Septic to Sewer in Changing Climate

(September 09, 2025)

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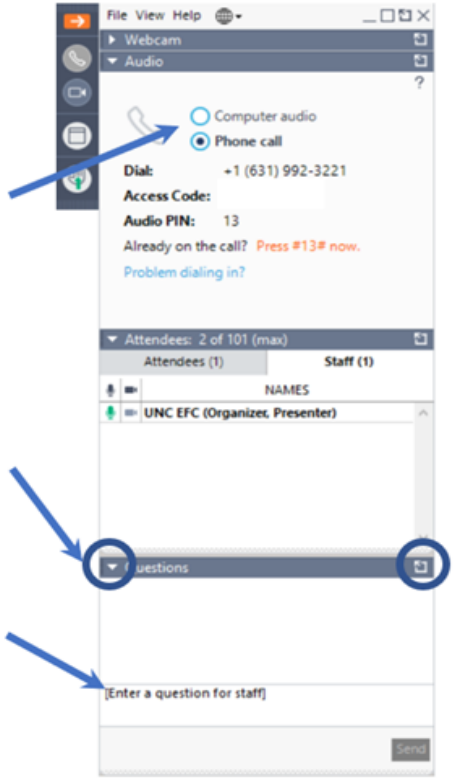

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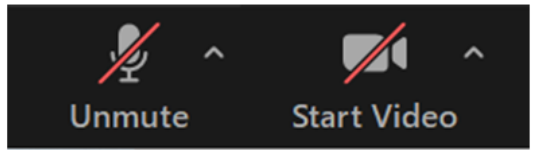

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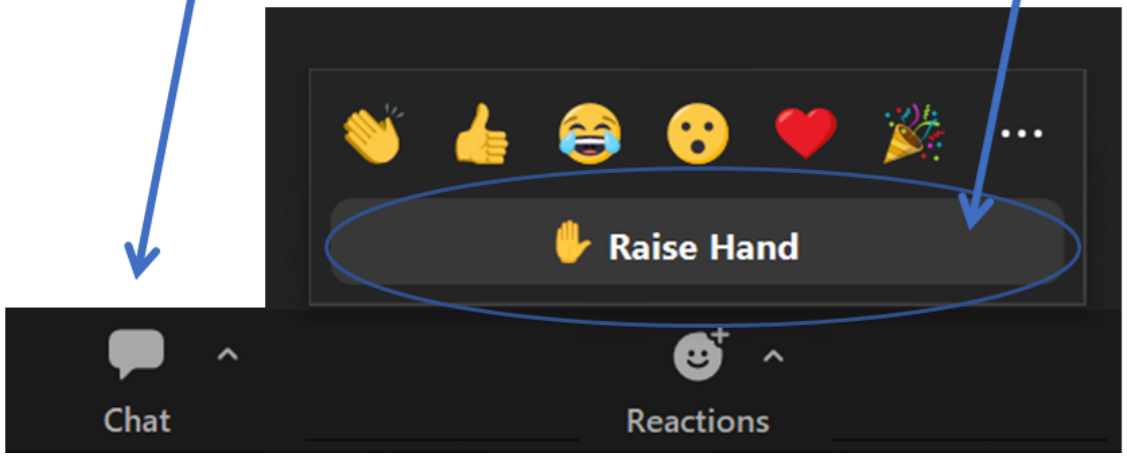

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The **Environmental Finance Center Network (EFCN)** is a university- and non-profit-based organization creating innovative solutions to the difficult how-to-pay issues of environmental protection and water infrastructure.

The EFCN works collectively and as individual centers to address these issues across the entire U.S, including the 5 territories and the Navajo Nation. The EFCN aims to assist public and private sectors through training, direct professional assistance, production of durable resources, and innovative policy ideas.

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Today's Speakers

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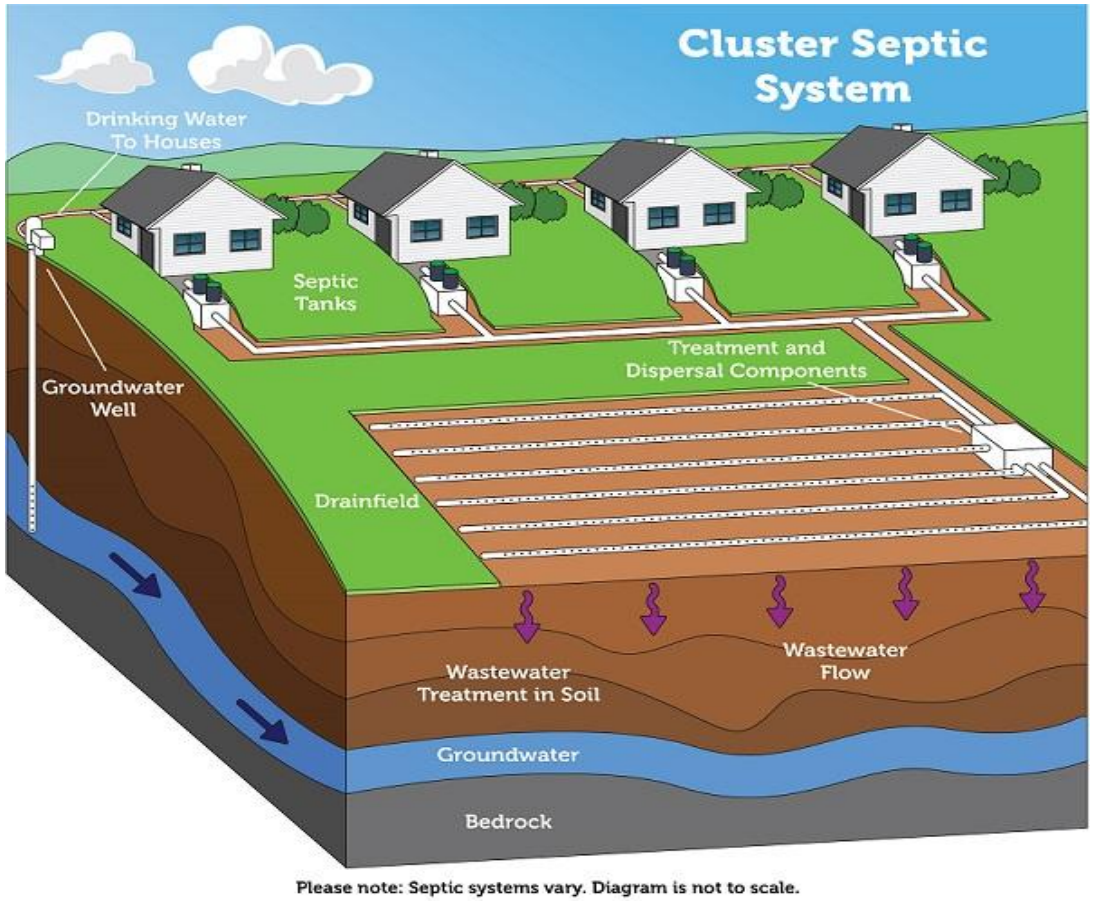
Webinar Outline

1. Introduction
2. Septic Systems
3. Climate Impacts on Septic System
4. Transition to Sewer System
5. Enhancing Existing Systems
6. State Programs
7. Resources
8. Question & Answer

Septic Systems

Septic systems

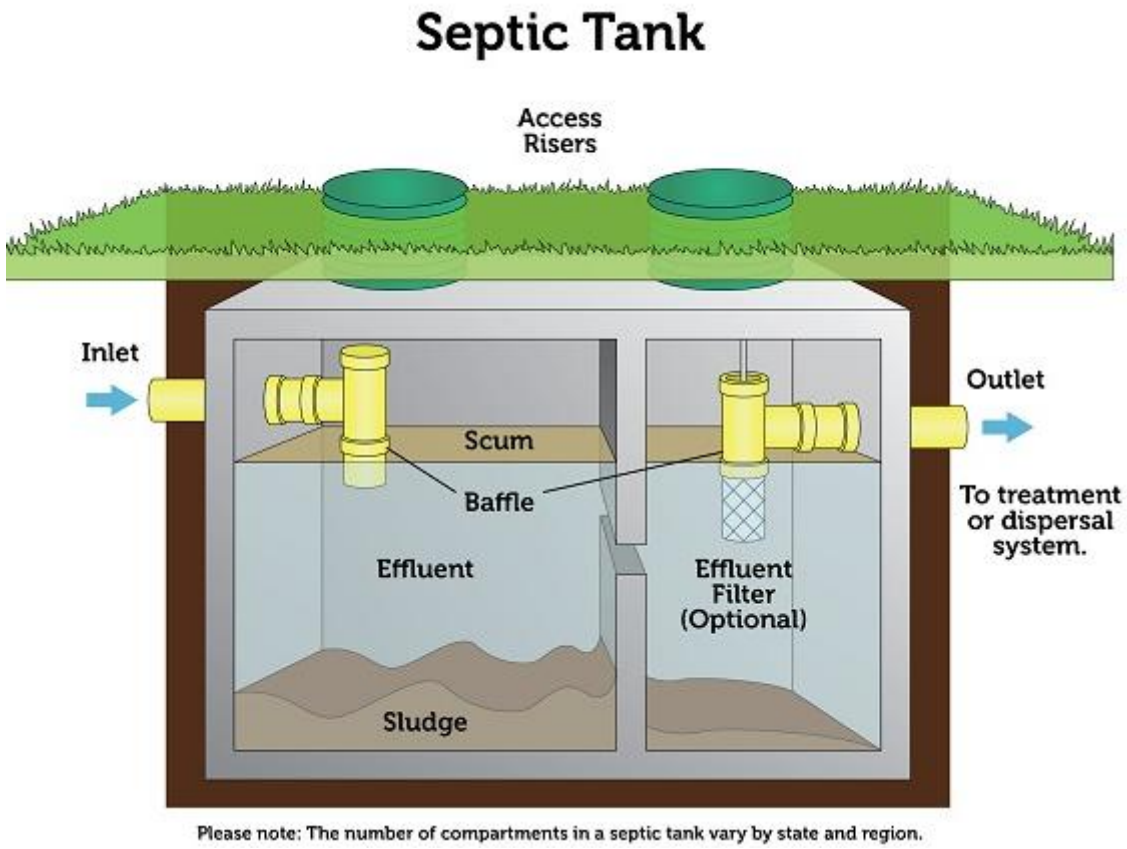
- Septic systems also known as decentralized or onsite systems
- **1 in 5 U.S. homes** rely on septic systems, serving over 21 million households
- Critical infrastructure for rural communities, tribal lands, and mobile home parks



Source: EPA

Septic systems

- Located on private property
- State or local governments regulate where systems can be installed
- Variety of technologies/types of systems
- Septic Systems face increasing risks from climate change, population growth, and aging infrastructure
- Failing systems can contaminate wells and local water bodies and contribute to nutrient pollution issues



Source: EPA

Understanding Septic System Function

Household Wastewater

- All water from toilets, sinks, showers, and appliances flows into the system.

