Steps to Develop a Tribal (or Rural) Onsite Wastewater Management Program

Tuesday, June 4, 2024

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

Certificate of Completion

This session has **NOT** been submitted for pre-approval of Continuing Education Credits, but eligible attendees will receive a certificate of attendance for their personal record.

To receive a certificate:

- You must attend the entire session
- You must register and attend using your real name and unique email address - group viewing credit will not be acceptable
- You must participate in polls
- Certificates will be sent via email within 30 days

If you have questions or need assistance, please contact smallsystems@syr.edu.

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About Us

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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Great Lakes Environmental Infrastructure Center

Environmental Finance Center for EPA Region 5

Serves small communities (population of less than 10,000) throughout EPA Region 5: Indiana, Illinois, Michigan, Minnesota, Ohio, Wisconsin, and 35 federally recognized American Indian governments.

Training, Research, and Technical Assistance to increase technical, managerial, and financial capacity (TMF) of utilities. Focus areas: Asset management, infrastructure funding, & financial management.

Greg Pearson, MBA Water & Wastewater Systems Trainer

Imagine you are assigned to develop an onsite wastewater management program for your community

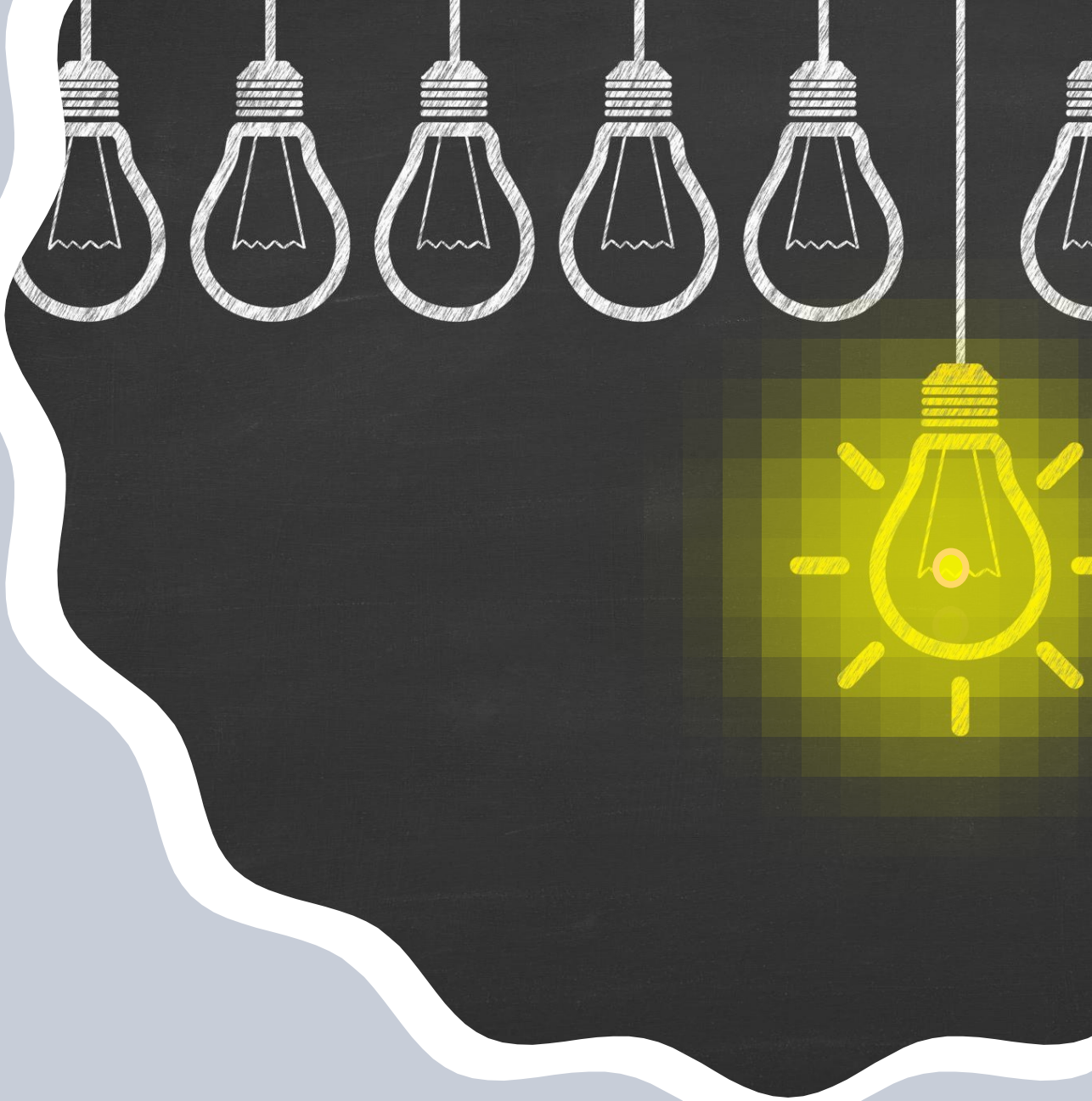
You are informed that there are many failing septic systems in the community and ground water sources are threatened with contamination. The community is in danger of regulatory enforcement actions.

