People Caring About Water

A to Z

April 2-4, 2019
Mystic Marriott Hotel
Groton, Connecticut

NOWRA
National Onsite Wastewater Recycling Association

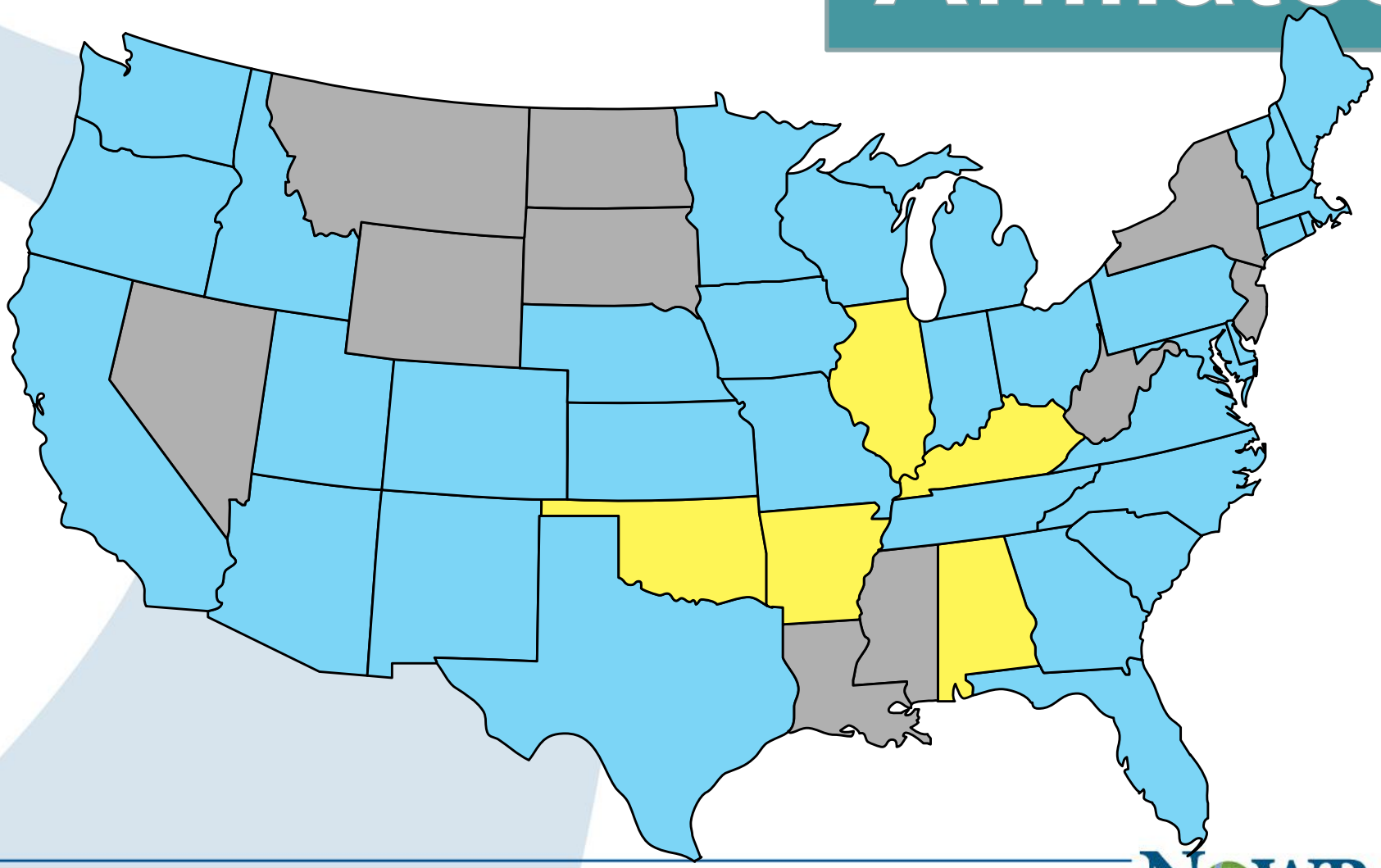
NOWRA Instructors and Class Information

- Instructors
  - John Buchanan, University of Tennessee
  - Sara Heger, University of Minnesota
  - Randy Miles, University of Missouri
  - Tom Fritts, Residential Sewage Treatment
- Presentation handouts

Goals & Mission

To strengthen and promote the onsite and decentralized wastewater industry through activities that support recognition and promotion of professionalism for industry practitioners.

Affiliates

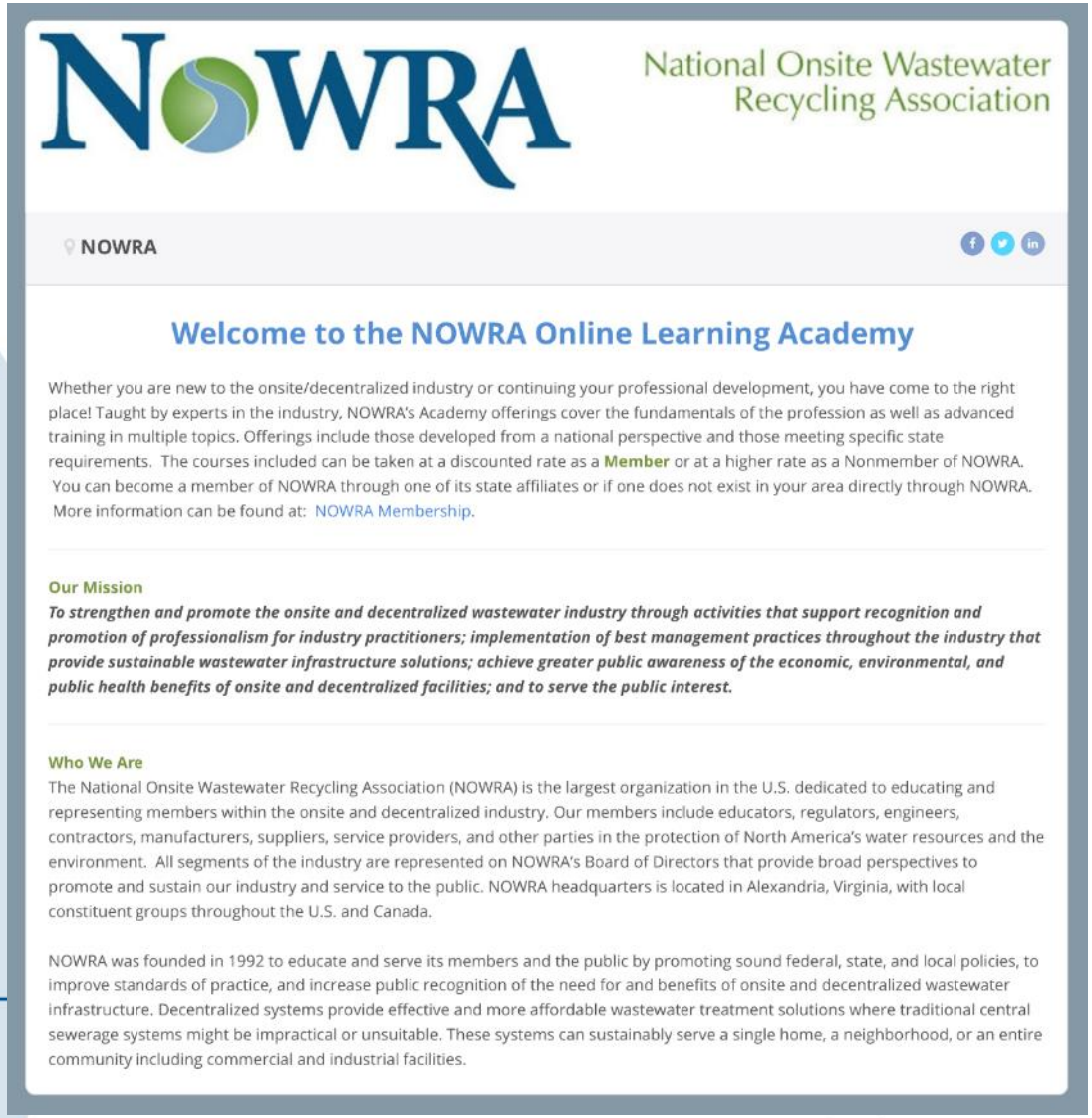


Blue = NOWRA Affiliates • Gold = Non-affiliated • Grey = No Association

Online Learning Academy

Log on to:

www.pathlms.com/NOWRA



Lobbying Objectives

1. Increase market share 30% to 35%
2. Secure a larger share of existing federal funding
3. Get EPA to change policies

Congratulations NOWRA MEMBERS!

America's Water Infrastructure Act passed Congress on October 12, 2018

Thank you to NOWRA's Federal Lobbying Board of Governors who supported this effort!

BIO MICROBICS
The Septic Experts Since 1982 CREWS ENVIRONMENTAL
INFILTRATOR water technologies
Jet Wastewater Treatment Solutions
norweco
Orenco SYSTEMS
Residential Sewage Treatment Company
Roth
SALCOR, INC.
SIEP Rhombus

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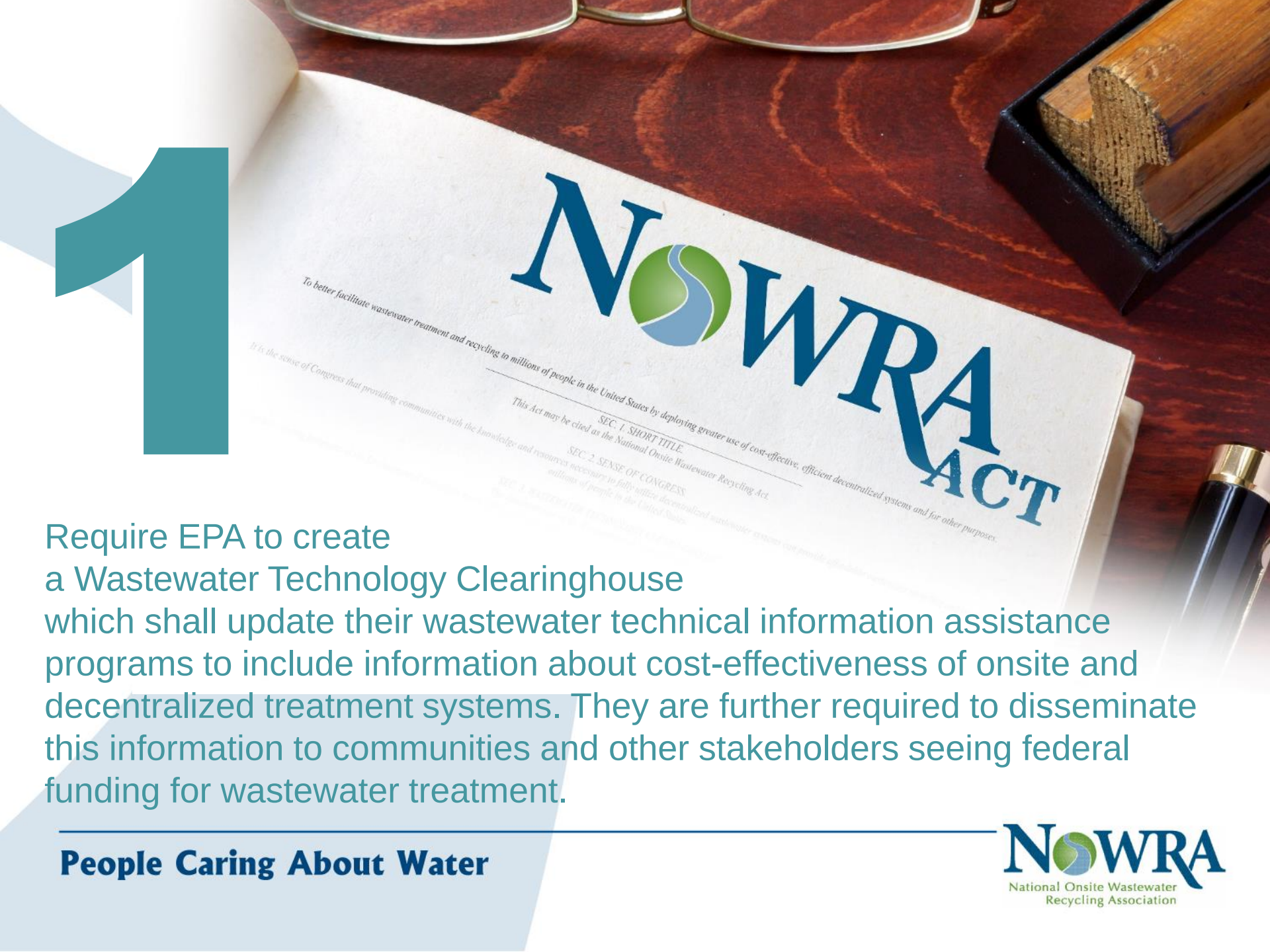
The NOWRA Act Will Do Three Things



1

Require EPA to create
a Wastewater Technology Clearinghouse
which shall update their wastewater technical information assistance programs to include information about cost-effectiveness of onsite and decentralized treatment systems. They are further required to disseminate this information to communities and other stakeholders seeing federal funding for wastewater treatment.