Septic Tank

- Solids settle to the bottom as sludge; oils and grease float as scum; bacteria begin breakdown process.

Drainfield

- Liquid wastewater (effluent) flows to soil absorption area where natural filtration occurs.

Purification

- Soil microbes remove harmful bacteria, viruses, and nutrients before water reaches groundwater.

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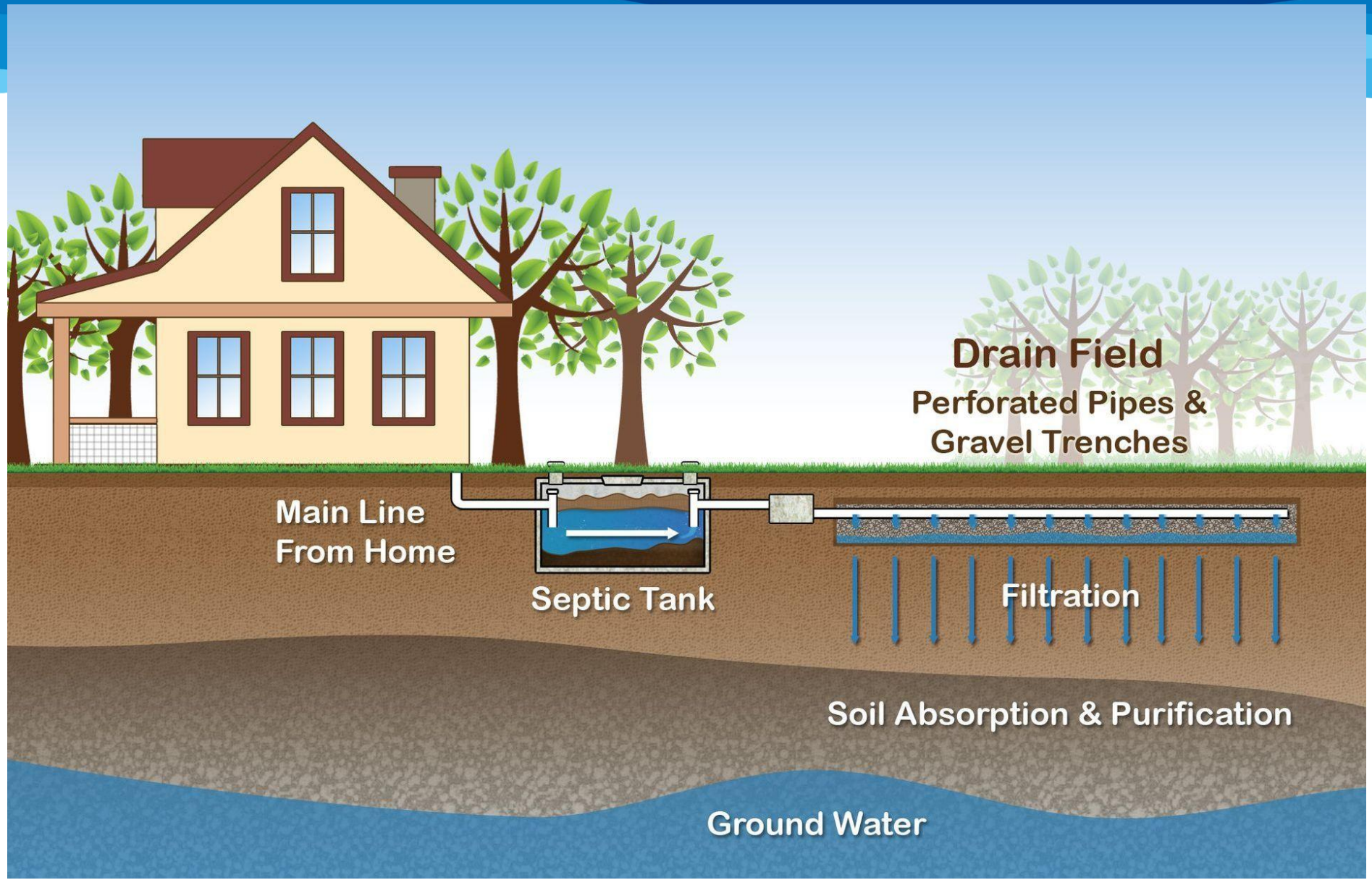
Understanding Septic System Function



Common Septic Configurations

1

Single-Family Systems

Most common type serving individual homes

- Conventional gravity systems with tank and drainfield
- Aerobic treatment units for challenging sites
- Mound systems for high water tables

2

Community Systems

Shared infrastructure for multiple homes

- Larger capacity tanks and drainfields
- Requires formal management agreements
- Economies of scale for maintenance

3

Mobile Home Parks

Specialized systems for dense communities

- Higher maintenance requirements
- Often aging infrastructure with limited oversight

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Essential Maintenance Requirements

Regular Inspections

- Professional evaluation every 3 years
- Look for signs of failure (wet spots, odors)
- Monitor sludge and scum layers

Pumping Schedule

- Every 3-5 years depending on household size
- More frequent for high-usage homes
- Only use licensed pumpers

Daily Practices

- Conserve water to prevent system overload
- Avoid flushing non-biodegradable items
- Keep hazardous chemicals out of drains

https://www.epa.gov/septic/septicsmart-week

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Do Your Part. Be SepticSmart!

Shield Your Field

Divert rain and surface water away and avoid parking vehicles and planting trees on your drainfield.

Don't Overload the Commode

Don't flush diapers, wipes or other items meant for a trashcan down the toilet.

Toilet paper only

Think at the Sink

Limit use of your garbage disposal and avoid pouring fats, grease, solids and harsh chemicals down the drain.

Don't Strain Your Drain

Use water efficiently and stagger use of water-based appliances, such as your washing machine or dishwasher.

Drainfield

Septic Tank

Well

Groundwater Recharge

Protect It and Inspect It

A typical septic system should be serviced every one to three years by a septic service professional.

Pump Your Tank

Ensure your septic tank is pumped at regular intervals as recommended by a professional.

Keep It Clean

If you are on a well, test your drinking water regularly to ensure it remains clean and free of contamination.

Aquifer

EPA
830-F-180-03 | May 2018

Mobile Home Park Septic Challenges

Higher Density Pressures

Mobile home parks typically place more homes per acre than conventional housing, creating greater wastewater volume per square foot of drainfield area.

Divided Responsibilities

Maintenance confusion arises when park owners manage communal systems while residents' control what enters them, leading to neglect and improper care.

Limited Resources

Many communities face financial constraints limiting system upgrades, repairs, and professional maintenance, leading to deferred attention until failure occurs.

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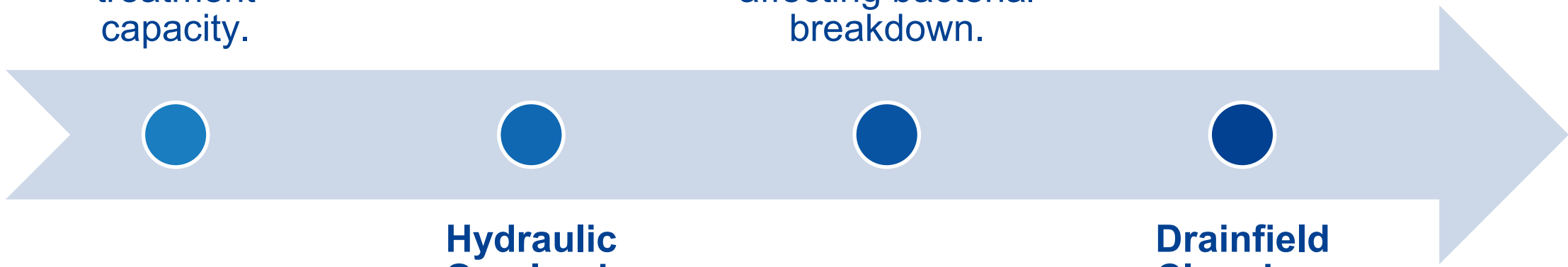
Common Failure Mechanisms

Reduced Retention Time: Insufficient treatment capacity.

Hydraulic Overload: System overload from excessive water use.

Chemical Disruptions: Harsh chemicals affecting bacterial breakdown.