“What could be causing this?” You ask yourself

“Where do I start?”

What we will cover

1. How onsite systems work
2. Design and Installation Factors
3. Inspection and Maintenance
4. Database and records
5. Permitting and Oversight



The BIG IDEA

Identify the main components required for a successful onsite wastewater management program

Essential questions

- What resources are already available?
- What are the main factors that affect onsite system performance?
- Where to start?

Poll #1

How does your current role relate to onsite wastewater management?

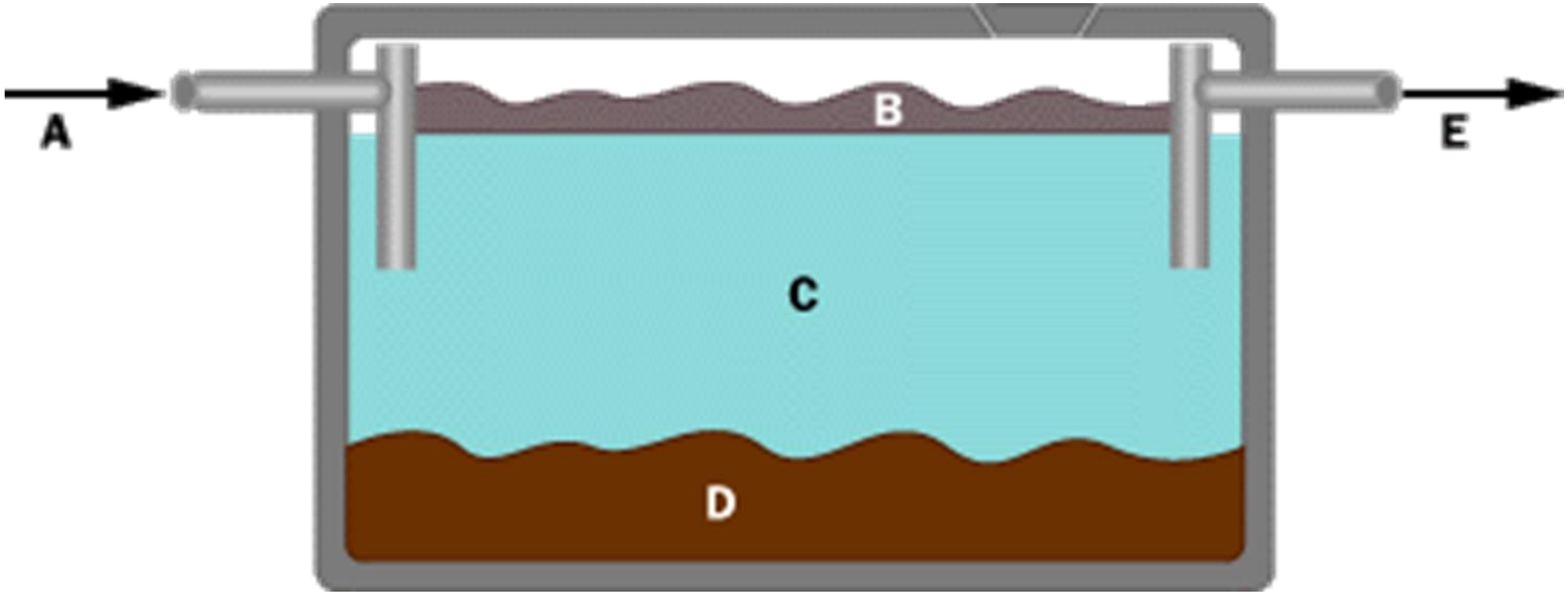
a. I conduct maintenance of onsite wastewater systems in my community.

b. I conduct regulatory oversight of onsite wastewater systems.

c. I have a septic pumping business.

d. Other (Comment in the chat).