2

Require communities of 2,500 people or fewer self-certify that they have considered onsite and decentralized systems before they make a treatment decision.

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3

One year after the bill's passage, EPA must provide a Report to Congress which describes

- How much SRF money has gone to deploy decentralized systems.
- The barriers to greater usage of onsite and decentralized technologies
- The cost-savings and environmental benefits of further deployment of these technologies
- What EPA is doing to help states identify eligible projects which are using decentralized technology.


Annual Conference
IN 2019
ALL ROADS LEAD TO Colorado!
Save the Date!
2019 ONSITE WASTEWATER
MEGA-CONFERENCE
OCTOBER 13-16, 2019
Loveland, Colorado
A partnership between NOWRA and CPOW (Colorado Professionals in Onsite Wastewater)

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A to Z
Septic System Treatment Overview

Sara Heger

NOWRA
National Onsite Wastewater Recycling Association

From outdoor plumbing to water reuse

EVOLUTION OF WASTEWATER TREATMENT GOALS

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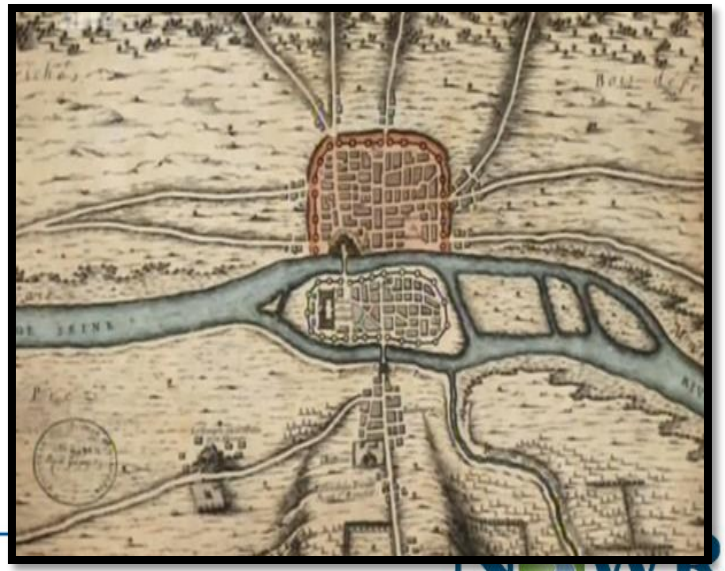
Truly Lets Start at the Beginning

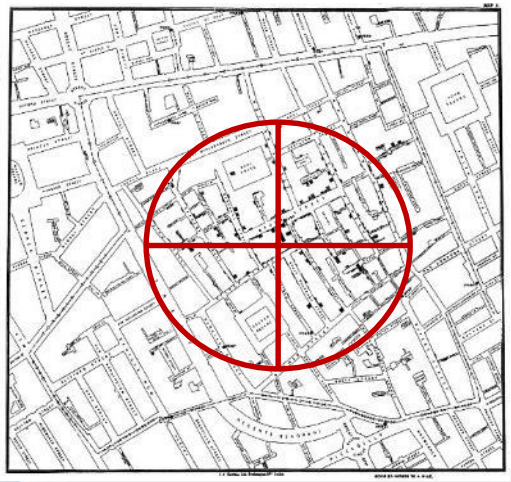
Deuteronomy 23:13 NIV

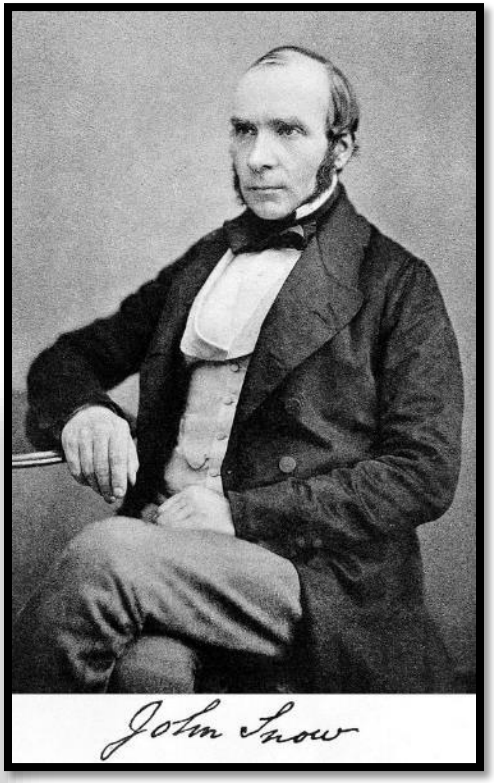
”As part of your equipment have something to dig with, and when you relieve yourself, dig a hole and cover up your excrement.”



Public Health Historical Perspective

- **John Snow**
  - Father of Epidemiology
  - London 1854 cholera outbreak
  - 500 fatal cases, 10 days
  - Linked to Broad St. pump
    - First link to water
- **Robert Koch**
  - 1883 isolated bacterium
  - *Vibrio cholerae*



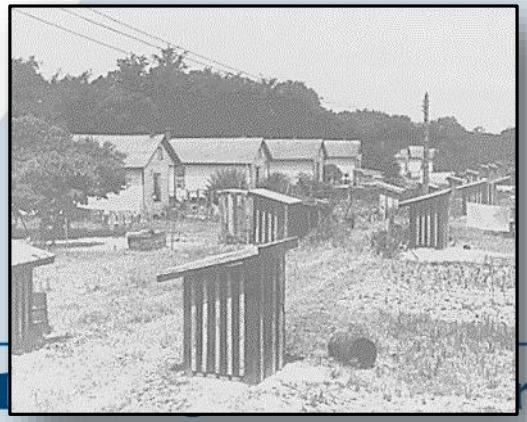


Onsite Sewage Disposal

~1900's Construction of Privies was a major milestone in reducing illness from water-borne diseases

EH Risks

Cholera
Typhoid
Dysentery
Hepatitis
Eutrophication of Lakes



Outdoor Plumbing: the pit privy

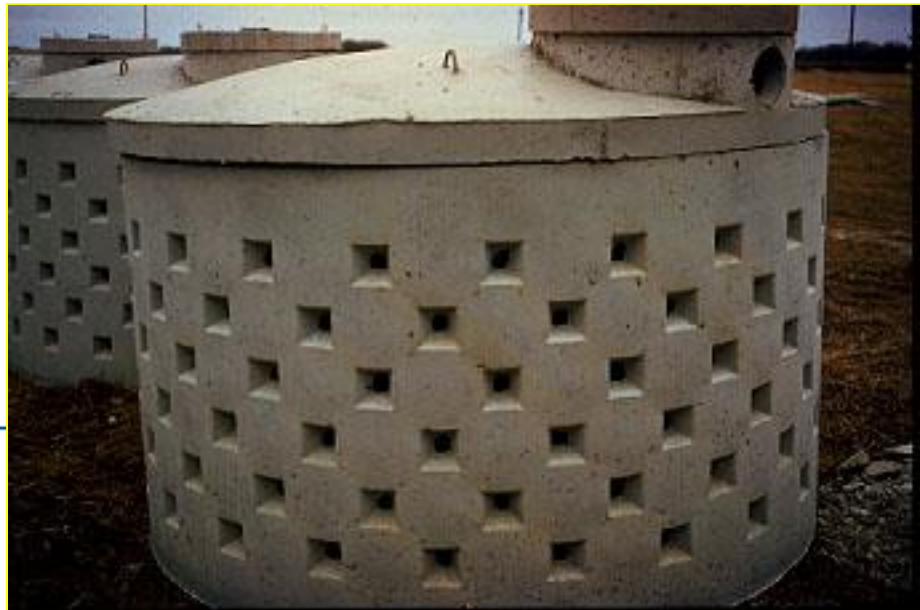
- Goal: designated place
- No carrier needed to convey waste
- Waste applied directly to the soil
- Public health concerns addressed
- Management: relocate

Indoor Plumbing

- Convenience
- Water carrier to convey waste out of facility
- ‘Collection system’
- Public health and pathogens
- Management: keep pipe flowing

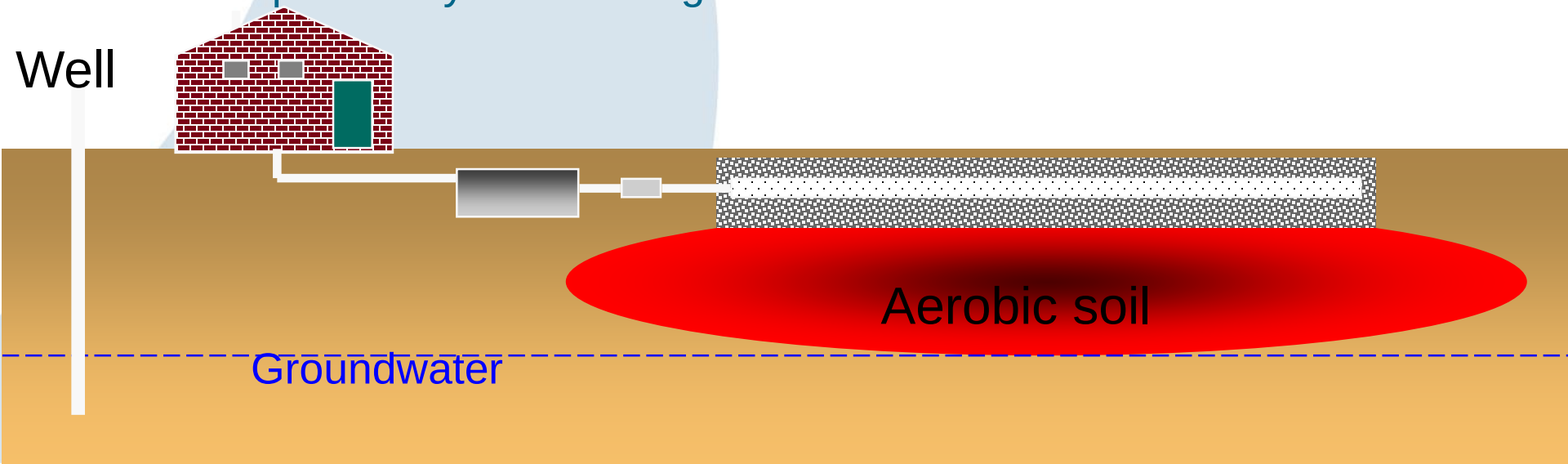
Disposal

- Goal: limit human contact
- Keep wastewater below ground
- Disposal options
- Public health
  - “Disposing” of pathogens
  - Treatment?
- Management: ~~install, flush and forget~~



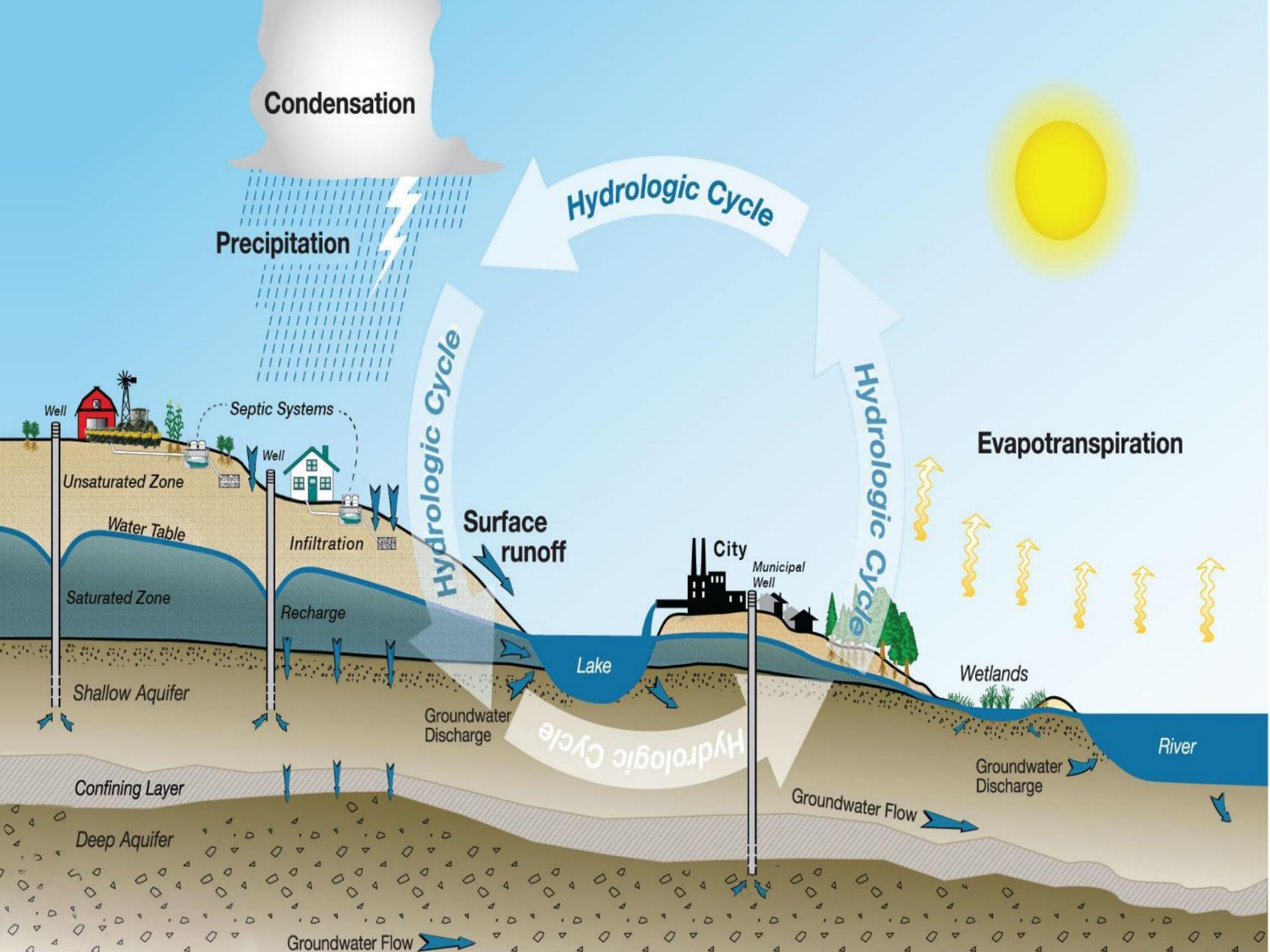
Septic Tank & Soil Treatment Area

- Evolving goal:
  - Disposal: effluent goes away versus
  - Dispersal: TREATMENT
- Public health AND environmental issues addressed
- Management:
  - Disposal: often none at all;
  - Dispersal: System management is critical