Drainfield Clogging: Blockage from oils, greases, and particulates.



Poll

- **Have you observed or heard of septic system failures in your area?**

Environmental & Public Health Risks

Groundwater Contamination
Failed systems allow untreated effluent to reach groundwater, potentially introducing pathogens, nitrates, and other contaminants to drinking water sources.

Surface Water Impacts
Contaminated runoff can reach streams, lakes, and wetlands, contributing to algal blooms, fish kills, and recreational water hazards.

Disease Transmission
Exposure to surfacing effluent can transmit E. coli, hepatitis, parasites, and other pathogens through direct contact or contaminated water consumption.

Waterborne Pathogens
E. coli, viruses, and parasites contaminate drinking water sources and recreational waters

Nitrate Contamination
Causes blue baby syndrome (methemoglobinemia) in infants and has been linked to certain cancers

Direct Exposure
Surface breakouts create hazardous conditions for children, pets, and wildlife.
Pathogens accumulate in filter-feeding organisms, causing illness when consumed

Poll

- **How often should a septic system be pumped under normal household use?**

Climate Impacts

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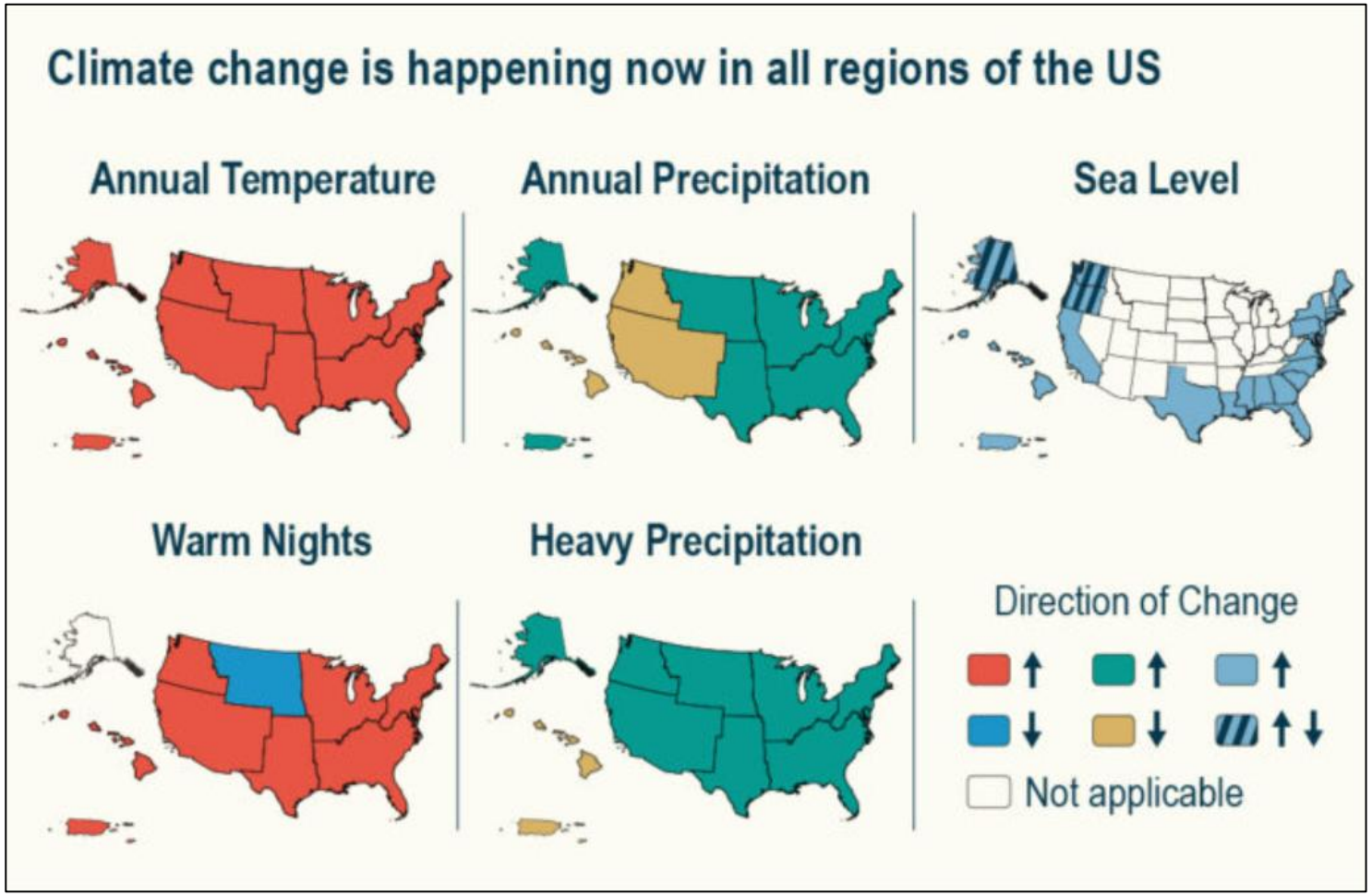
Climate Change Threats to Septic Systems

Sea Level Rise

Coastal communities face rising groundwater tables

- Saltwater intrusion damages bacterial communities
- Reduced separation between drainfields and groundwater
- Permanent inundation of low-lying systems



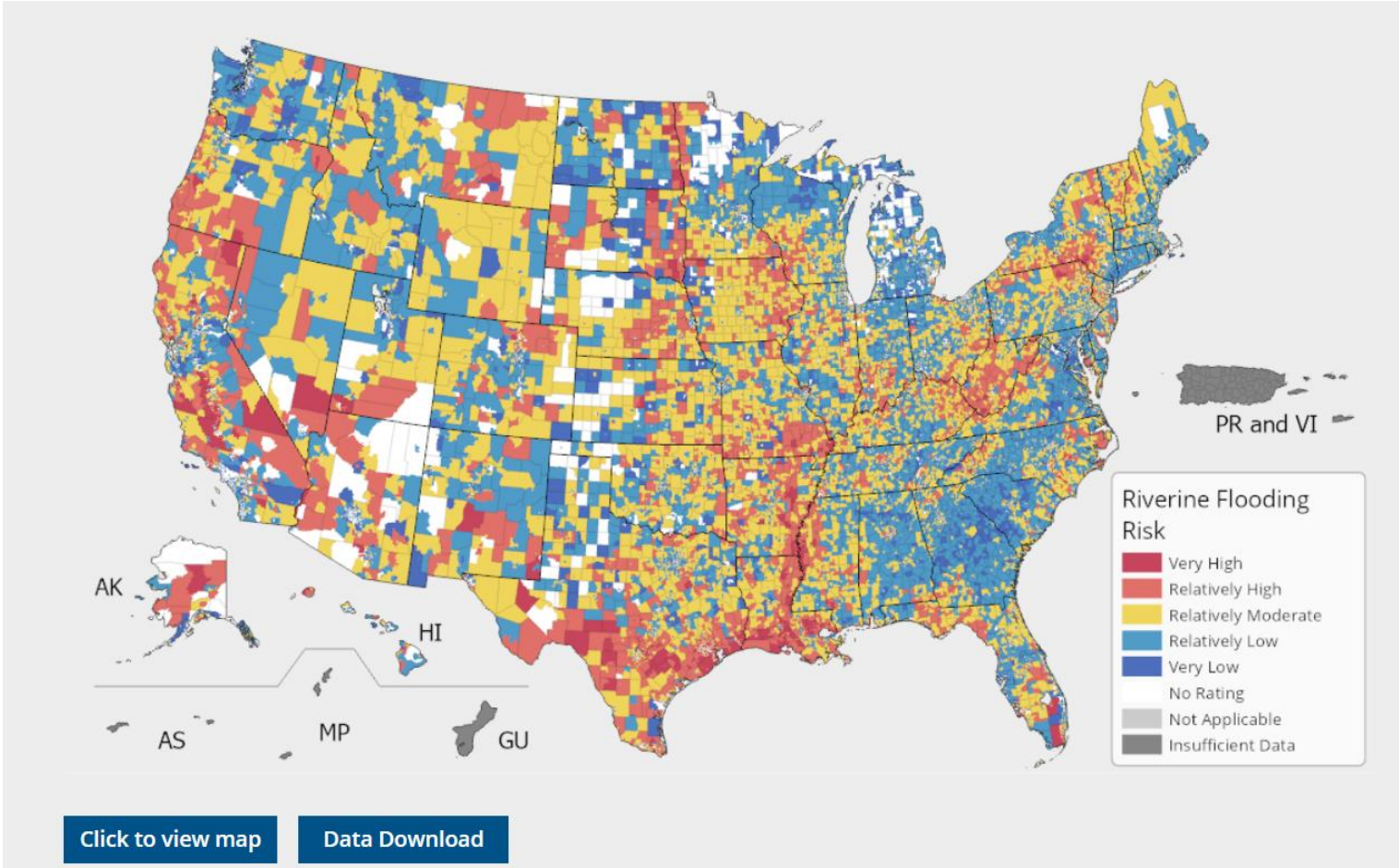
Source: Fifth National Climate Assessment (NCA5)

Climate Change Threats to Septic Systems

Increased Flooding

More frequent and intense precipitation events are overwhelming systems

- Saturated soils prevent proper filtration



Source: https://hazards.fema.gov/nri/riverine-flooding

Climate Change Threats to Septic Systems

1

Rising Water Tables

Sea level rise and increased rainfall elevate groundwater levels, reducing the essential unsaturated soil layer needed for treatment.