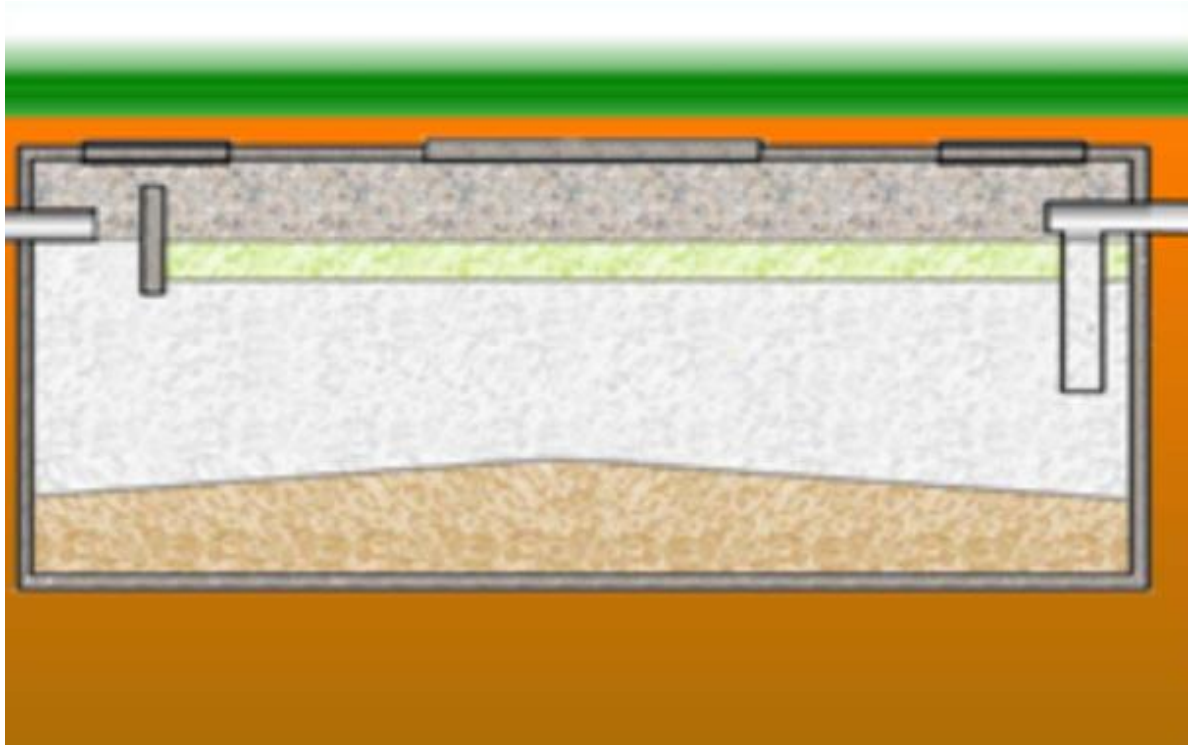
How Do Onsite Systems Work



Onsite treatment processes

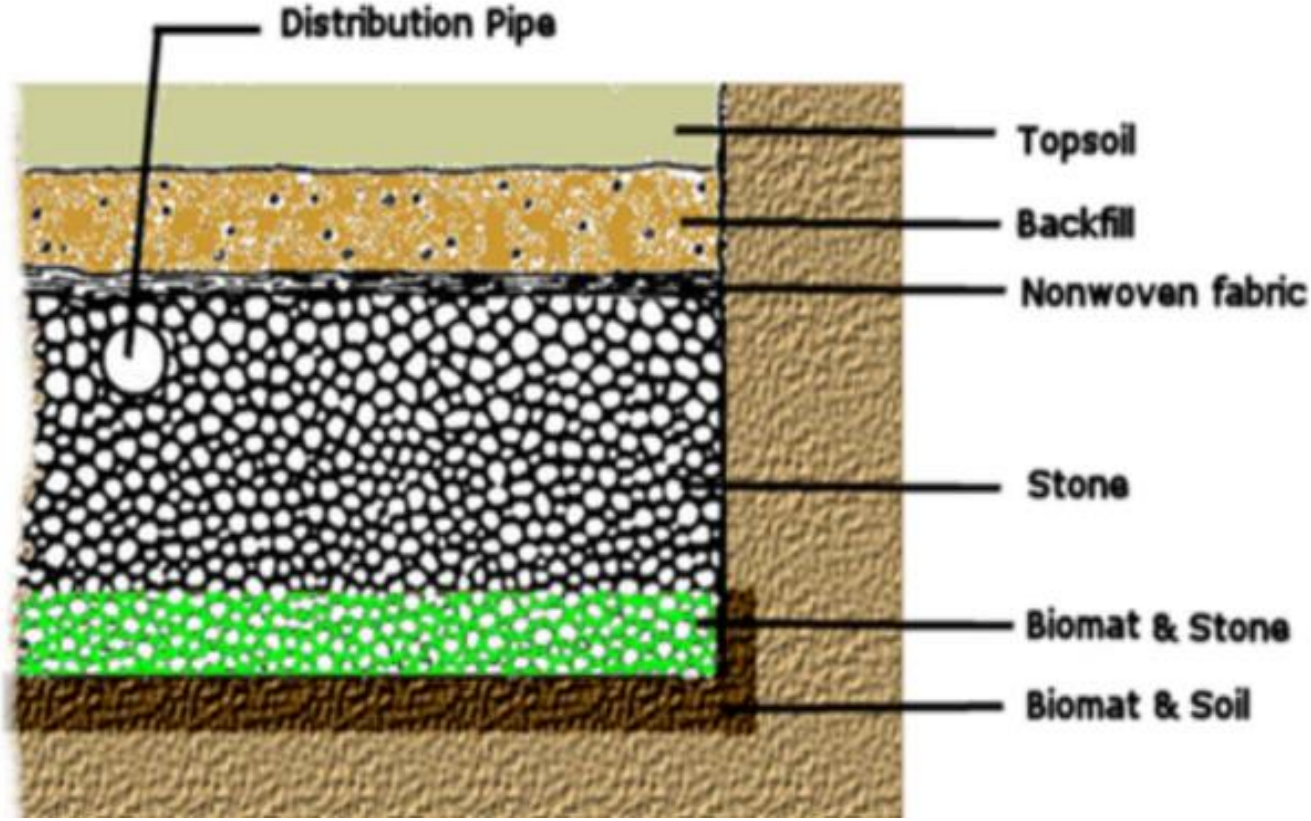
Septic Tank

- Separates solids from liquids
- Anaerobic decomposition of solids

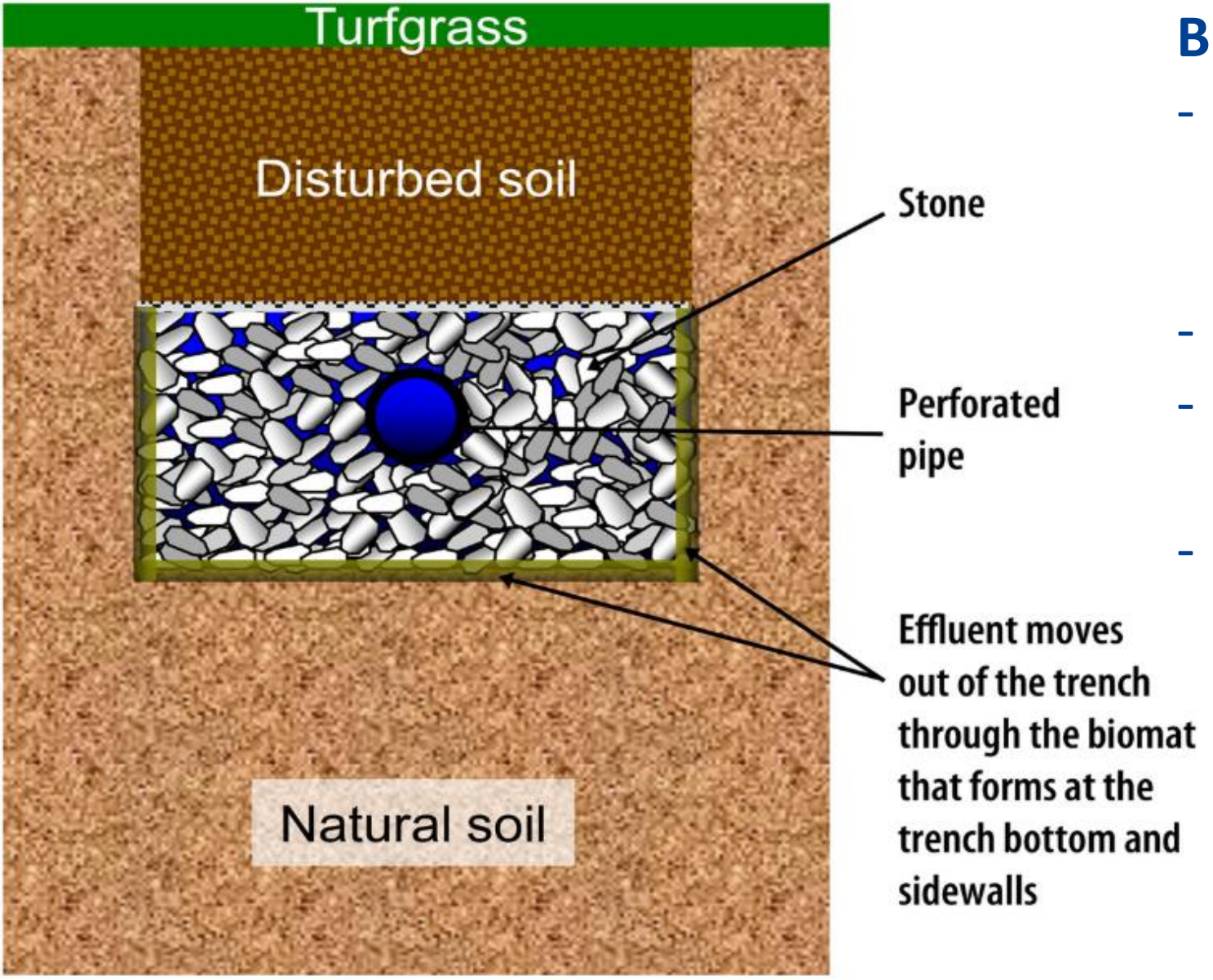


Leachfield (soil)

- Liquid flows through perforated pipes into soil
- Biological matt provides filtration and aerobic treatment



Biomat



Biological Mat

- Consists of a variety of microorganisms that creates a biological treatment system
- Adsorption and filtration
- Where 99% of drain field treatment occurs
- Develops at bottom of the trench where flow meets the soil

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Removal efficiencies

Water Quality Parameter	% Removal In A Septic Tank	% Removal In A Leach Field
BOD (Biochemical Oxygen Demand)	15% to 50%	75% to 90%
TSS (Total Suspended Solids)	25% to 45%	75% to 90%
Settleable Solids	> 90%	75% to 90%
Enteric Bacteria	10% to 40%	80% to 90%
Enteroviruses	No Significant Reductions	generally high but variable
Protozoa	No Significant Reductions	generally high but variable