Goal: Treatment AND Dispersal

- Address environmental concerns in addition to public health concerns
- Technological advancements now allow removal of:
  - Pathogens
  - Solids
  - Nutrients
- System management is vital to treatment
- Goal is now DISPERSAL
  - Hydrologic cycle

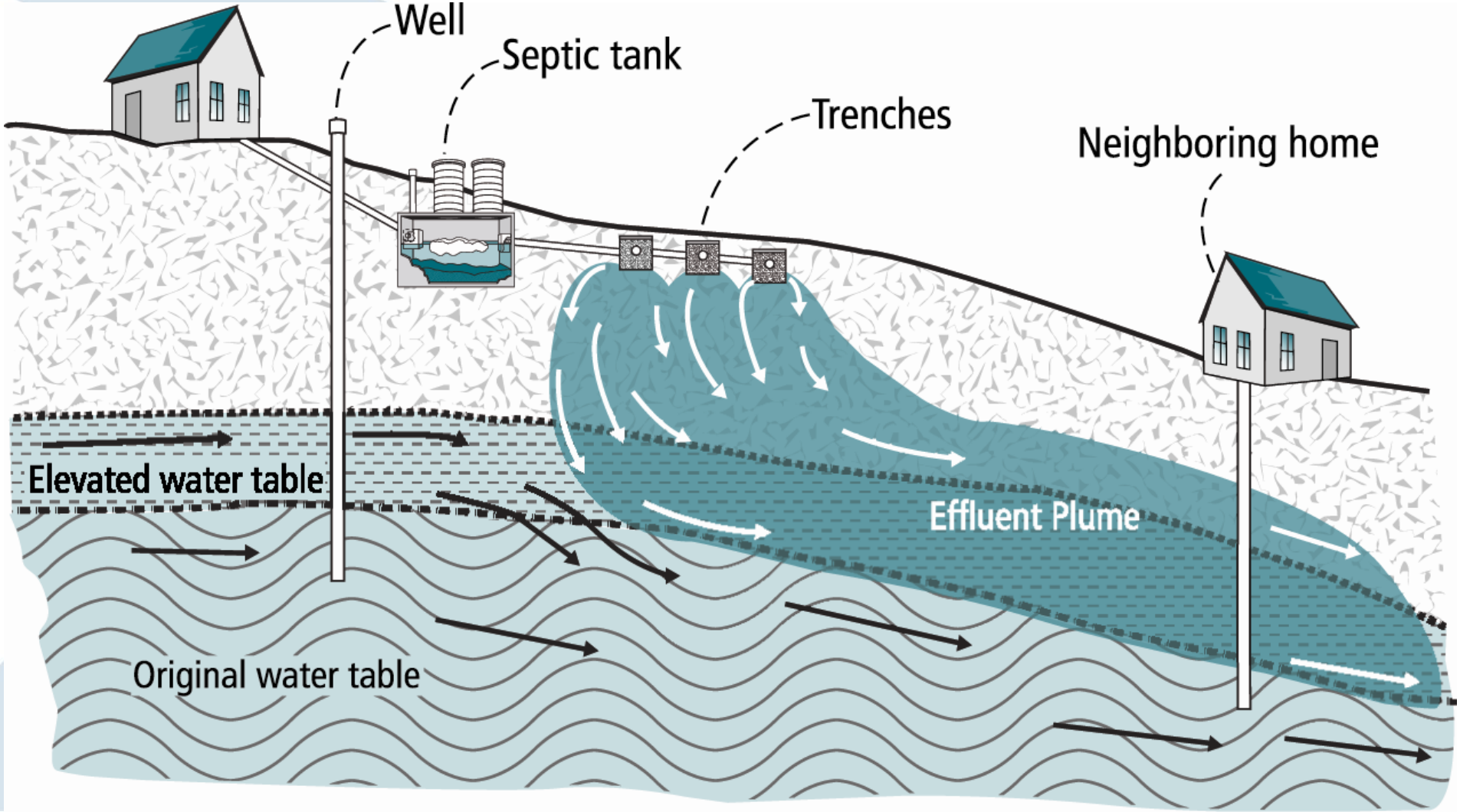

Condensation
Precipitation
Hydrologic Cycle
Hydrologic Cycle
Hydrologic Cycle
Hydrologic Cycle
Evapotranspiration
Well
Septic Systems
Well
Unsaturated Zone
Water Table
Saturated Zone
Infiltration
Recharge
Surface runoff
City
Municipal Well
Lake
Wetlands
River
Shallow Aquifer
Groundwater Discharge
Groundwater Discharge
Confining Layer
Deep Aquifer
Groundwater Flow
Groundwater Flow

Reuse

- Goal: careful use of a valuable resource
- Wastewater vs. water
- Potable vs. Non-potable uses
  - Landscape reuse
  - Toilet flushing
  - Some areas are looking at it as potable
- Management: O&M is Even More Critical

What is Wastewater?

All wastewater must be treated



So What's in Wastewater?

TABLE 4-1 Chemical and Microbial Quality of Untreated Graywater from Individual and Combined Sources

Parameter	Bathroom	Laundry	Kitchen Sink and Dishwasher	Graywater Combined (excludes kitchen water)
Physical				
Temperature (°C)	29	28-32	27-38	
Turbidity	28-240	14-210		15-140
Total suspended solids (TSS), mg/L	54-200	120-280	240-2,400	
Total dissolved solids (TDS), mg/L	140-1,300			310-930
Electrical conductivity (µS/cm)	82-250	190-1,400		
Chemical				
pH	6.4 – 8.1	8.1-10	6.3-7.4	6.7-7.6
Alkalinity	24-67	83-200	20-340	150-200
BOD_5 (mg/L)	26-300	48-380	1,000-1,500	125-250
COD (mg/L)	100-630	13-720	3.8-1,400	250-430
Total organic carbon (mg/L)	30-100	100-280	600-880	
Sodium absorption ratio				2.3 - 6
Boron (mg/L)				0.1-1.6
Chloride (mg/L)	9.0-19	9.0-90		22-34
TN (mg/L)	5-17	6-21	0.3-74	0.6-5.2
TP (mg/L)	0.1-4	0.1->100	68-74	
PO_4 (mg/L)	0.94-49	4-170	13-32	4-35
NH_4 (mg/L)	<0.1-15	0.04-11	0.005-6	0.15-3.2
NO_3 (mg/L)	0.28-6.3	0.4-2	0.3-5.8	0-4.9
Anionic surfactants (mg/L)	21	92	6	
Microbial				
Total coliform/100 mL	$10^{2.7}$-$10^{7.4}$	$10^{1.9}$-$10^{5.2}$	10^{7}-10^{9}	$10^{7.2}$-$10^{8.8}$
Pseudomonas aeruginosa/100 ml				1.99×10^{4}
E. coli/100 mL	$10^{1.6}$-$10^{3.4}$	$10^{1.5}$-$10^{3.9}$	$10^{5.4}$-10^{9}	
Cryptosporidium spp.	no detection	no detection		

NOTE: Graywater as defined in this report does not include kitchen water.

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Three Approaches to Wastewater Treatment

1) Centralized

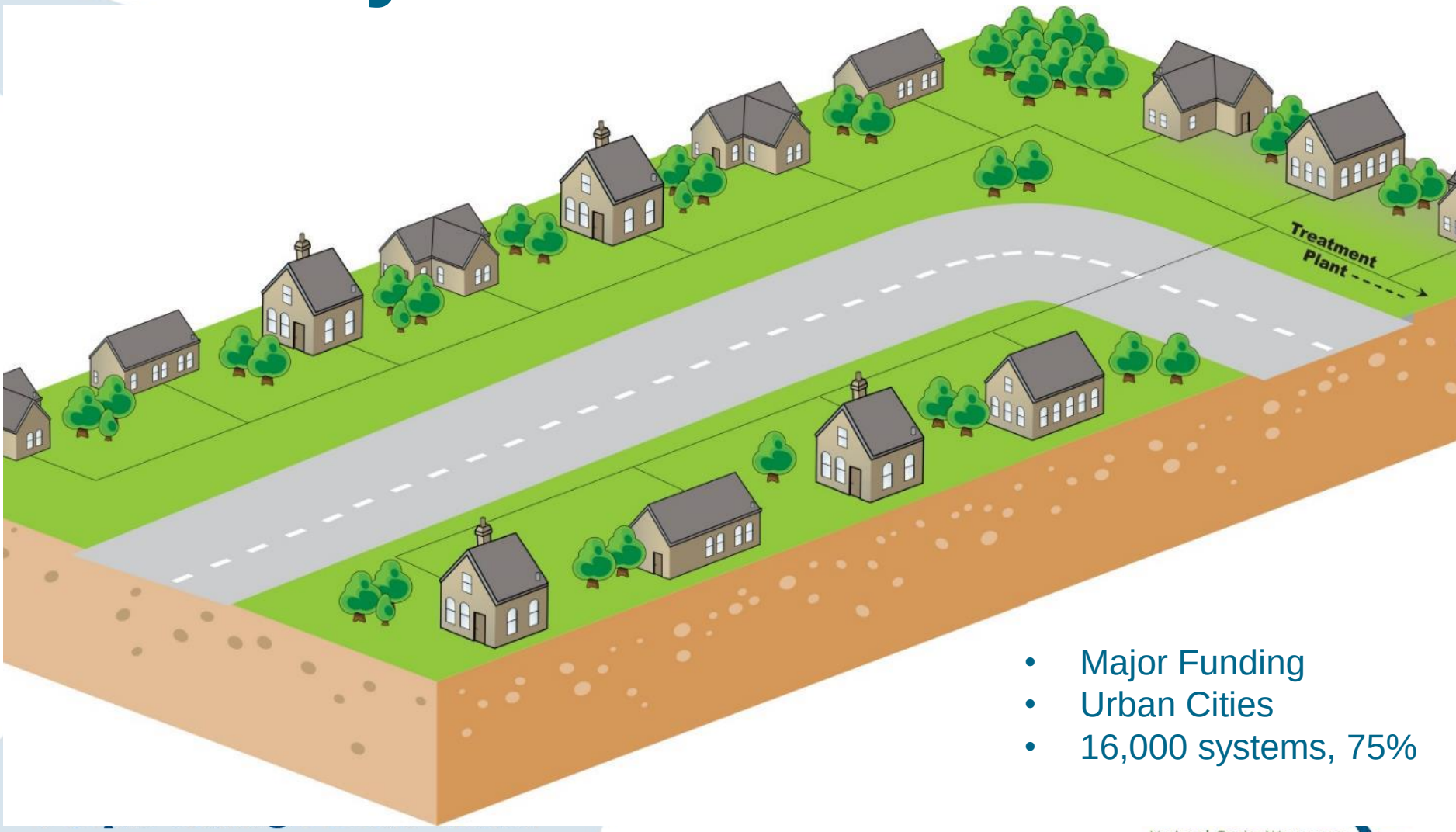
- Collection network for many homes
- Central treatment facility
- Discharge – surface requires state permit

2) Decentralized

- Individual or small group of homes
- Onsite treatment facilities (near site)
- Soil based dispersal or subsurface discharge