2

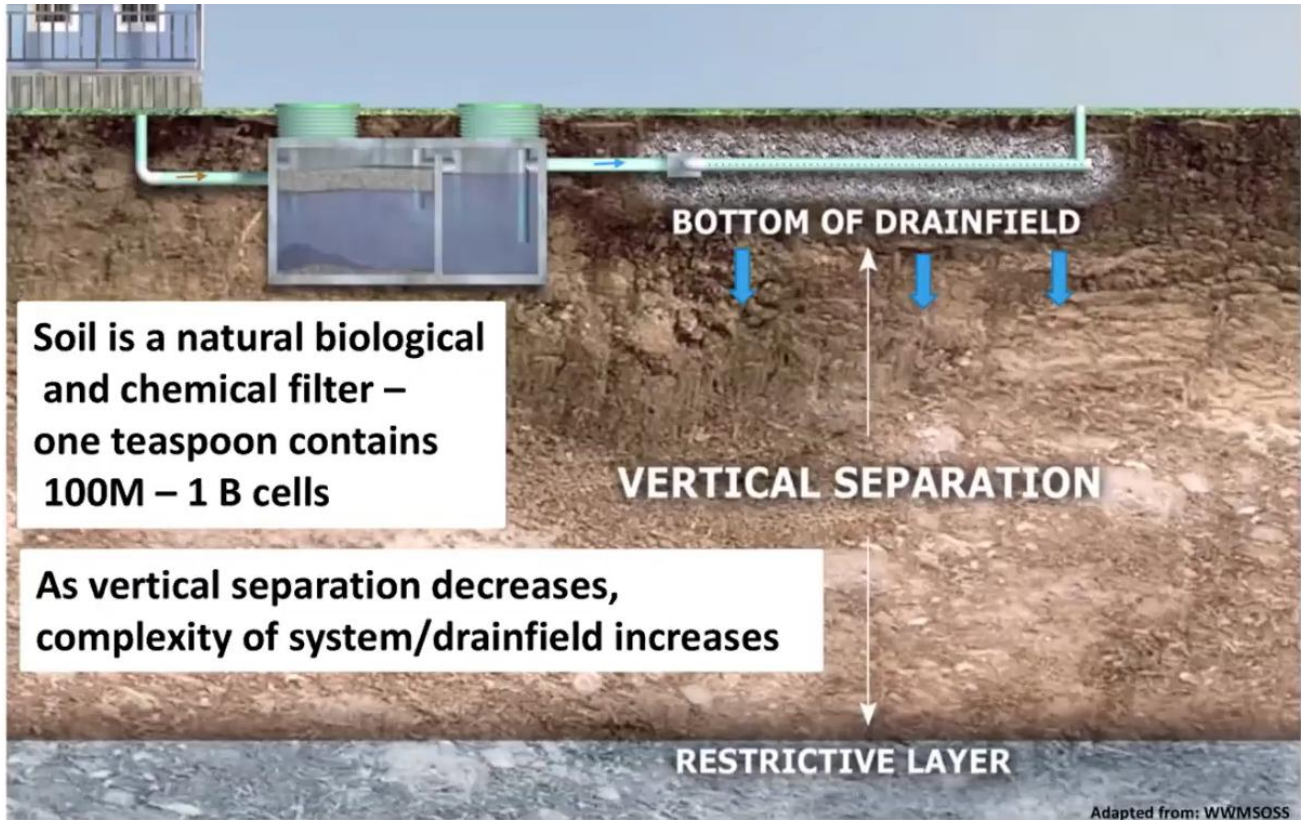
Extreme Precipitation

Intense storms saturate drainfields, preventing absorption and forcing untreated effluent to the surface.

3

Extended Droughts

Soil shrinkage creates cracks and preferential flow paths, allowing effluent to bypass treatment zones.



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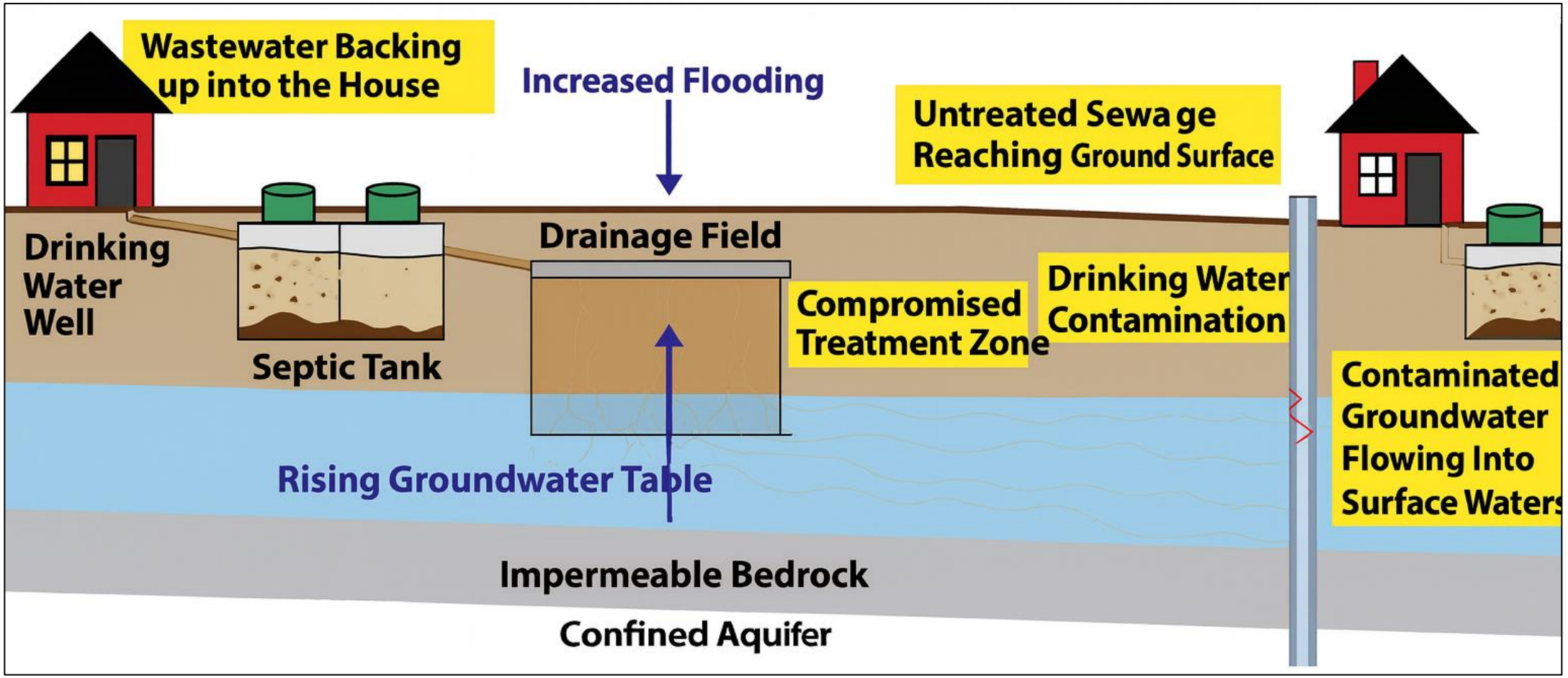
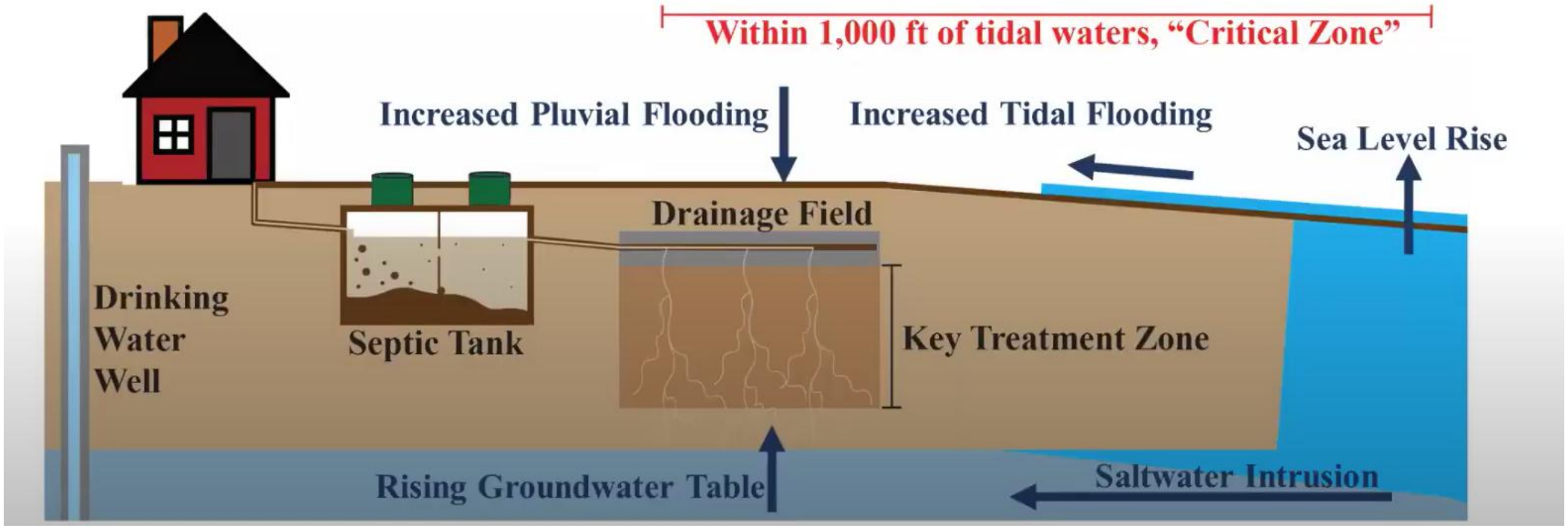
Importance of Unsaturated soil