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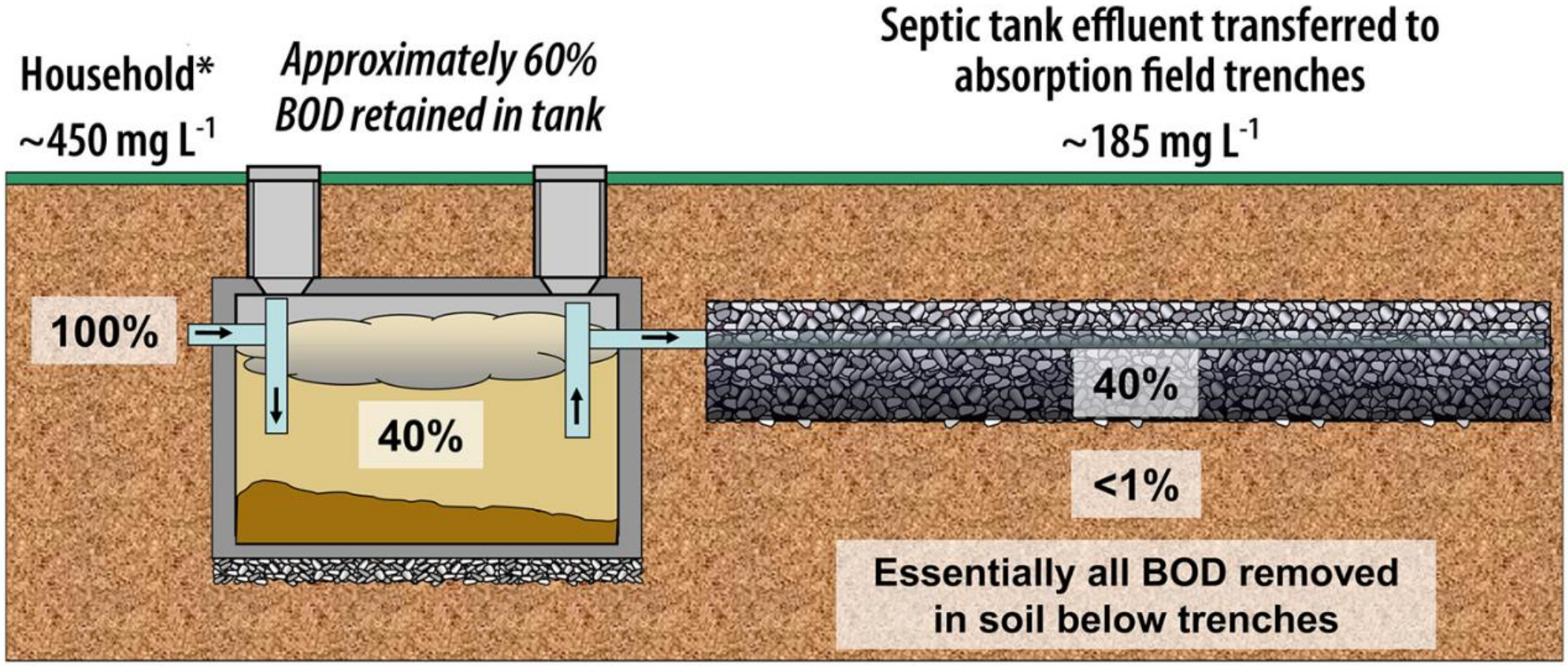
BOD in onsite systems



Design Factors

1. Estimated flow in gpd – Storage should be 2.5 x average daily flow

2. Qualities of wastewater

- BOD, TSS, FOG (garbage disposal grinder flows)

3. Permeability of Soil – Perk test

- Sand/gravel about 1ft drain pipe per 1gpd)
- Larger leach field size – 2ft per 1gpd (silts, loams)
- Mound system - clays