3) Combination

Centralized Systems



- Major Funding
- Urban Cities
- 16,000 systems, 75%

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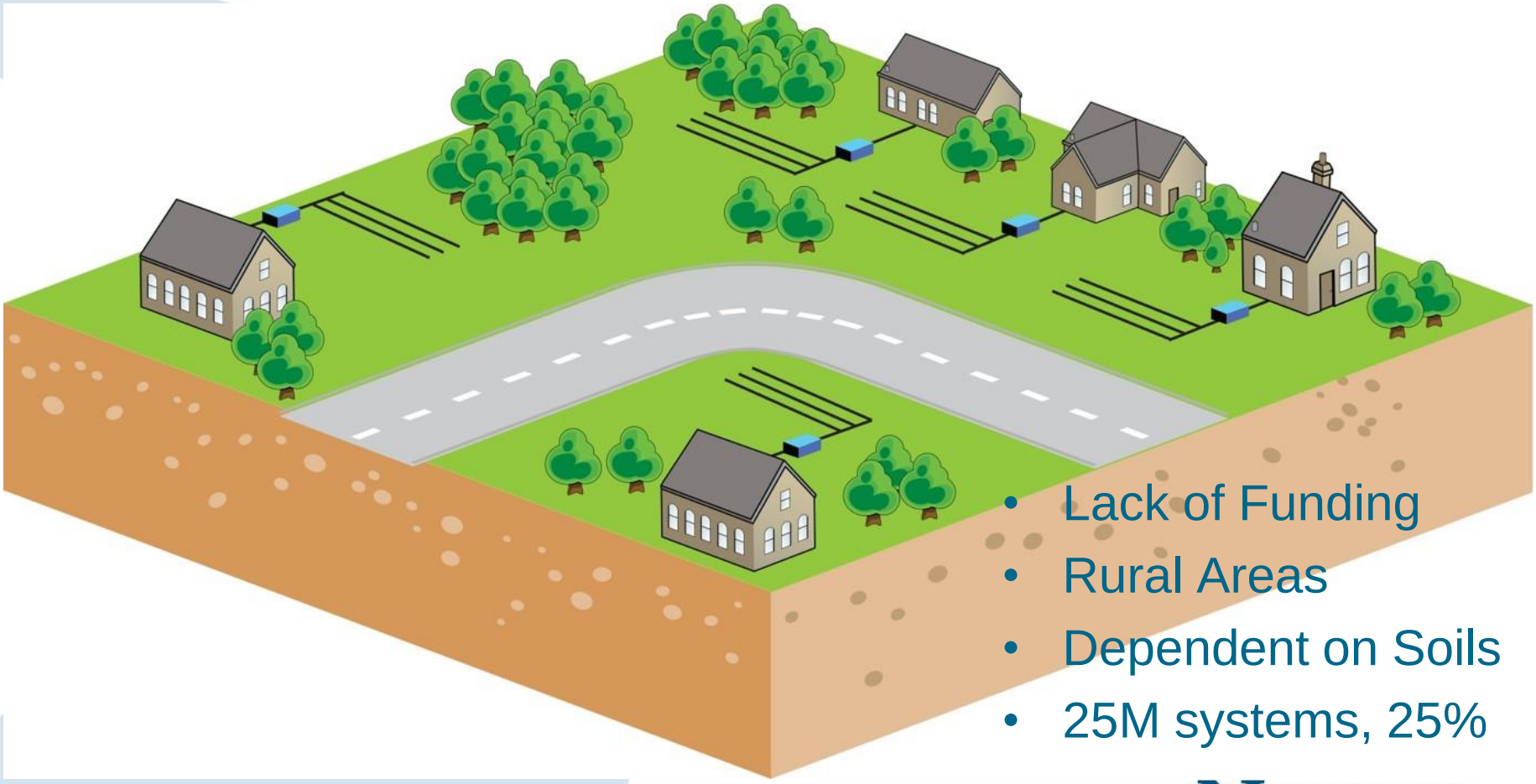
Decentralized Systems



- Lack of Funding
- Rural Areas
- Dependent on Soils
- 25M systems, 25%

Advantages of Decentralized Systems

- More cost effective (lower capital costs)
- Simple, easier to maintain
- Lower O&M requirements
- Lower energy requirements
- Can be designed for a variety of site, size and soil conditions
- Enhanced opportunities for wastewater reuse
- Greater opportunities for ‘green development’

Decentralized Approach

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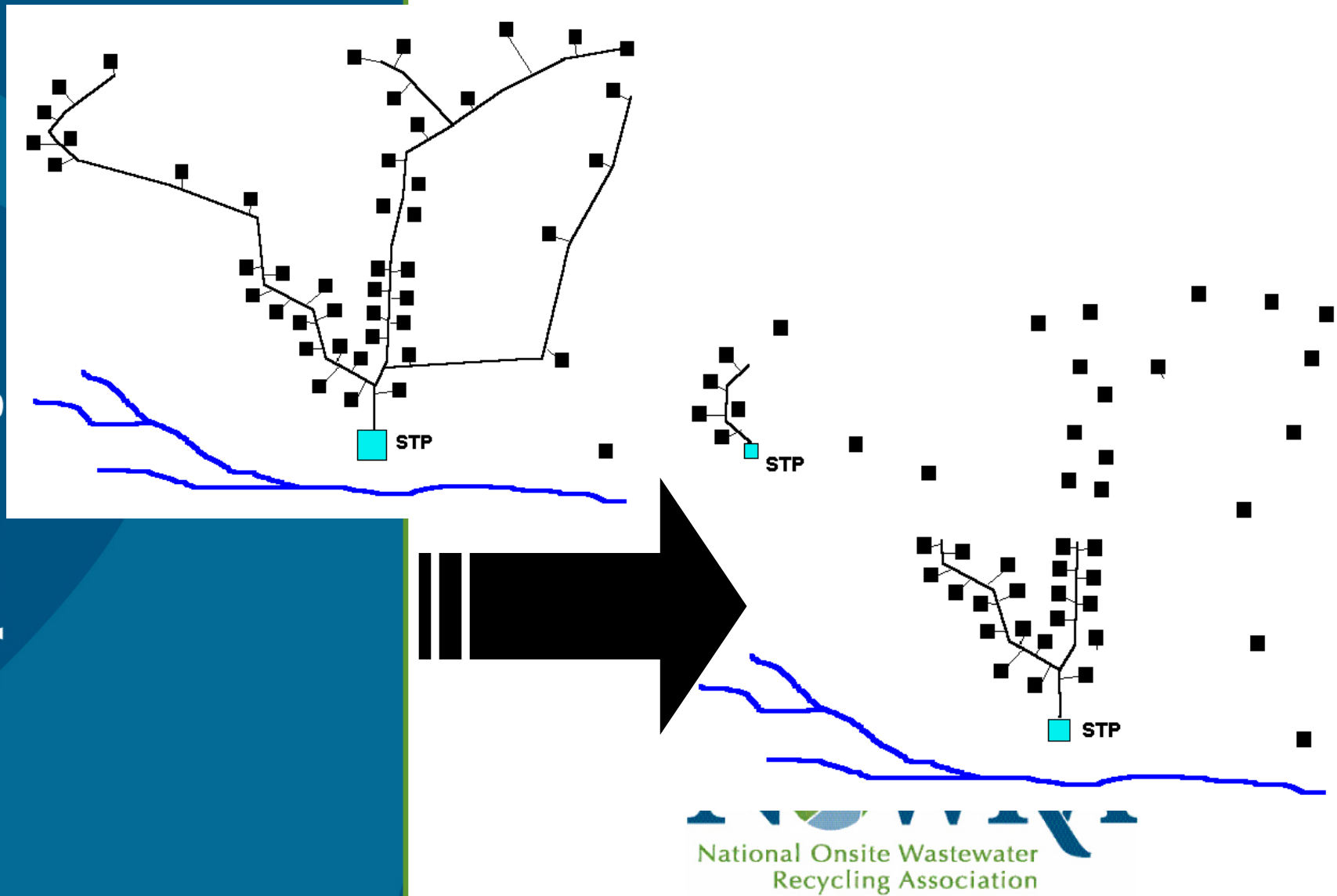

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Decentralized Treatment is Important Nationally

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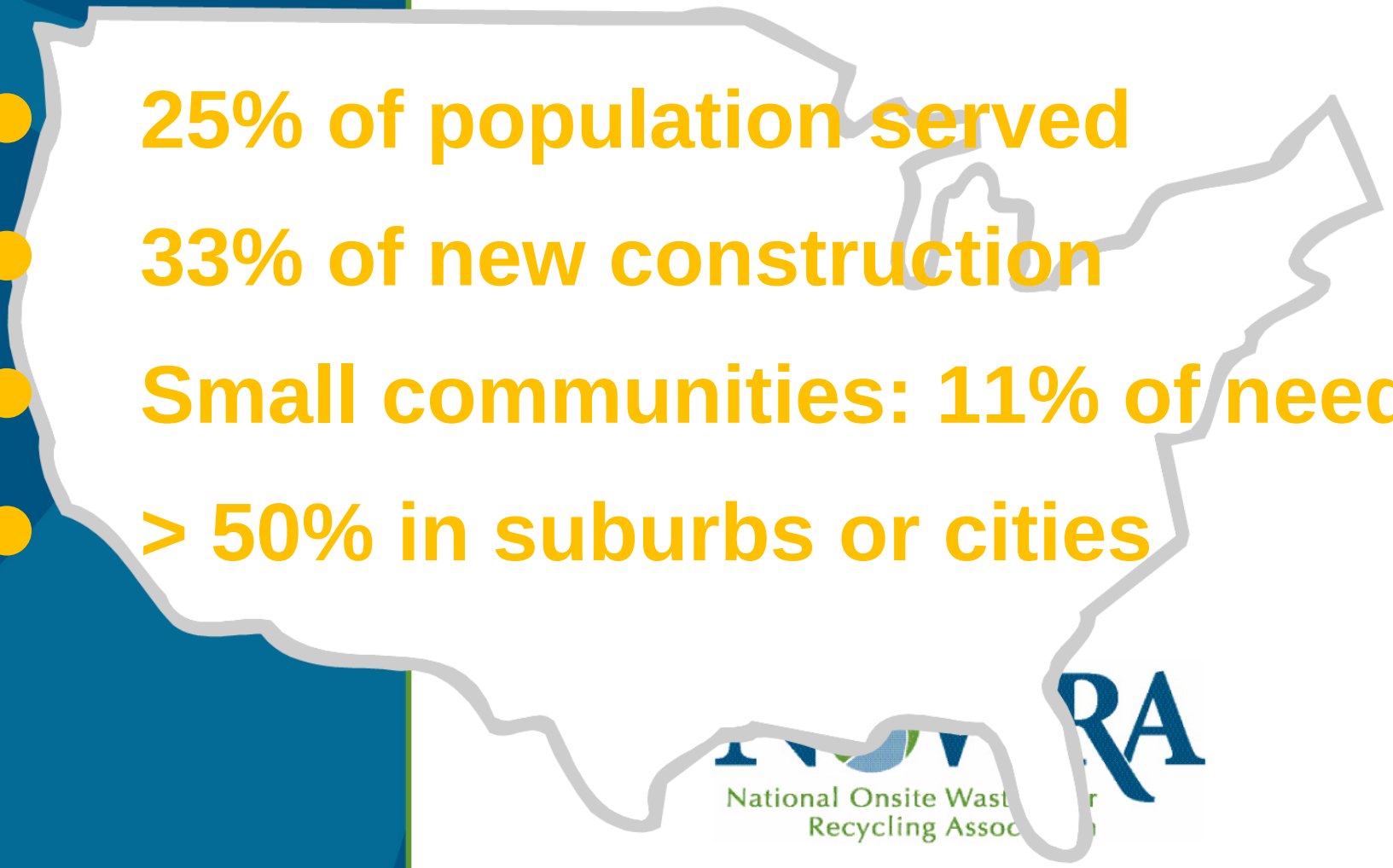
- 25% of population served
- 33% of new construction
- Small communities: 11% of need
- > 50% in suburbs or cities