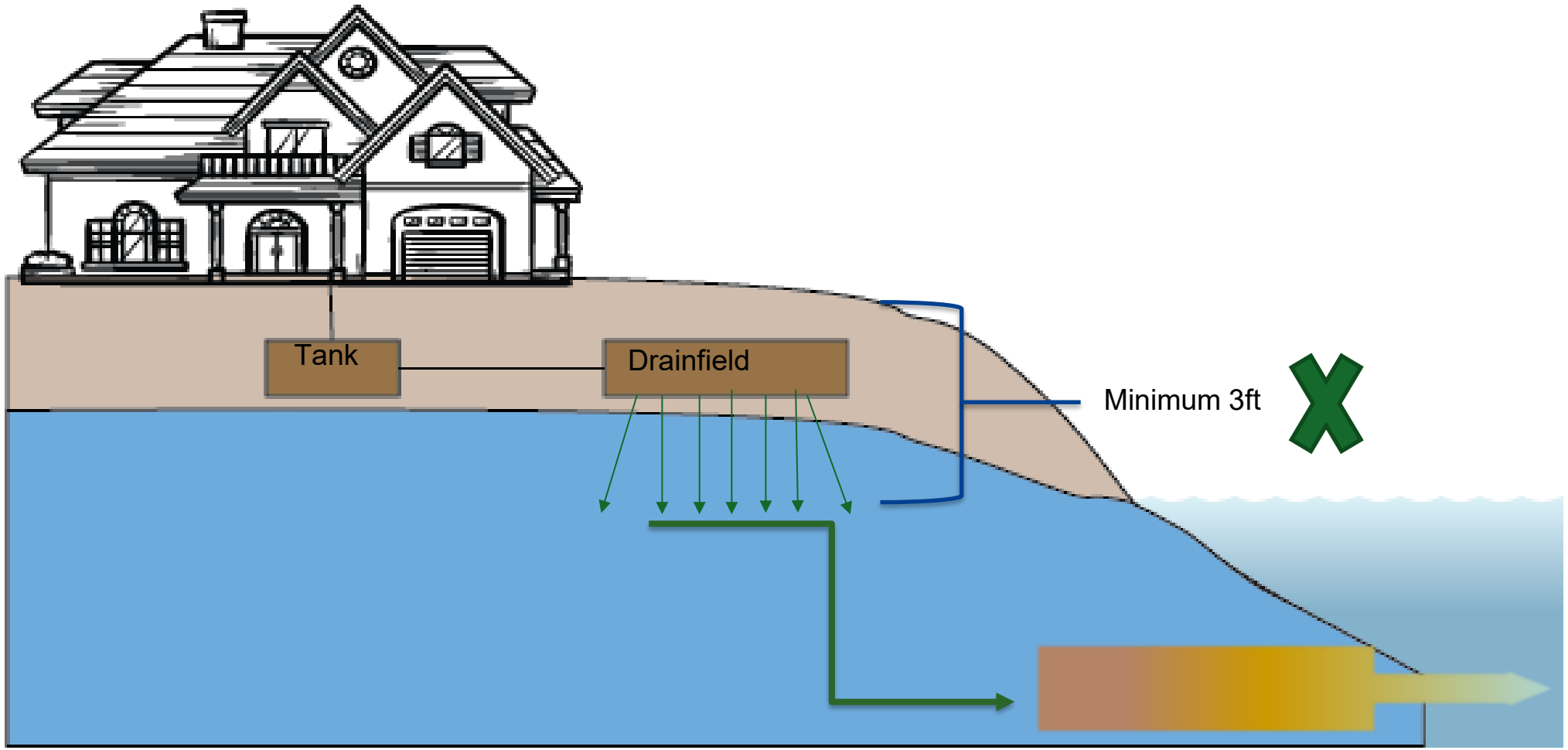


Septic Systems in Coastal Areas

Septic systems in coastal areas, such as the Chesapeake Bay Critical Area, face a unique combination of hazards, many of which are being exacerbated by climate change.



The problem with coastal septic systems



Poll

- **What do you see as the greatest climate-related risk to septic systems?**

Transition to Sewer Systems

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When to Transition

1 Repeated System Failures

Communities are experiencing cumulative or persistent system failures that require multiple repairs within short timeframes, indicating a fundamental inadequacy.

2 Climate Events

Communities are dealing with major climate events that compromise system function, such as rising sea levels or storm surges.

3 Drinking Water Contamination

Pathogens or nitrates are detected in nearby wells, which indicates a serious public health threat.

4 Community Growth

Existing systems operating beyond designed capacity with no remediation potential

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Community-Specific Decision Factors

Population Density & Growth

Higher density (>2 homes per acre) favors centralized solutions; projected growth of >15% in 10 years justifies infrastructure investment

Financial Capacity

Community median income, existing debt ratio, and eligibility for federal/state funding programs determine affordable options

Environmental Conditions

Poor soils, high water tables, or proximity to sensitive waters (<1,000 ft) necessitate advanced treatment

Regulatory Requirements

TMDL implementation plans, groundwater management zones, or special watershed protections may dictate minimum standards

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Connection Options

Connect to Existing System

- ✅ Pros: Economy of scale
- ⚠️ Cons: Inadequate treatment facility capacity
- 💰 Who Pays: Existing users, government program

Build or Extend Conventional Sewer to Centralized Facility

- ✅ Pros: Economy of scale
- ⚠️ Cons: Stimulates new development
- 💰 Who Pays: New development, existing users, government programs

Connection Options

Build Alternative Sewer to Centralized Treatment

✅ Pros: Overall cost savings

⚠️ Cons: Operator training required, economy of scale dependency

💰 Who Pays: Existing users, government programs

Poll

- **What benefit of sewer connection do you consider most important?**

Centralized Sewer Systems

Centralized systems connect homes to a municipal collection network that transports wastewater to a central treatment facility.

- Professional management by trained operators
- Consistent performance monitored through regular testing
- Ability to meet stringent environmental standards
- Economies of scale for larger populations
- Most cost-effective in areas with >4 homes per acre
- Typical treatment capacity: 50,000+ gallons per day

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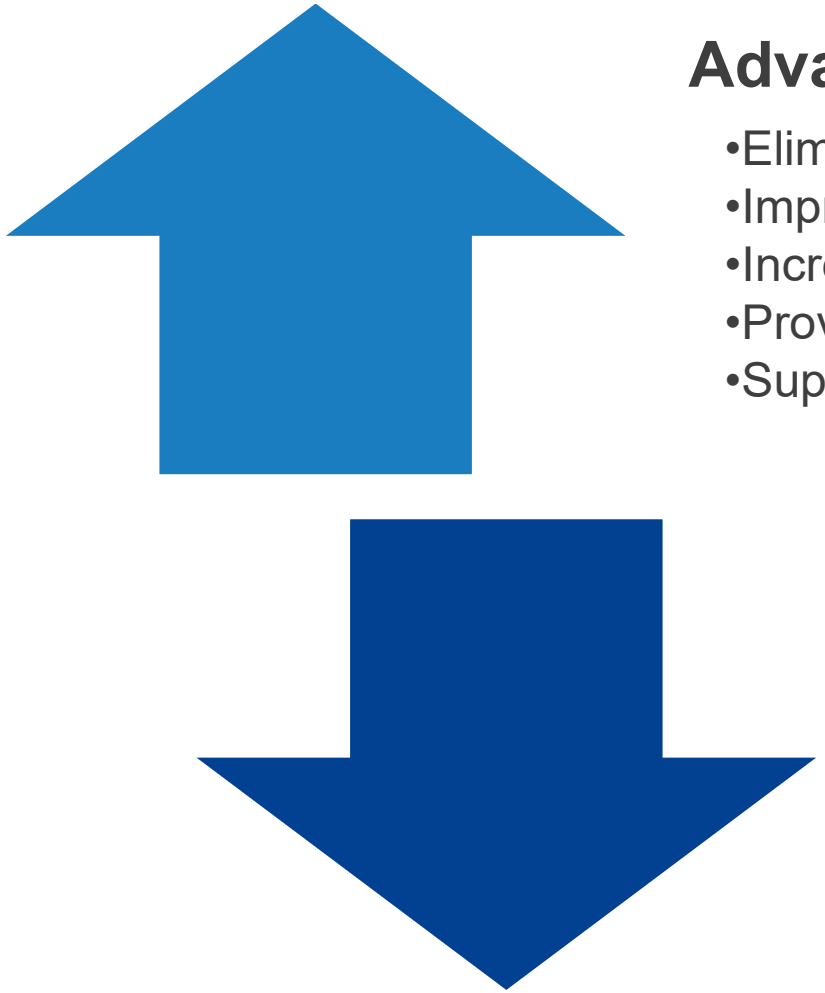
Centralized Sewer Systems



Advantages

- Eliminates individual maintenance responsibilities
- Improves environmental protection with advanced treatment
- Increases property values by 5-10% on average
- Provides long-term stability through shared infrastructure
- Supports future community growth and development

Challenges

- High capital costs: $3,000-$10,000+ per connection
- Ongoing monthly fees averaging per household
- Extensive construction disruption lasting 6-18 months
- Requires municipal capacity for operation and management
- Installation costs increase with distance from existing infrastructure

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Issues in Septic to Sewer Transition

Funding Application Hurdles

- Requires extensive preliminary design for NEPA compliance.
- Land value and easement costs increase project expenses.