4. Depth to limiting factors

- depth to high water table, bedrock, or fractured bedrok

5. Distance to water sources or property borders

- may require pre treatment – filters, aeration, disinfection

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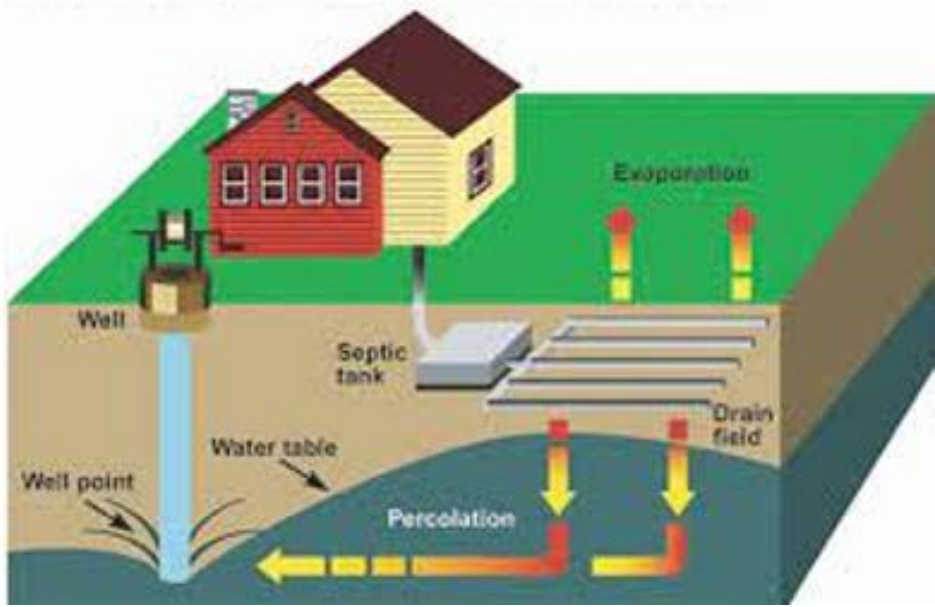
Estimating daily flows and system size

Daily Combined Wastewater Flow Formula = 150 gal/day per bedroom.

- *Combined flows include clearwater, graywater, and blackwater.*

Estimate drain field and septic tank size for a three bedroom house with combined flows

- Total estimated flow = 150 gpd x 3 = 450 gpd.
- Leachfield design would require a minimum of 450 feet of leach line in ideal soil; more with a less permeable soil with slower percolation.
- Septic tank would need to be at least 450 gpd x 2.5 = 1,125 gallons



Public facilities estimations

Public Facility Wastewater Flows

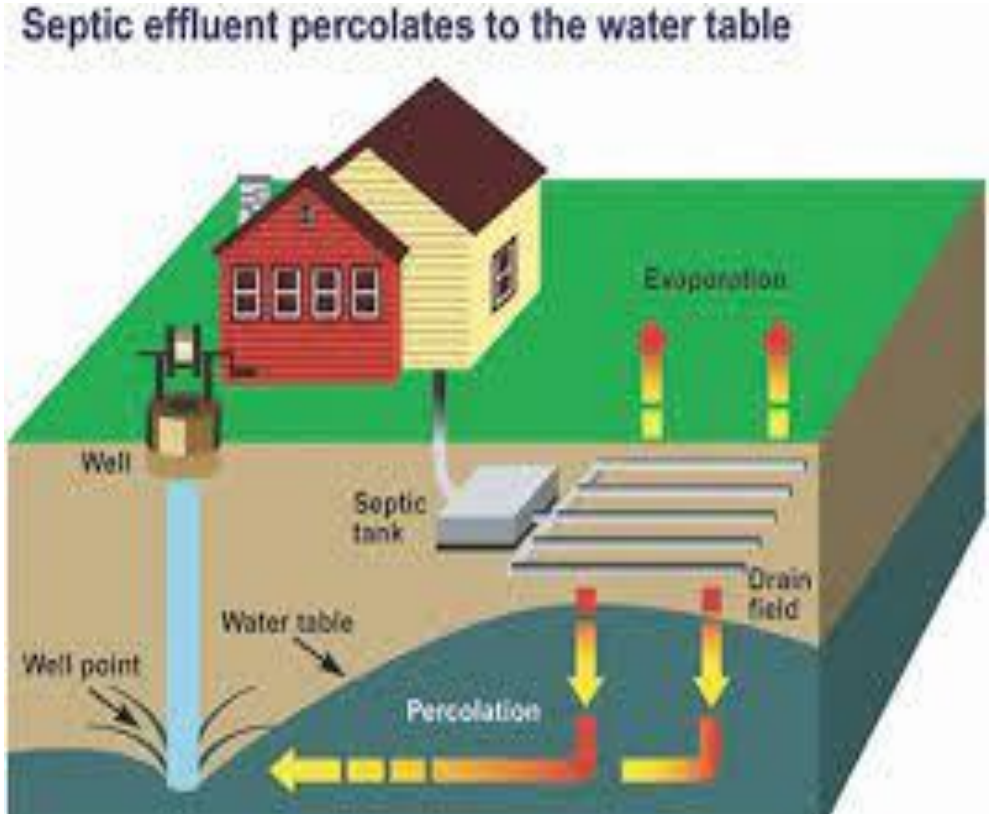
Source	Unit	Estimated Wastewater Flow (gpd)
Apartment or Condominium	Bedroom	100
Assembly hall (no kitchen)	Person (10 sq. ft./person)	1.3
Bar or cocktail lounge (no meals served)	Patron (10 sq. ft./patron)	4
Bar or cocktail lounge* (w/meals – all paper service)	Patron (10 sq. ft./patron)	8
Beauty salon	Station	90
Bowling alley	Bowling lane	80
Bowling alley (with bar)	Bowling lane	150
Camp, day and night	Person	25
Camp, day use only (no meals served)	Person	10
Campground or Camping Resort	Space, with sewer connection and/or service building	30
Campground sanitary dump station	Camping unit or RV served	25