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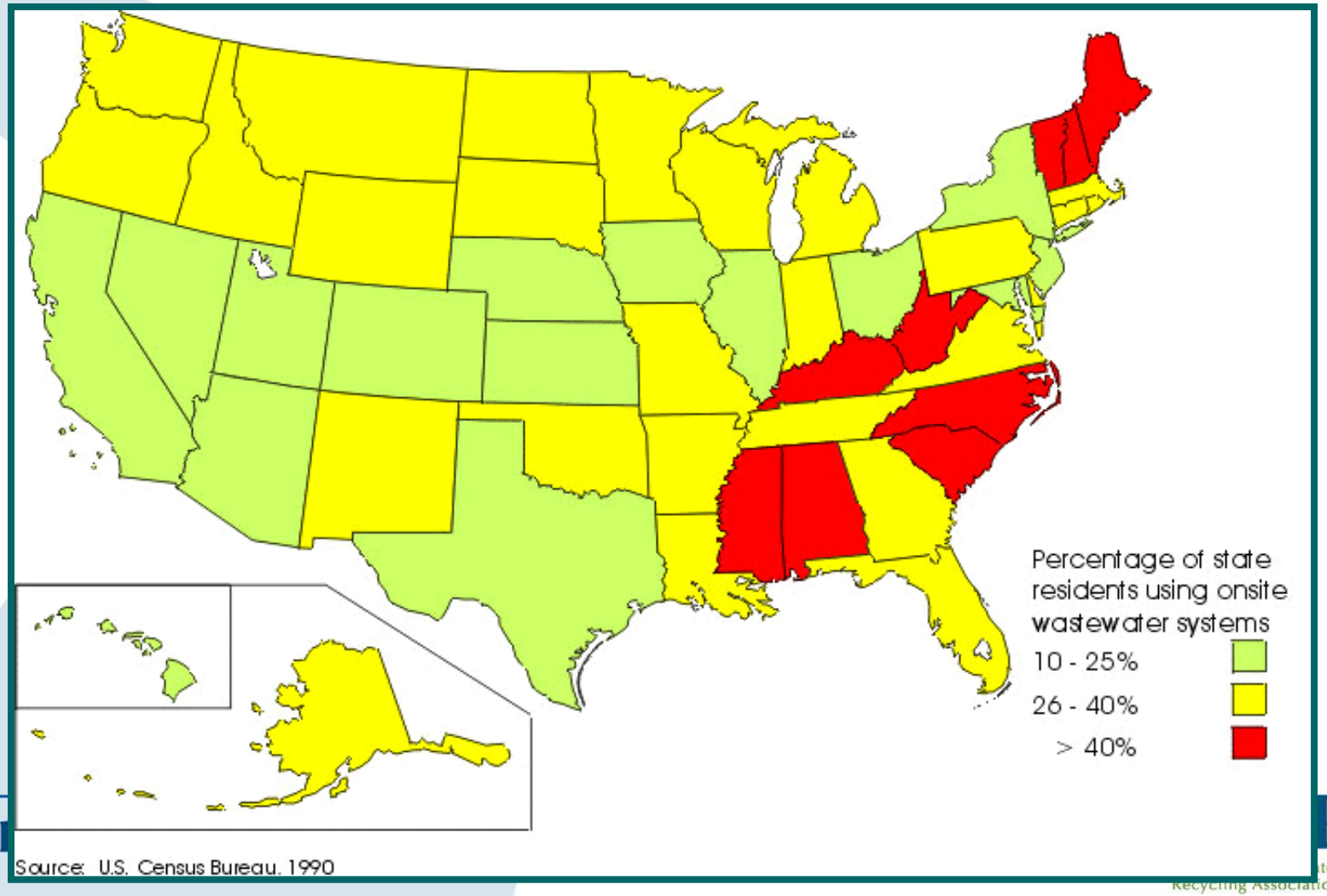
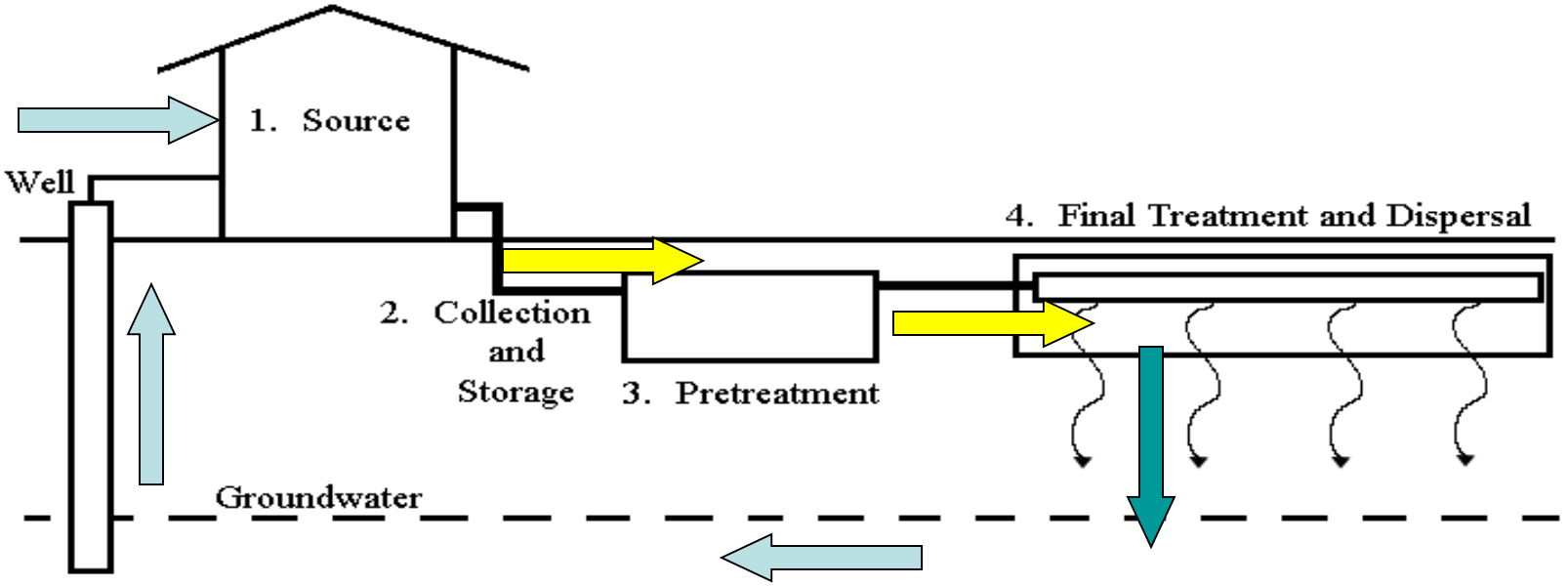
Recycling Assoc

Where Septic Systems Are Used



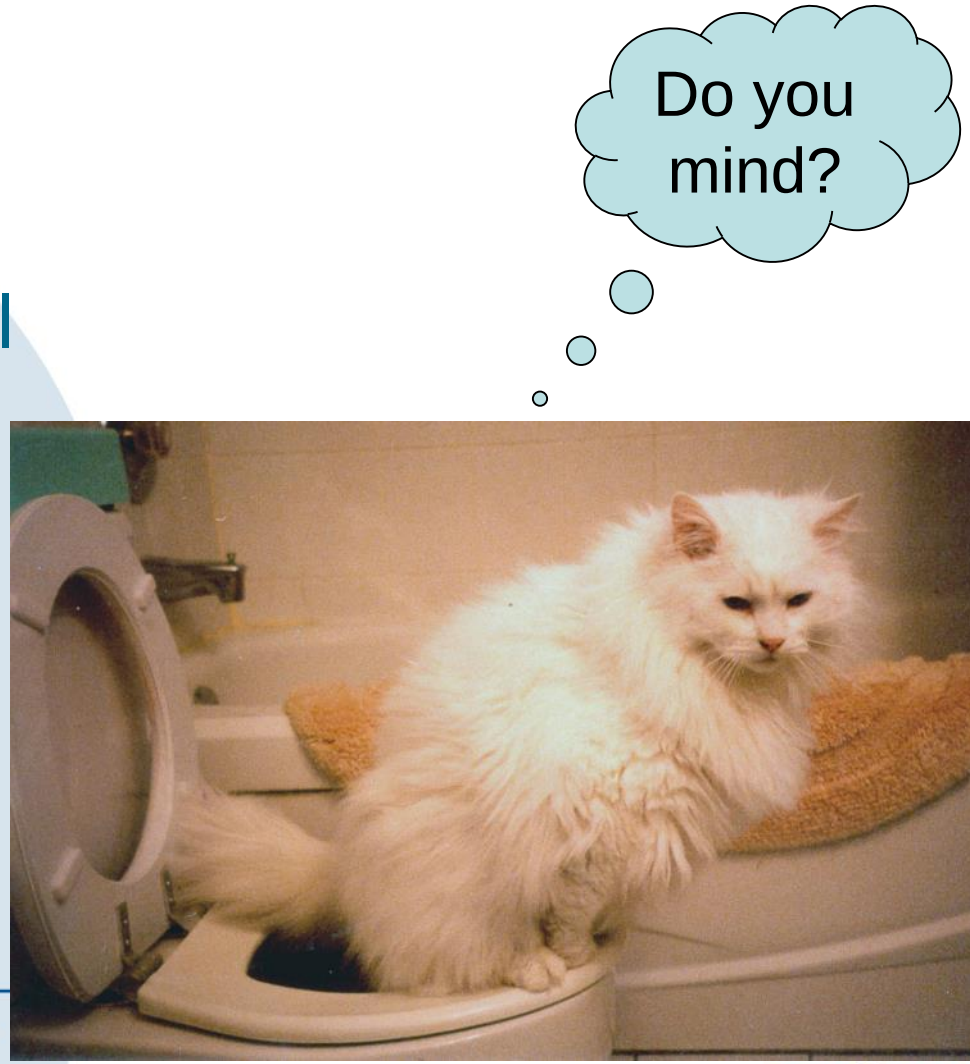
What Is an Onsite Wastewater Treatment System?