Infrastructure Interference

- Locating underground cables and utilities complicates installation.
- Restrictions on road rights-of-way hinder easement acquisition, causing delays.

Easement Challenges

- Resident reluctance to grant easements leads to project redesigns and potential eminent domain actions.

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Upgrading Existing Septic System

Upgrade On-Site System

✅ Pros: Project confined to a single property

⚠️ Cons: Vulnerable to climate impacts

💰 Who Pays: Existing users, government programs

Build Alternative Sewer to Cluster Treatment System

- ✅ Pros: Overall cost savings
- ⚠️ Cons: Vulnerable to SLR, economy of scale issues
- 💰 Who Pays: Existing users, government programs

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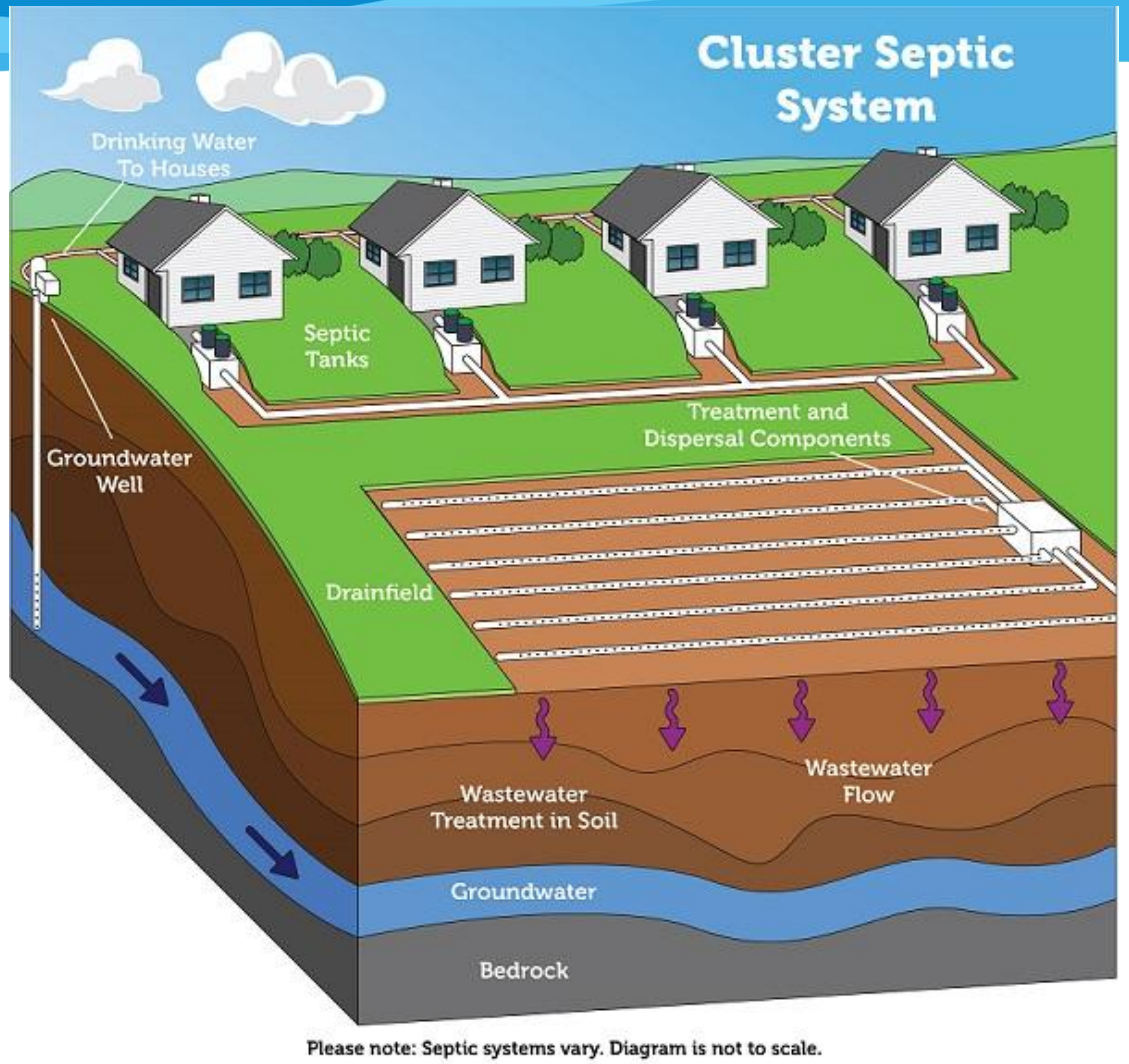
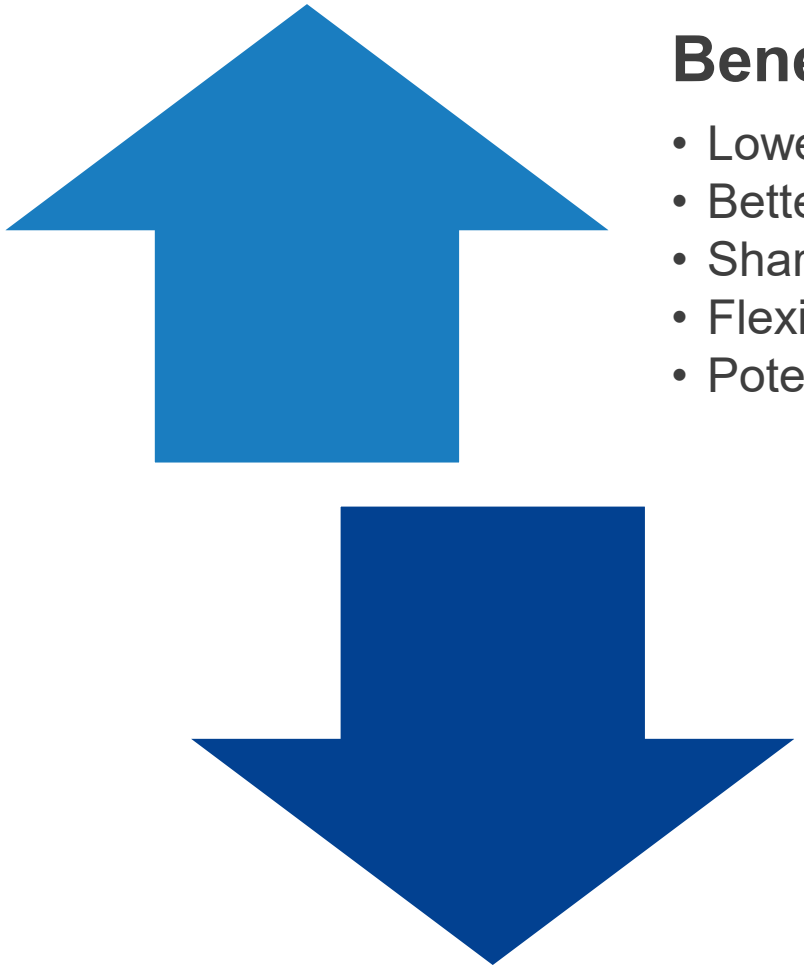
Cluster Systems: The Middle Ground

- Cluster systems serve multiple properties (typically 2-100 homes) with a shared collection and treatment system, offering:
- Better treatment than individual septic systems
- Lower cost than centralized municipal systems
- Typical treatment capacity: **1,500-30,000 gallons per day**
- Ideal for subdivisions, small villages, and lakefront communities



Source: EPA

Cluster System Considerations



Benefits

- Lower per-home costs than centralized systems
- Better treatment than individual septic
- Shared maintenance costs across multiple properties
- Flexibility in siting and design to match local conditions
- Potential for phased implementation to spread costs over time

Challenges

- Ongoing maintenance needs (quarterly to monthly inspections)
- More complex operations than individual systems
- Potential for higher costs if poorly managed
- Limited precedent in some jurisdictions, creating regulatory hurdles

