and state Clean Water State Revolving Fund (CWSRF) administrators understand how the CWSRF can be a viable source of financing for decentralized systems.

The Guide details (1) the CWSRF Program; (2) How to Use the CWSRF to Finance Decentralized System Projects; (3) Options for CWSRF Loan Repayment; and (4) Initiating a Financing Program for Decentralized Wastewater Systems with the CWSRF. This summary sheet highlights key content from these sections.

**1 The CWSRF Program**

EPA's CWSRF Program, administered individually by each state and Puerto Rico, provides low-cost financing for wastewater infrastructure and water quality projects, including decentralized wastewater system projects. The CWSRF functions like an environmental infrastructure bank, providing funding, primarily in the form of below-market interest rate loans to eligible borrowers. However, it is important to note that States are afforded extensive flexibility in administering their program, including defining project and applicant eligibilities, financing terms, and loan forgiveness options for qualified borrowers. Contact your state for details.

**CWSRF Financing Fundamentals**

**Is my project eligible for CWSRF funding?**
- Planning and design
- Construction
- CWSRF CANNOT pay for *operations and maintenance* (O&M)

Your state's CWSRF staff can help you understand what costs may/may not be included in a CWSRF loan.

**What kinds of projects are eligible?**
- New septic system installation
- Repair/replacement projects
- Converting cesspools to septics
- Cluster systems or community package plants
- Certain fees associated with setting up a special district or a Responsible Management Entity

**Am I eligible to apply?**

The CWSRF may lend to:
- Communities, municipalities, townships, counties, political subdivisions
- Individual homeowners
- Citizen groups
- Non-profit organizations
- Public utility computers

**What terms are available?**

Within statutory limits, state CWSRF programs have a great deal of flexibility to offer borrowers, including leeway with:
- Interest rate and repayment loans
- Limited amounts of loan forgiveness
- Sculpted repayment structures to accommodate borrower cash flows

Check with staff in your state about how a CWSRF loan can be customized to fit your needs.

# Future Affordability Work

**Analyze water affordability in Alabama**

**Conduct water and wastewater affordability studies for additional states**

Including interest from Mississippi and Virginia

**Enhance data to incorporate:**

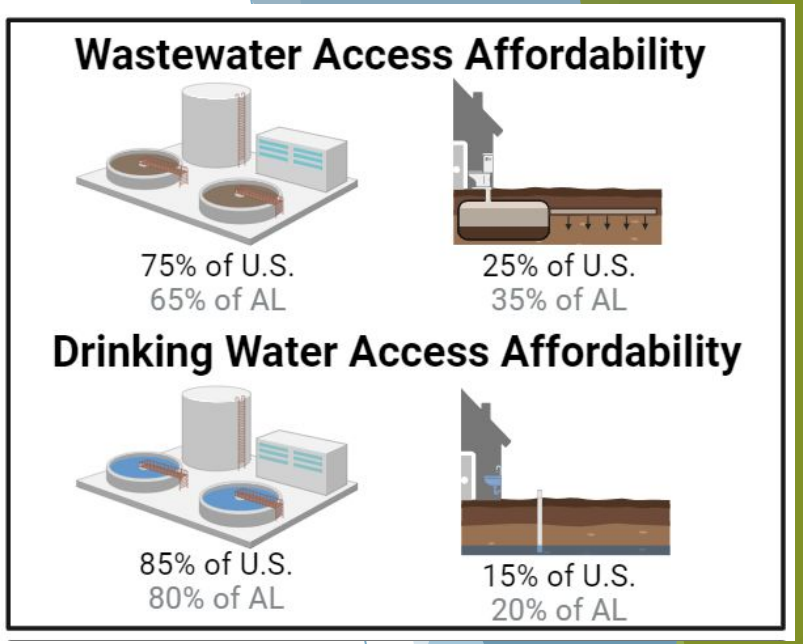
Connection fees

Variable rate structures & O&M costs

Seasonal bill variance

**Develop innovative utility financing and billing structures**

**Provide the hard evidence needed to support policy and funding allocation decisions**



# Collaboration with Alabama Rivers Alliance

## Analyzing Alabama's State Revolving Fund Program (SRF)

- Single largest program for water and wastewater infrastructure funding ($8.7 billion nationwide in 2023)
- Existing regulatory framework in comparison to other states
- Visualization of spatial distribution of applicants, funded projects, and sociodemographic data

## Evaluating the effectiveness to reach underserved communities

## Understanding barriers local communities face accessing funding

## Developing a suite of strategies and policy recommendations

## Educating elected officials and residents

Alabama Rivers Alliance

# Acknowledgements


- Funding Institutions
- Faculty and Collaborators:
  - Dr. Mark Elliott- University of Alabama
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  - Alabama Rivers Alliance
  - Lacey Christian- University of South Alabama
  - Rebecca Etter- Auburn University
  - Dr. Stephanie Rogers- Auburn University
  - Dr. Drew Capone- Indiana University
  - Dr. Bennett Bearden- Geological Survey of Alabama
  - Dr. Joe Brown- University of North Carolina Chapel Hill


Global Communities

Alabama Rivers Alliance

USDA

United States Environmental Protection Agency

Columbia World Projects
Columbia University

# Questions?

Email: jmaxcybrown@crimson.ua.edu