1. Wastewater Source
2. Collection and Storage
3. Pretreatment components
4. Final Treatment and Dispersal components



Wastewater Source

- User
  - Domestic
  - Commercial
  - Industrial

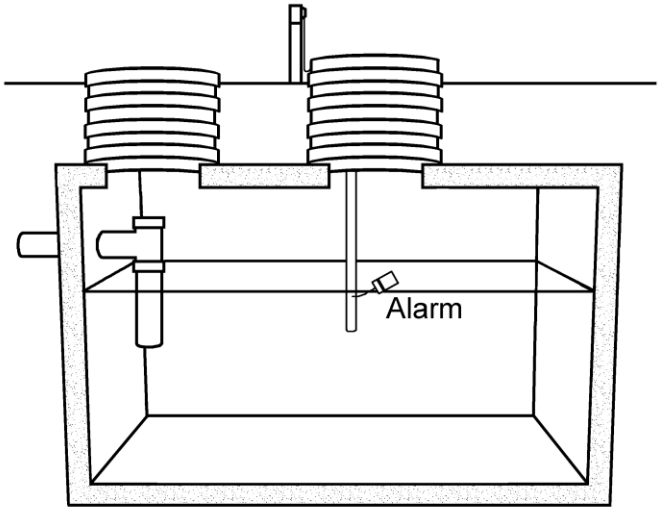


Collection

- Piping from facility with cleanout
  - Blackwater
  - Graywater

Collection

- Holding tanks
- Composting toilets
- Incinerating toilets

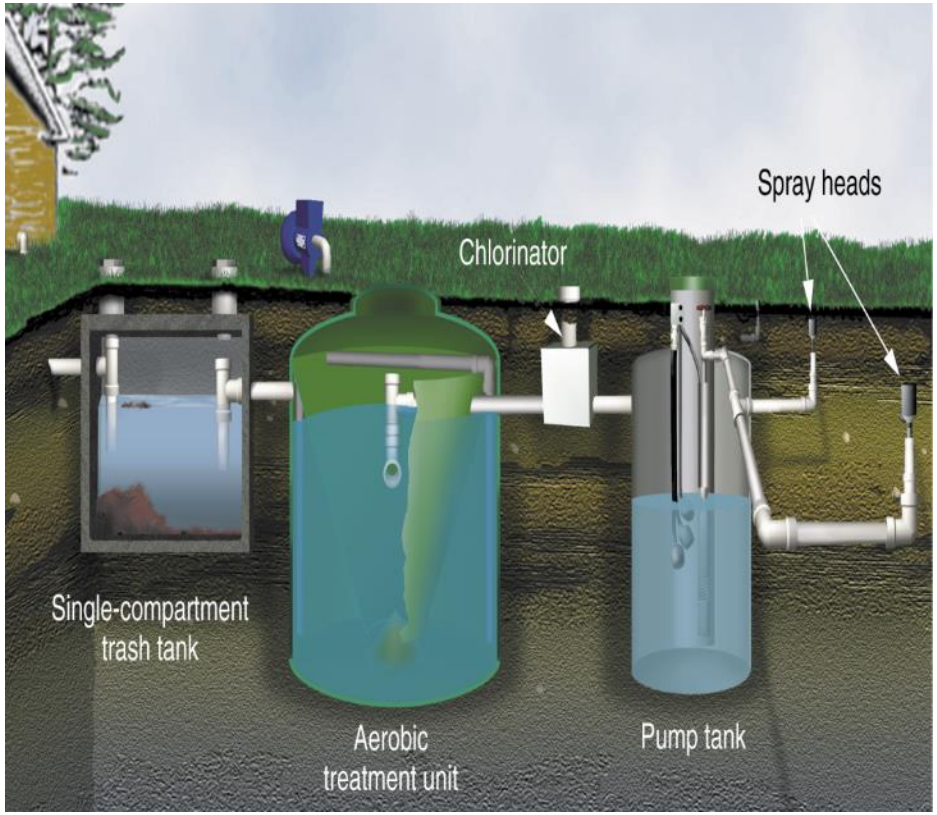



Courtesy of Clivus Multrum

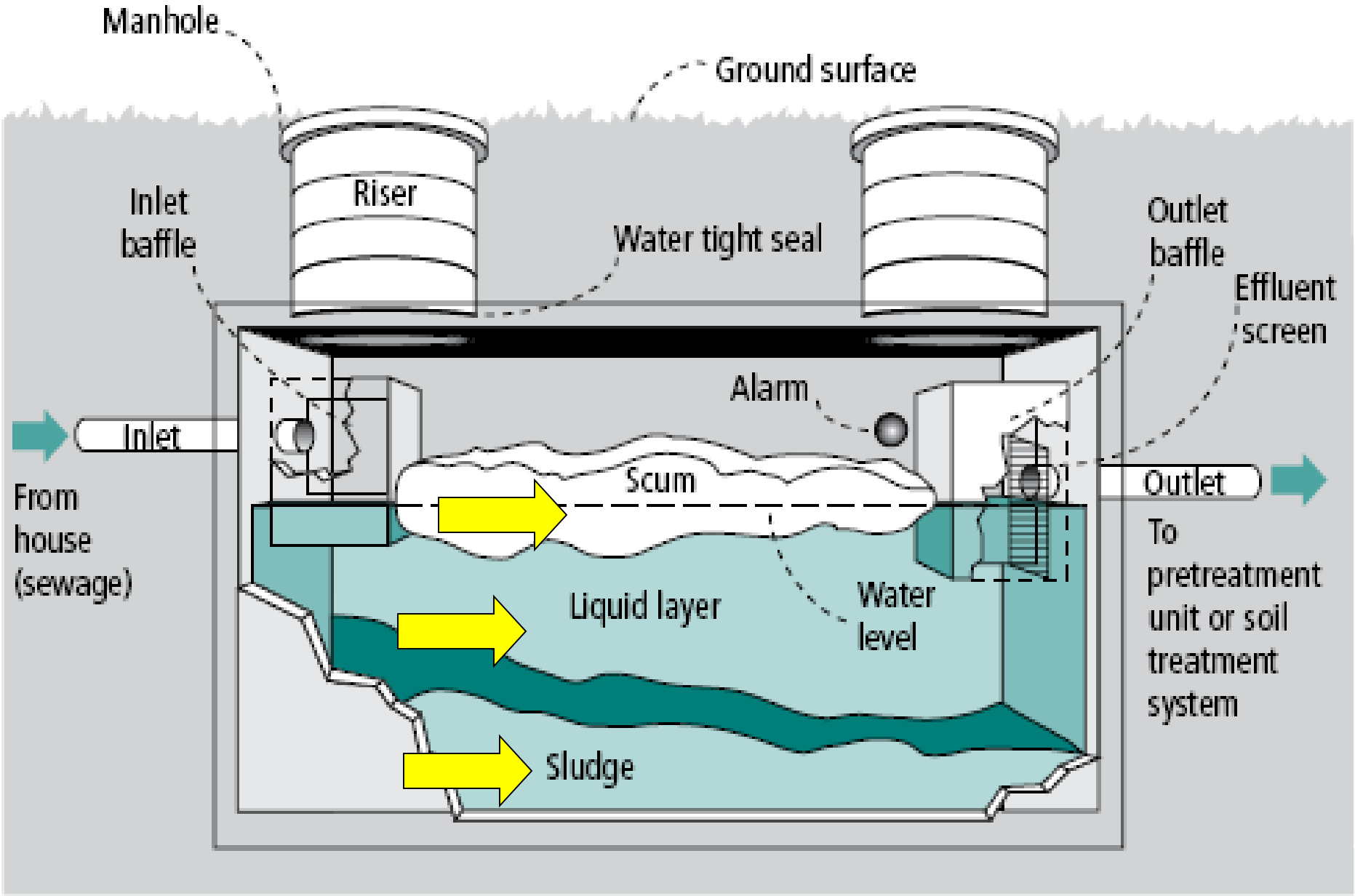

Courtesy of Incinolet

Pretreatment

- Septic tanks
- Aerobic treatment units
- Media filters
- Constructed wetlands
- Membrane bioreactors
- Disinfection



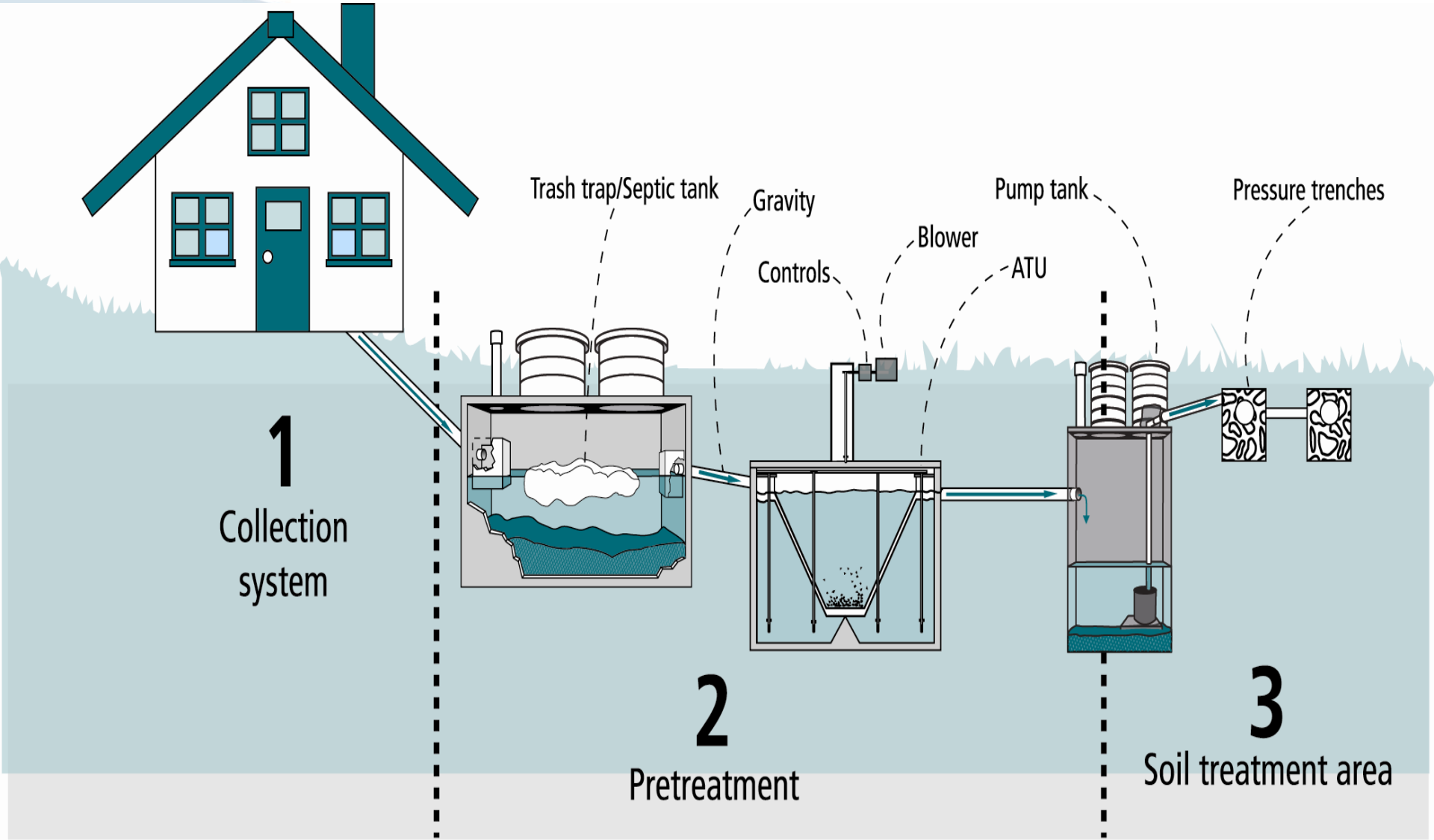
Septic Tank


Manhole
Ground surface
Riser
Inlet baffle
Water tight seal
Outlet baffle
Effluent screen
Alarm
Inlet
From house (sewage)
Scum
Outlet
To pretreatment unit or soil treatment system
Liquid layer
Water level
Sludge

Septic Tank: Primary Treatment

- Job of tank: catch the solids
- Water tight tank, inlet, inlet baffle, inspection pipes, manhole, outlet baffle, outlet pipe
- Layers in tank
  - Scum layer: floating soap, grease, toilet paper, etc
  - Liquid layer: water, liquid, and suspended solids
  - Sludge: heavy organic and inorganic materials in the bottom of the tank
- Anaerobic bacteria breakdown organic solids

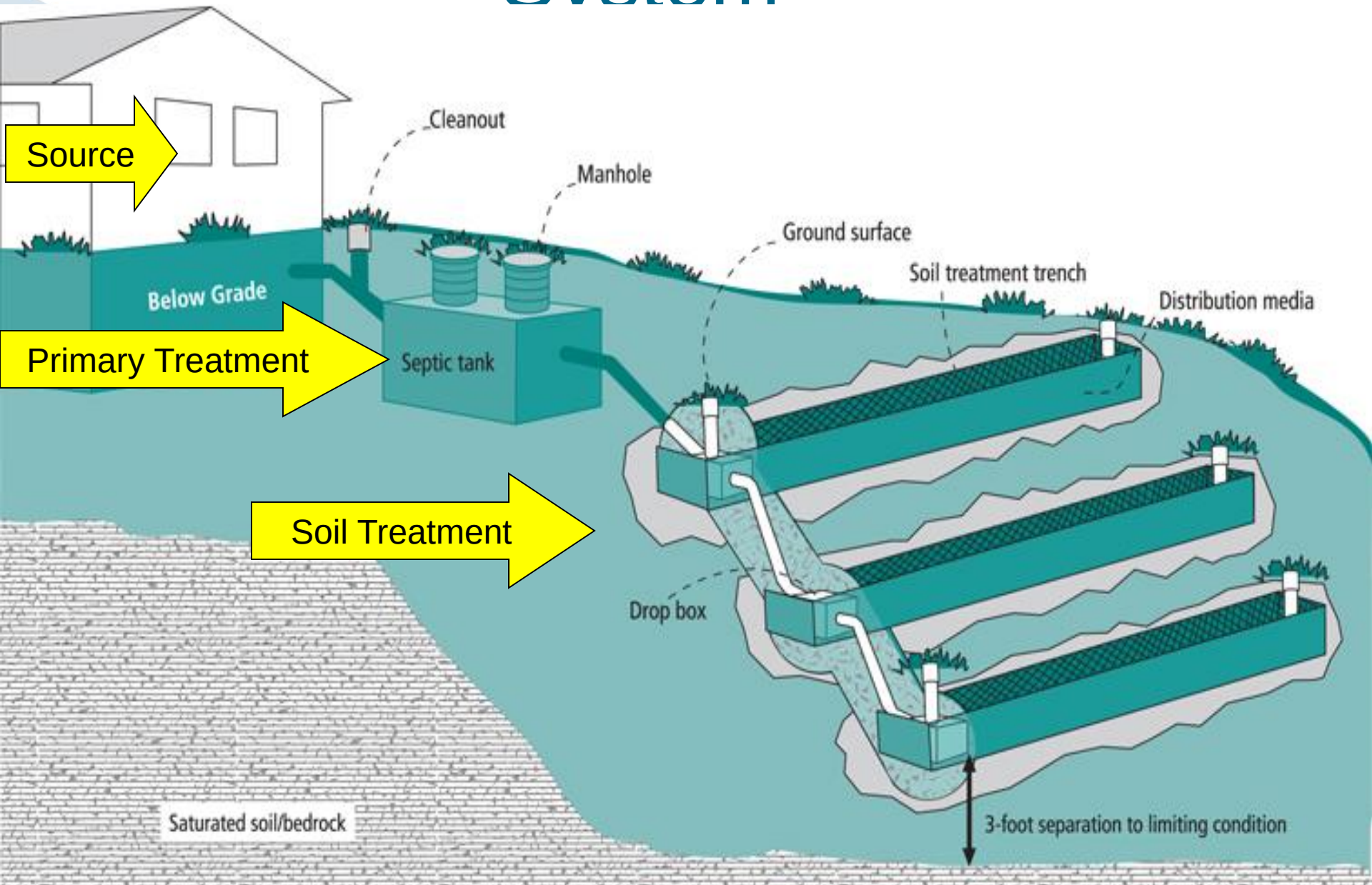
Septic System Incorporating Pretreatment