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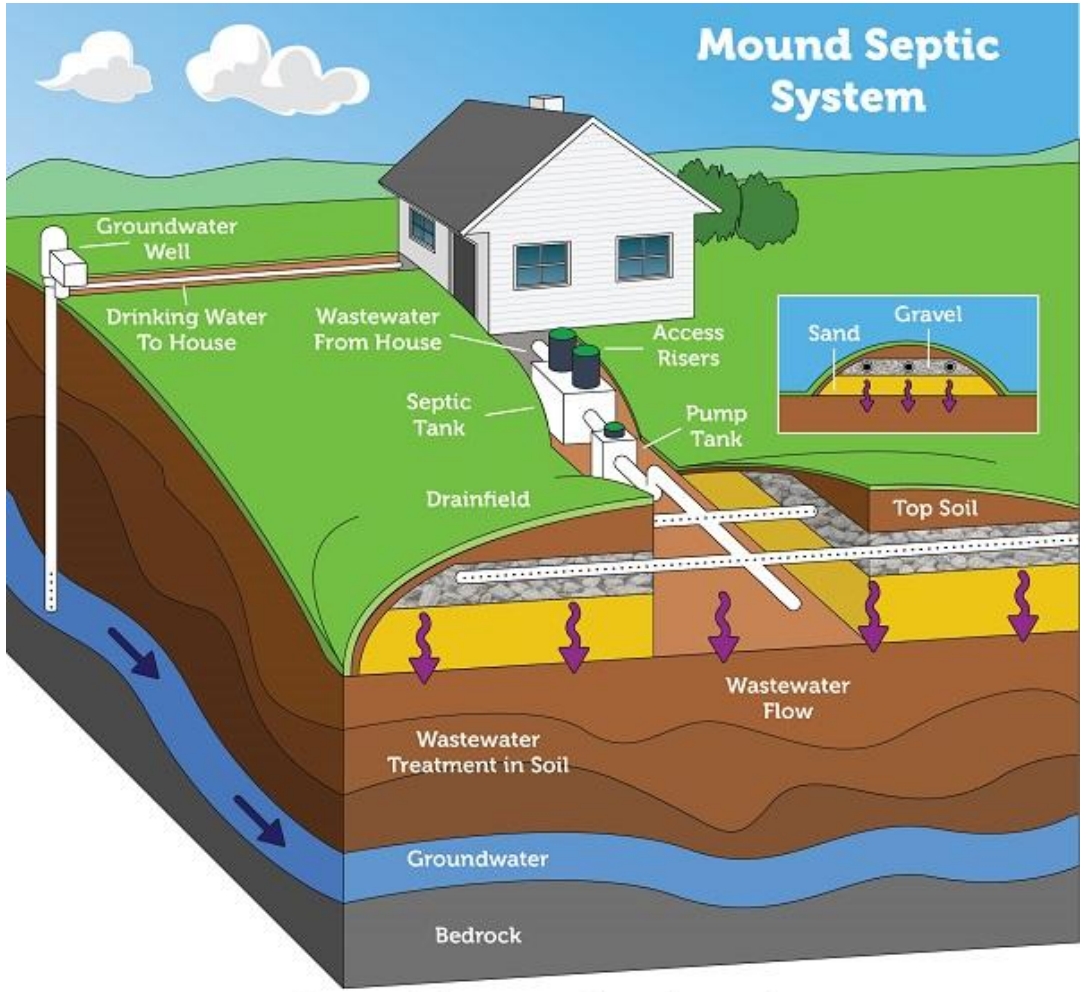
Raised Mound and Elevated Systems

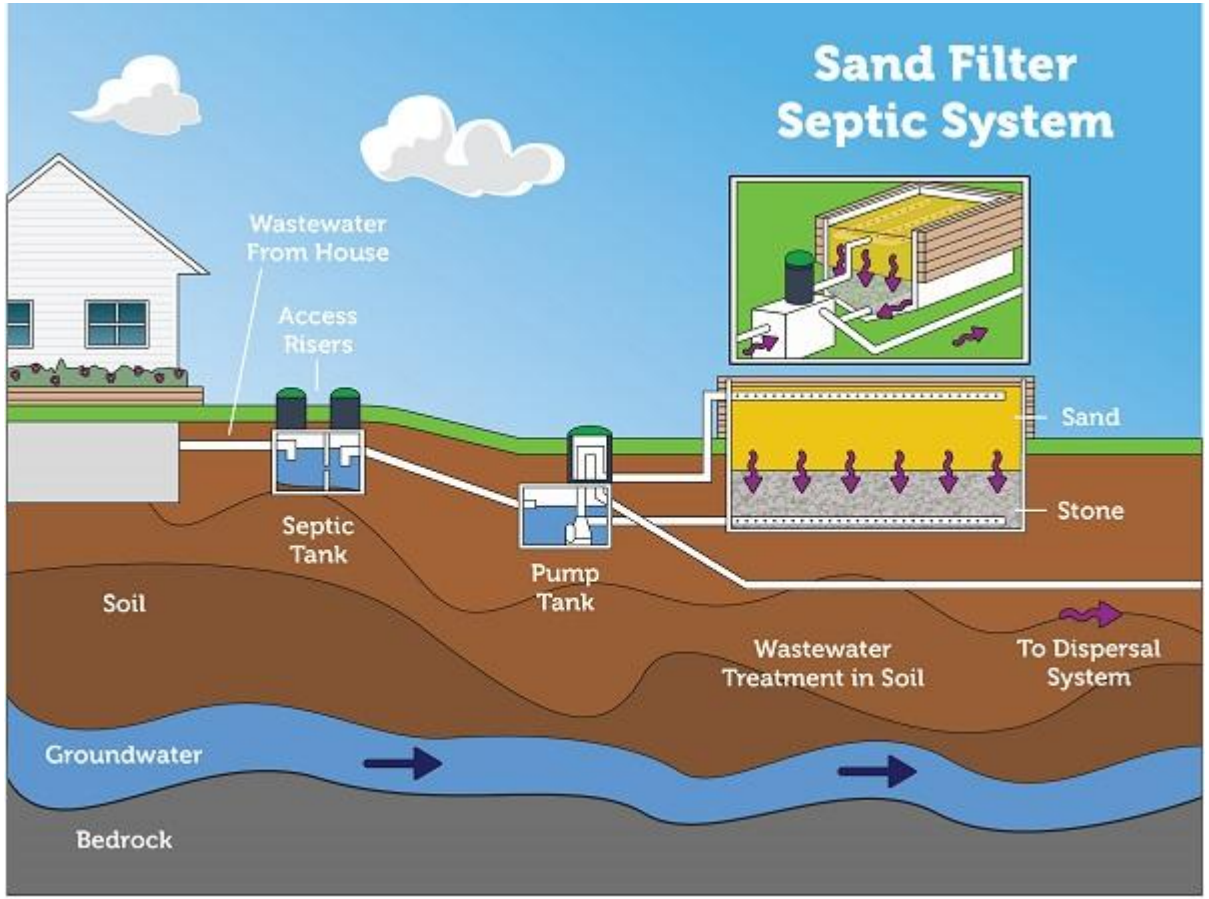
- Raised mound systems are a potential solution for properties with shallow soil depth conditions or high groundwater levels.
- Elevated systems are installed completely above ground and are, therefore, protected from sea level rise.



Source: EPA

Recirculating Sand Filter System

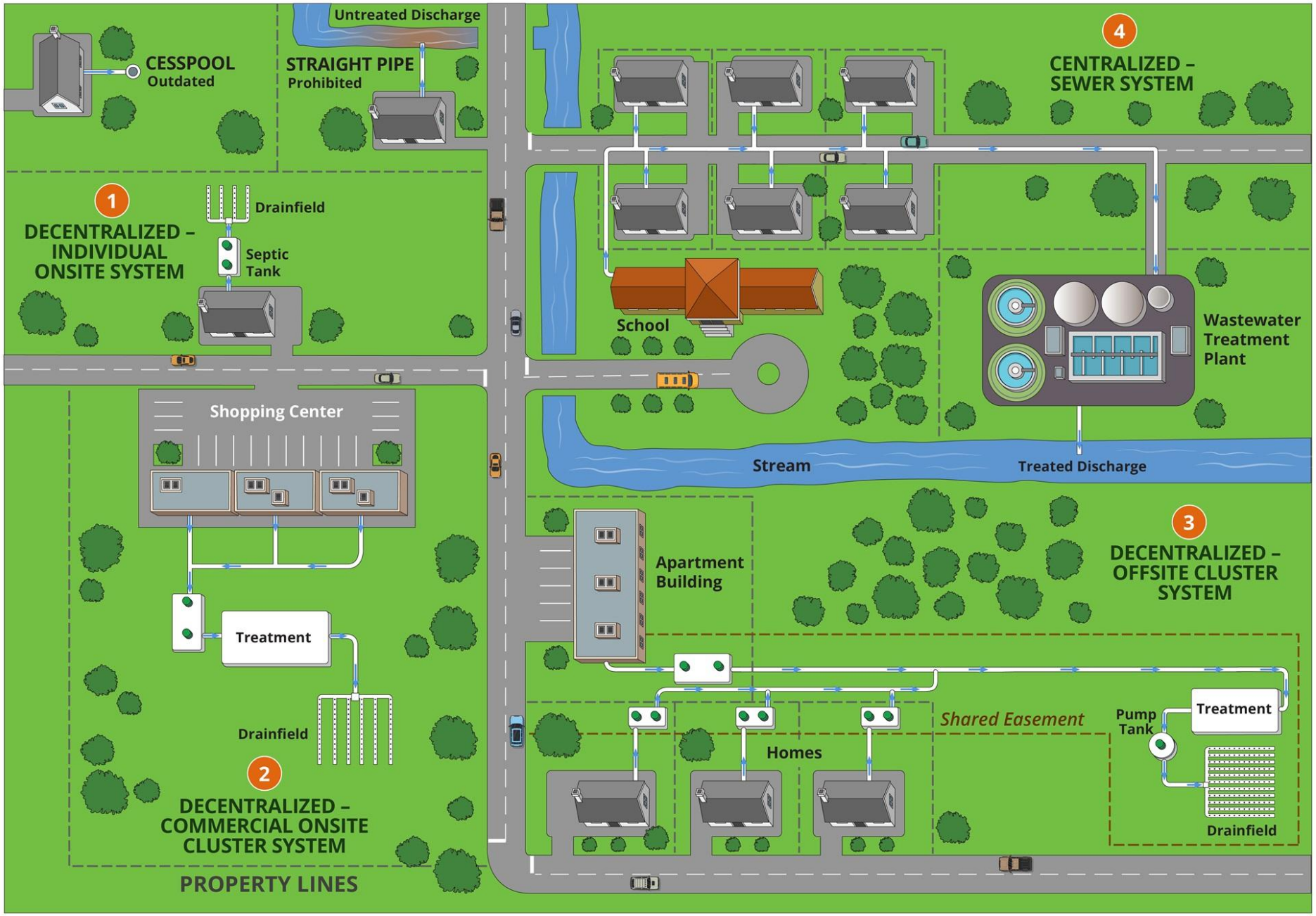
- Sand filters are above or below ground systems using a PVC-lined or concrete box filled with sand.
- Effluent is pumped through pipes, treated as it filters through sand, and discharged to the drainfield.
- They offer high nutrient removal but are more expensive than conventional septic systems.