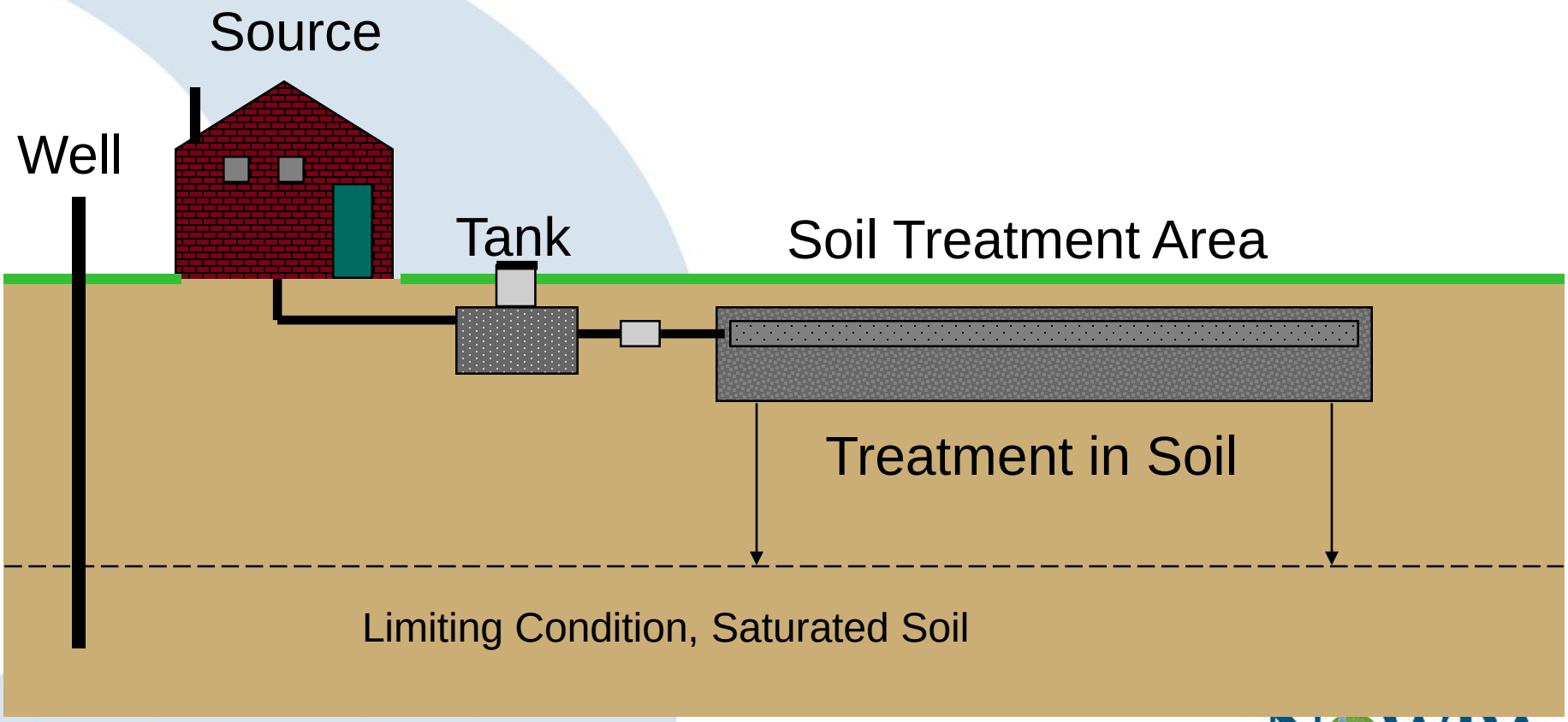
What is a Soil Treatment Area?

- A soil treatment system:
  - Safely treats and disperses and recycles wastewater
  - All the treatment and dispersal takes place on site or close by
  - Natural physical, chemical, and biological processes occur primarily in the soil

Components of a Septic System



Septic System Components



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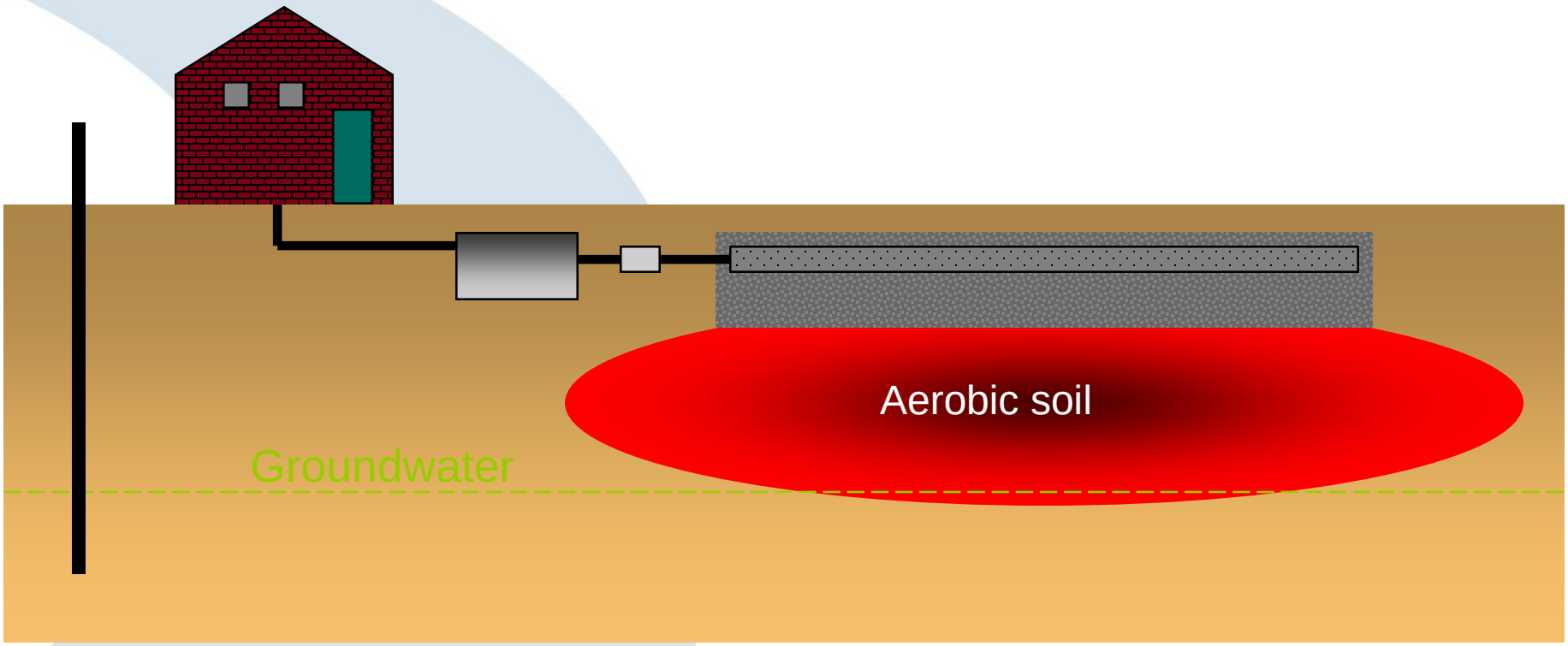
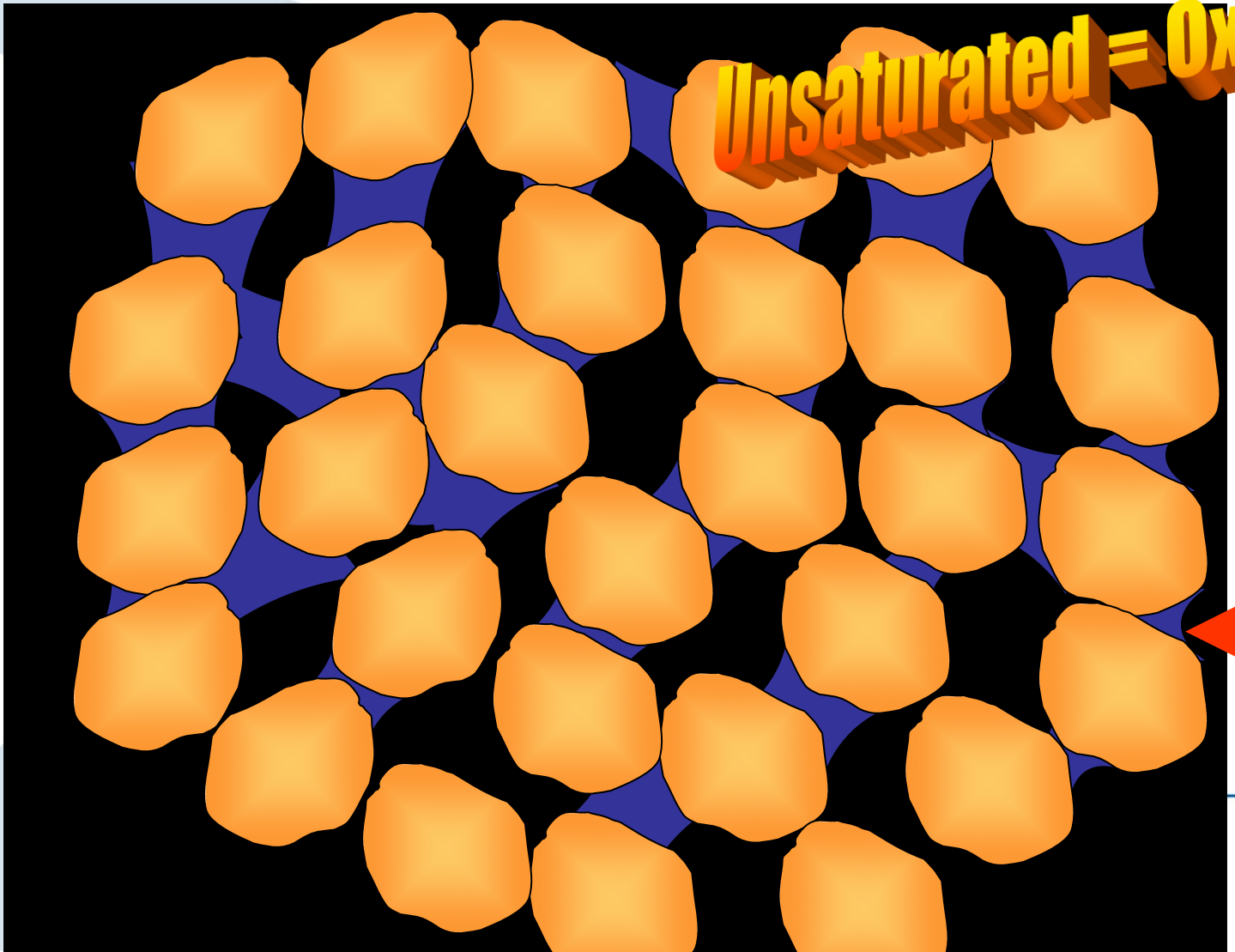
Process When Wastewater Enters Soil

- Biomat forms
- Results in unsaturated conditions
- Aerobic organisms treat the wastewater

Aerobic zone



Unsaturated Soils



Pores are filled with Air & water along the soil particles

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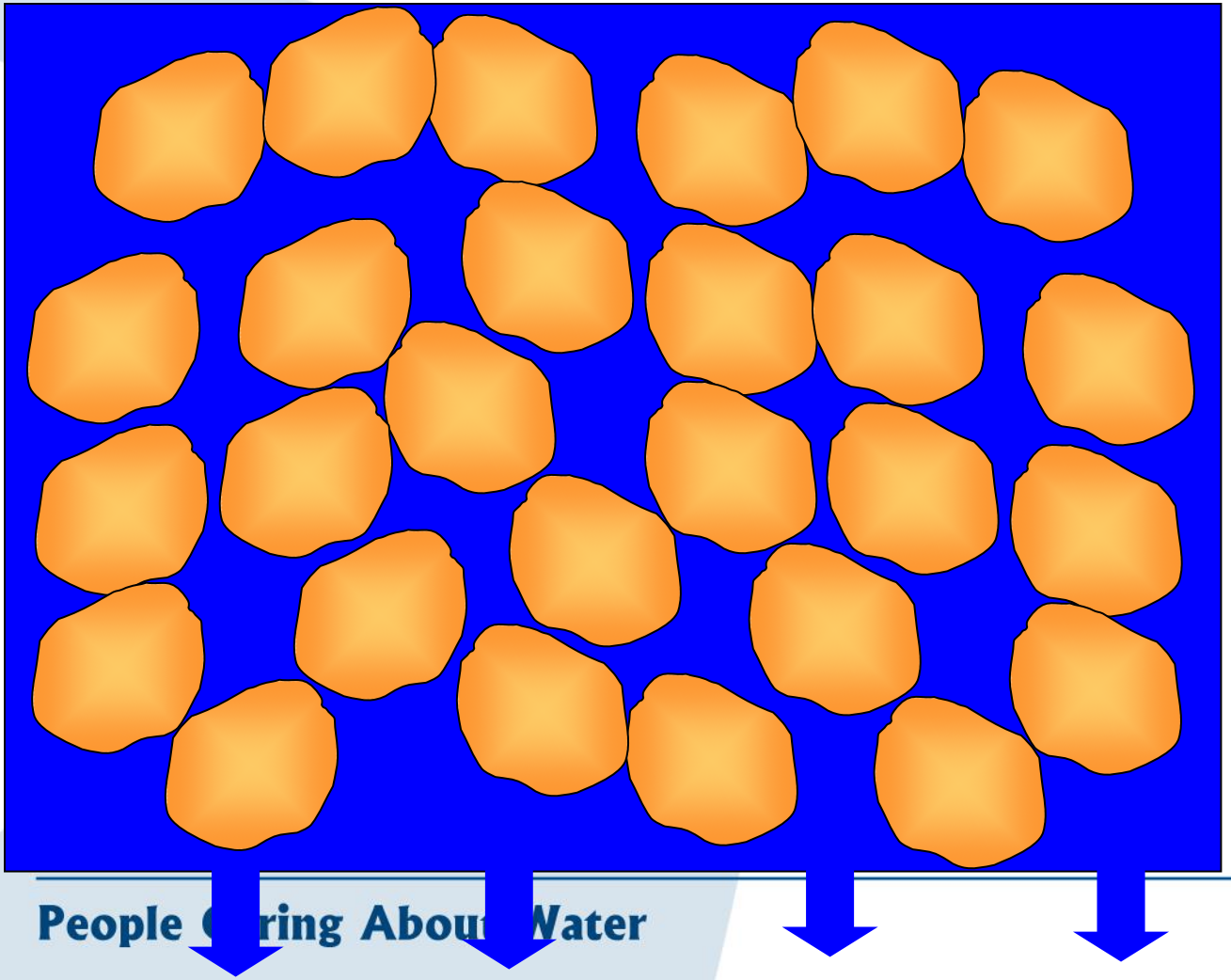
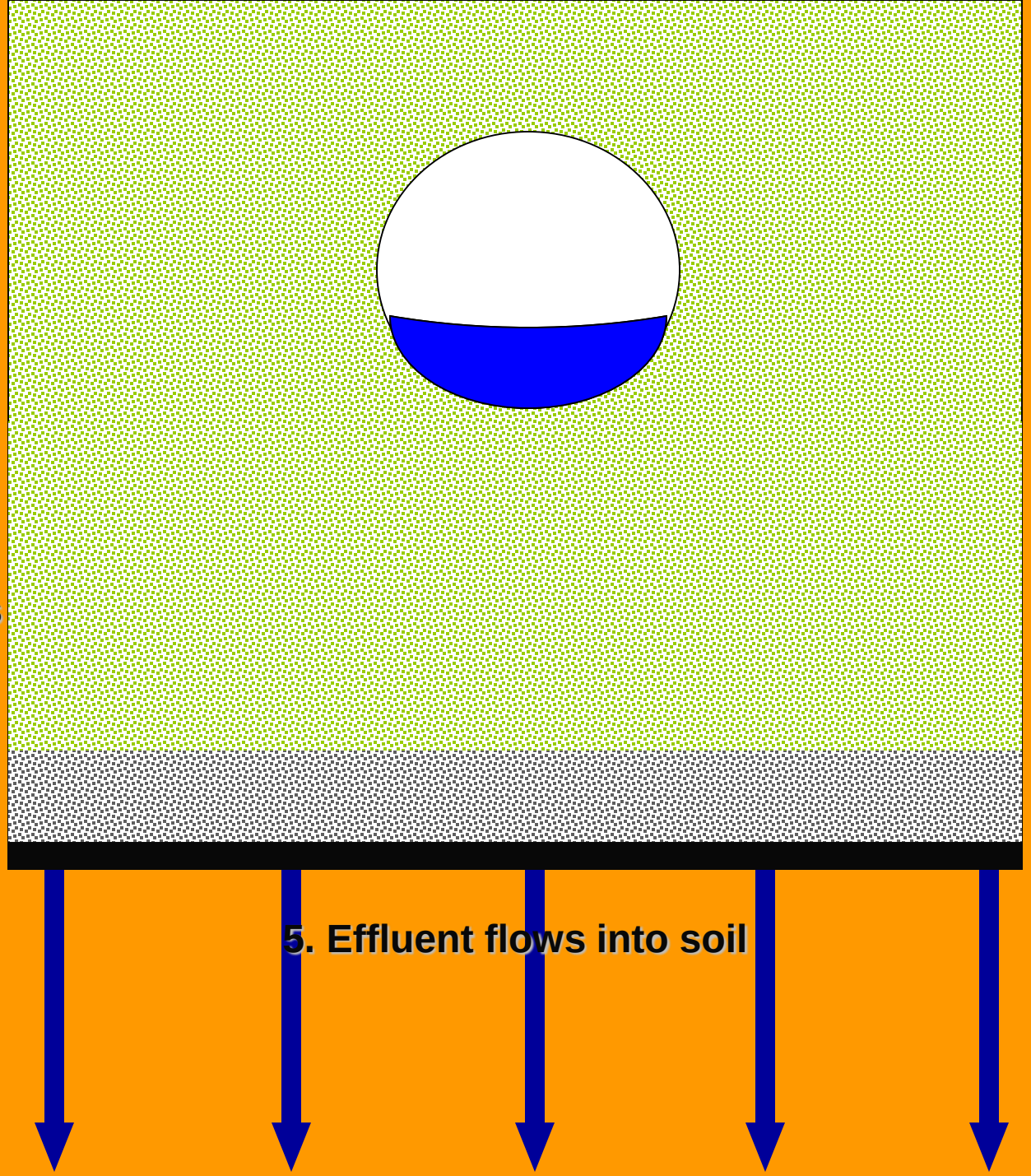
Saturated Soils



Pores are filled with water

BIOMAT

1. Effluent flows into pipe

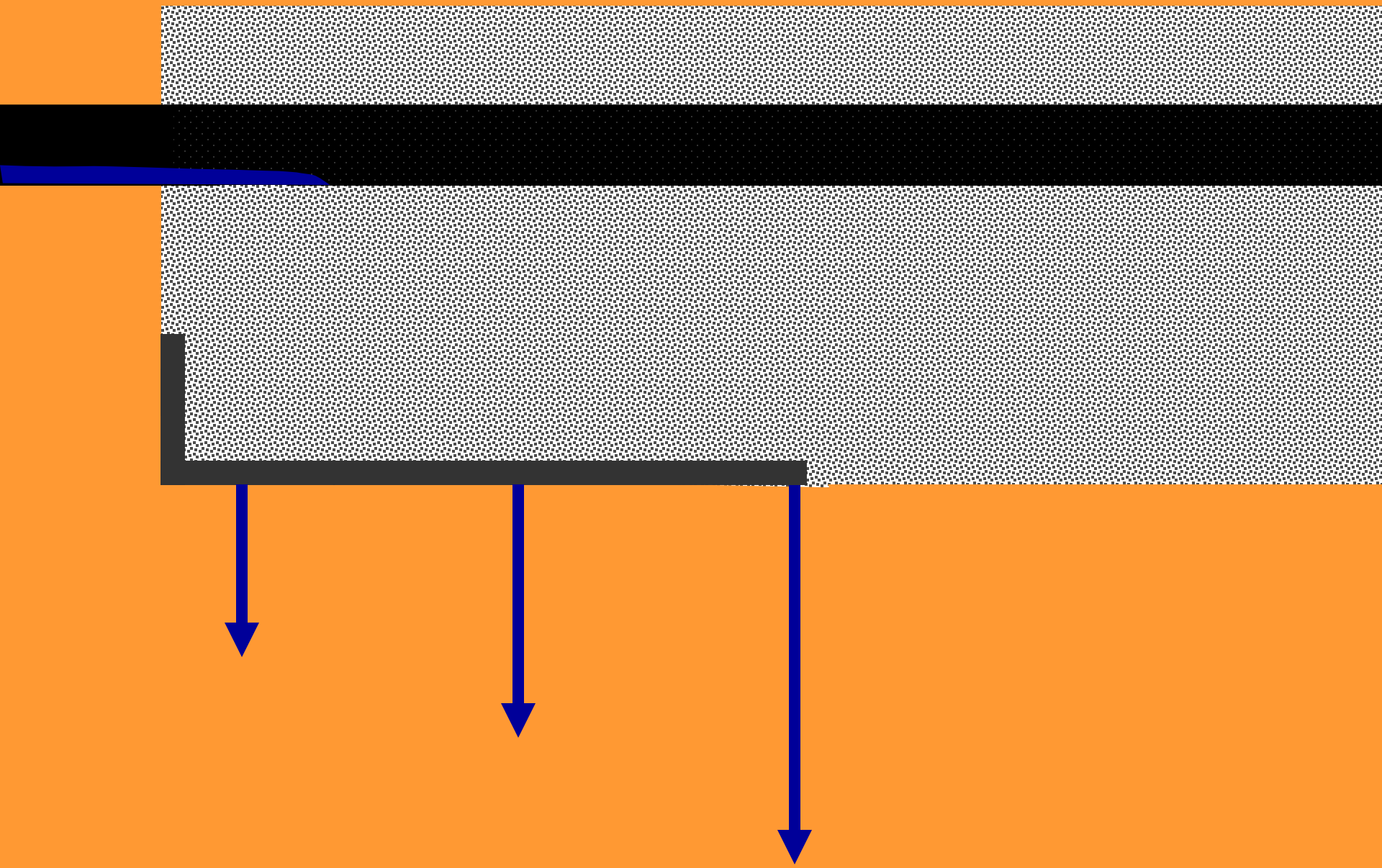


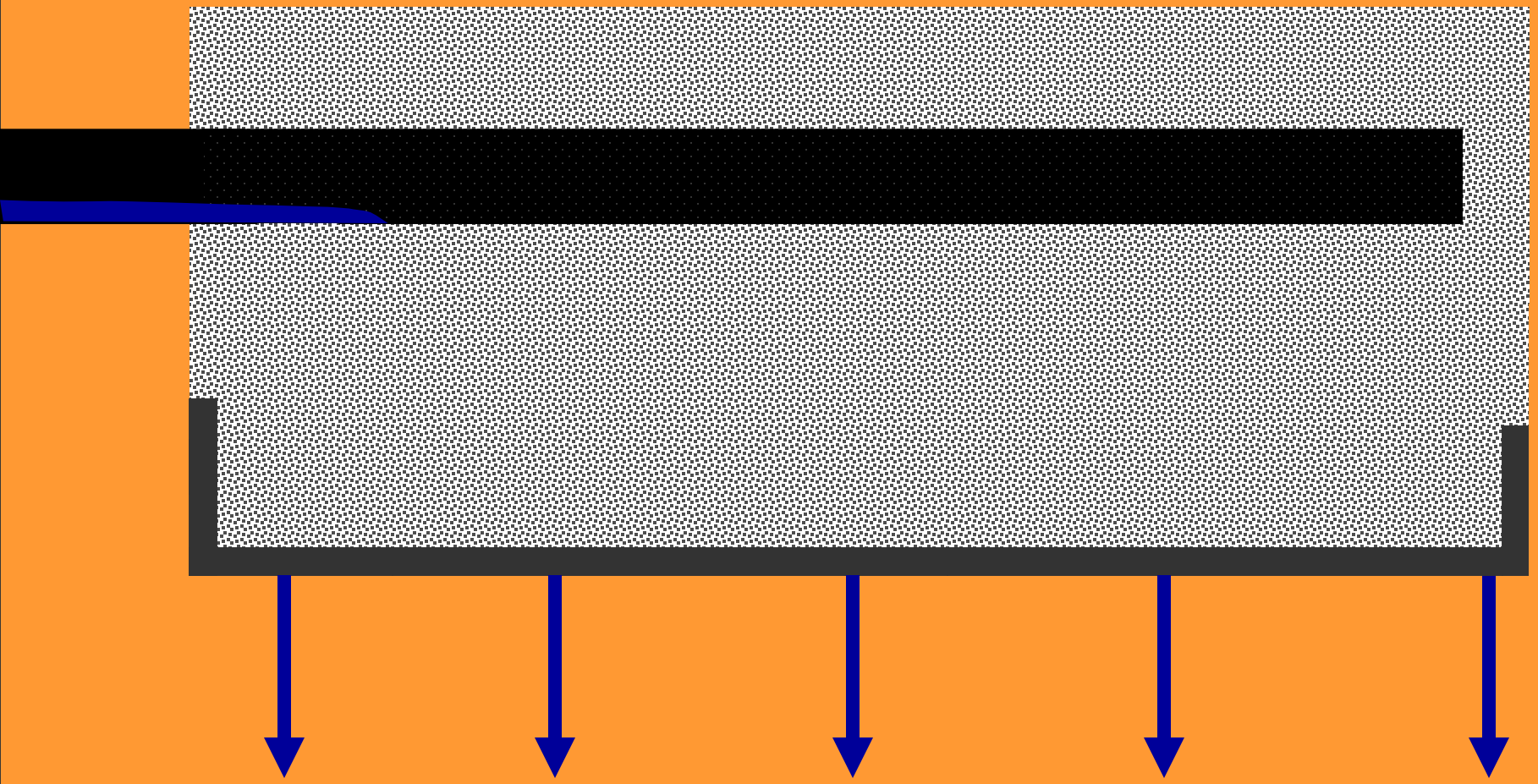
2. Effluent flows out of pipe and into gravel

3. Effluent begins to pond and flows across soil interface.

4. Biomat begins to form

5. Effluent flows into soil


NOT TO SCALE



NOT TO SCALE

System Type and Size

- System type based upon soils and site
  - Depth to limiting condition
    - Bedrock or saturated soils
  - Area available
- System size based upon:
  - Use
    - Number of bedrooms
    - Garbage disposal
  - Soils
    - Percolation test results,
    - Soil type (sand, loam, clay)

Color & Saturation

Well Drained

Moderately Well Drained

Poorly Drained

Management

- Out of site, out of mind doesn't work!
  - Regular inspection & maintenance can prevent system failure
  - Proper care & maintenance will prolong system life & save money
  - Selling is easier

QUESTIONS

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QUESTIONS?