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

Source: EPA

Four Examples of Decentralized and Centralized Wastewater Treatment



Source: EPA

Planning for Successful Transitions

01

Technical Assessment

Conduct comprehensive feasibility studies and engineering analyses to identify most appropriate solutions for specific site conditions

02

Community Engagement

Build resident and stakeholder support through transparent communication about benefits, timeline, and financial implications

03

Financing Strategy

Develop blended funding approach utilizing grants, low-interest loans, and resident contribution mechanisms when appropriate

04

Long-term O&M Planning

Establish sustainable operation and maintenance protocols with clear responsibility assignments and revenue mechanisms

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Poll

- **In your community, what is the biggest barrier to transitioning from septic to sewer?**

State Programs

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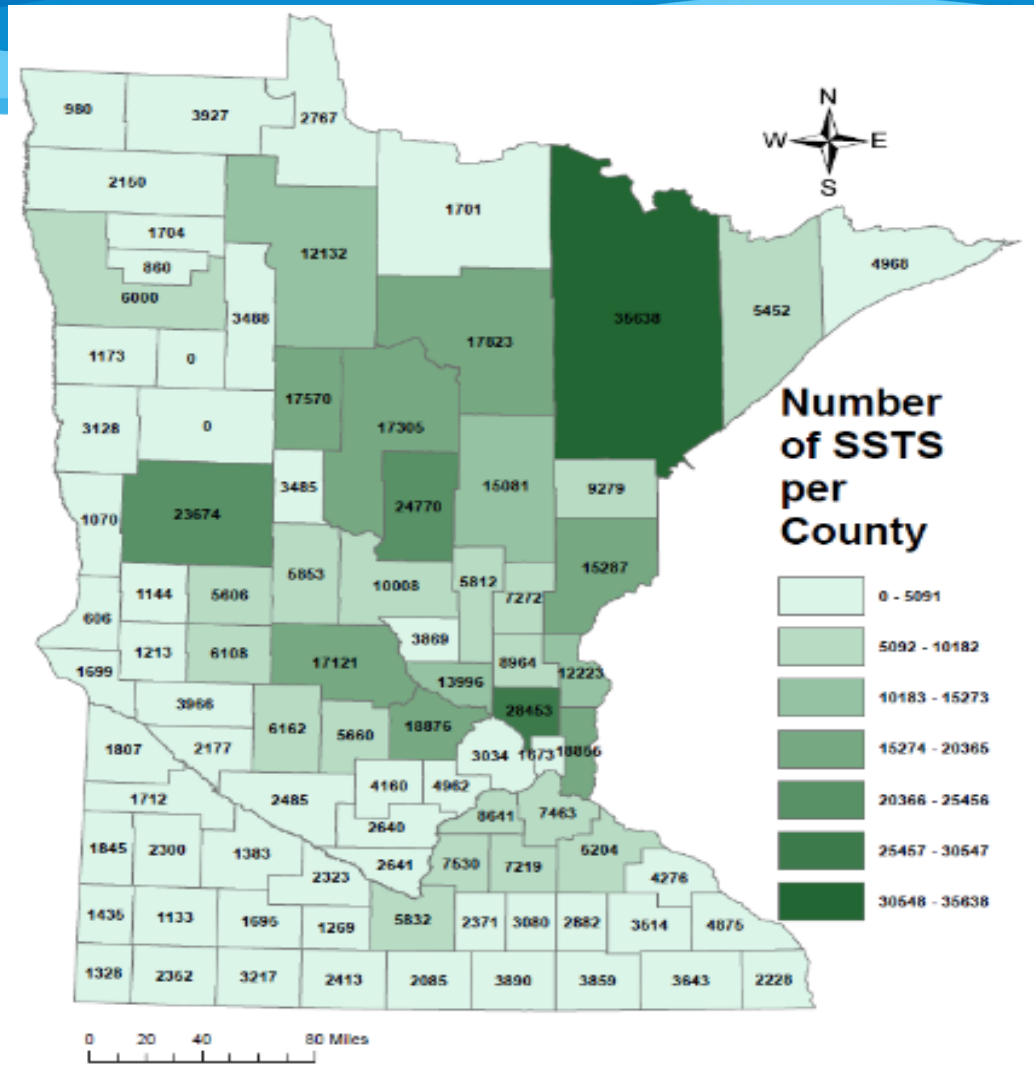
State Septic Database

- Virginia Example of Septic System Data Management
- Florida Onsite Sewage Treatment and Disposal System (OSTDS) Data Management
- Minnesota Septic System Data Collection and Management



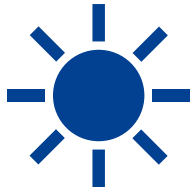
Source: Minnesota Septic System Data Collection and Management

Lessons from Virginia

Data Tracking Works

Targeted Requirement Help

Dedicated Oversight Matters



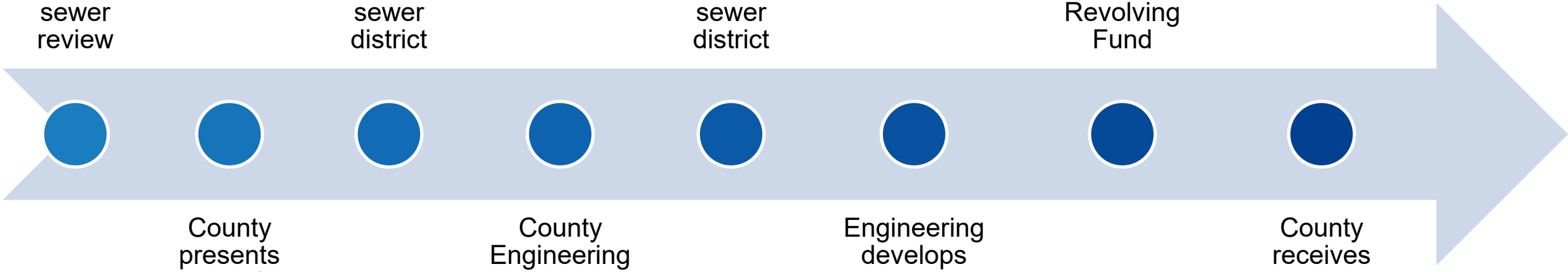
Climate-Stress Insight

Regulation Is Not Enough Alone

Lessons from Delaware

- Delaware runs a dedicated Septic Rehabilitation Grant Program to help low-income homeowners replace failing systems or connect to municipal sewers.
- Grants cover site evaluation, design, permits, construction, and the cost of connection or system abandonment for central sewer transitions.
- Delaware's "Community Septic Elimination Program" at the county level also works to convert clusters of homes or subdivisions

Delaware's Approach



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Florida

- Several homes were converted from septic to advanced central sewer systems as part of FDEP and Monroe County mandates, especially to protect sensitive marine environments.
- Included hybrid systems with both gravity and low-pressure collection technologies, expedited design-build, and phased construction.
- Integrating funding from State Revolving Funds (SRF), county taxes, was key for affordability
- Stakeholder buy-in and clear regulatory timetables ensured completion

California

- Multiple neighborhoods transitioned from individual septic systems to public sewer service using federal and state grant funding.
- Each area project paid construction and connection costs, making conversions “no cost” for many homeowners.
- Proactive outreach, ensuring areas were “shovel ready,” and removing individual financial barriers resulted in rapid adoption and community health improvements.

New York

- A countywide funding program targeting “priority waterbodies,” reimbursing up to half the cost (up to $10,000) for failing septic replacements near lakes, rivers, and estuaries.
- Owner-driven application/inspection process, geographic and condition-based eligibility, no direct income cap.
- Geographic targeting ensures scarce funds address water quality threats efficiently, and clear administrative procedures improve public trust and participation.

Other State Programs

Rhode Island:

- Community Septic System Loan Program (via SRF) provides **low-interest loans** for septic repair, replacement, and sewer connections.

Massachusetts

- Community Septic Management Program funds **local septic management plans** and provides financing to help homeowners upgrade systems.

Key Takeaways

1

Proactive Monitoring

Implement regular inspection programs focusing on high-risk communities before failures occur. Early intervention costs significantly less than emergency response.

2

Education Campaigns

Develop materials specifically for mobile homes, residents and homeowners explaining system maintenance, warning signs, and proper usage practices.

3

Climate Adaptation

Begin incorporating climate change projections into system designs, approvals, and community planning to improve long-term resilience.

4

Financial Assistance

Explore grant programs, low-interest loans, and cost-sharing initiatives to help vulnerable communities upgrade failing infrastructure.

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Resources

- Septic System Types
- Septic System Care and Maintenance
- EPA Webinars on Septic Systems
- Frequently Asked Questions on Septic Systems
- Funding for Septic Systems

Conclusion

Septic Systems Are Vulnerable
Coastal flooding, sea level rise, and heavy precipitation are increasing septic failures.

Data Collection & Monitoring Are Essential
Tracking failures and pump-outs enables better planning and risk assessment.

Sewer Conversion Can Be a Solution
But must be balanced with careful land-use planning to avoid promoting development in flood-prone areas.

Equity & Affordability Are Critical
Grants, loan programs, and cost-sharing help ensure low-income communities are not left behind.

Policy & Technical Assistance Matter
Centralized state offices, strong regulations, and coordinated funding mechanisms support long-term resilience.

Long-Term Risk Management Needed
Routine maintenance reduces emergencies, but climate-driven risks require systemic and proactive solutions.

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Questions?

This program is made possible under a cooperative agreement with US EPA.

Contacts

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