System failures

30% of septic systems fail.

Past examples

- Racine, MO 1992, two drinking water wells at a nearby church and school were contaminated, causing 28 cases of Hepatitis A.
- Coconino County, AZ 1989, failure of a resort leach field resulted in 900 cases of gastroenteritis.
- Richmond Heights, FL 1974, a drinking water well was contaminated by a failed septic system resulting in 1,200 cases of gastrointestinal illness



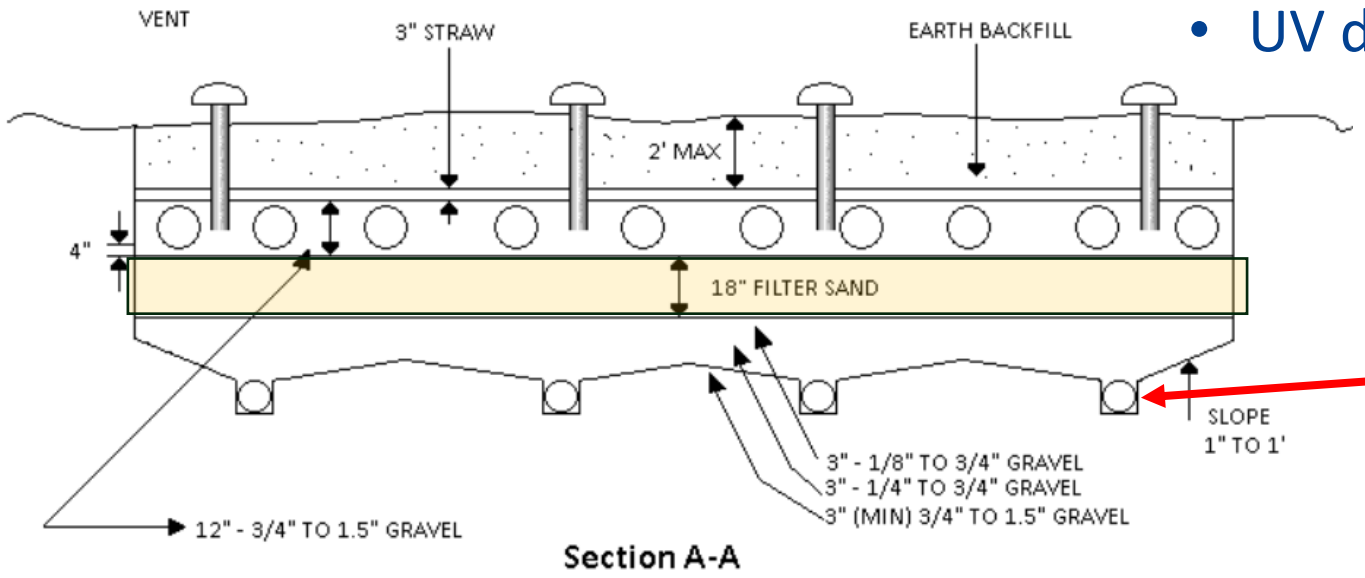
Special circumstances requiring pre-treatment

Factors

- High strength wastewater
- Aquifers or streams near drain field
- System located in sensitive watershed

Pretreatment Examples

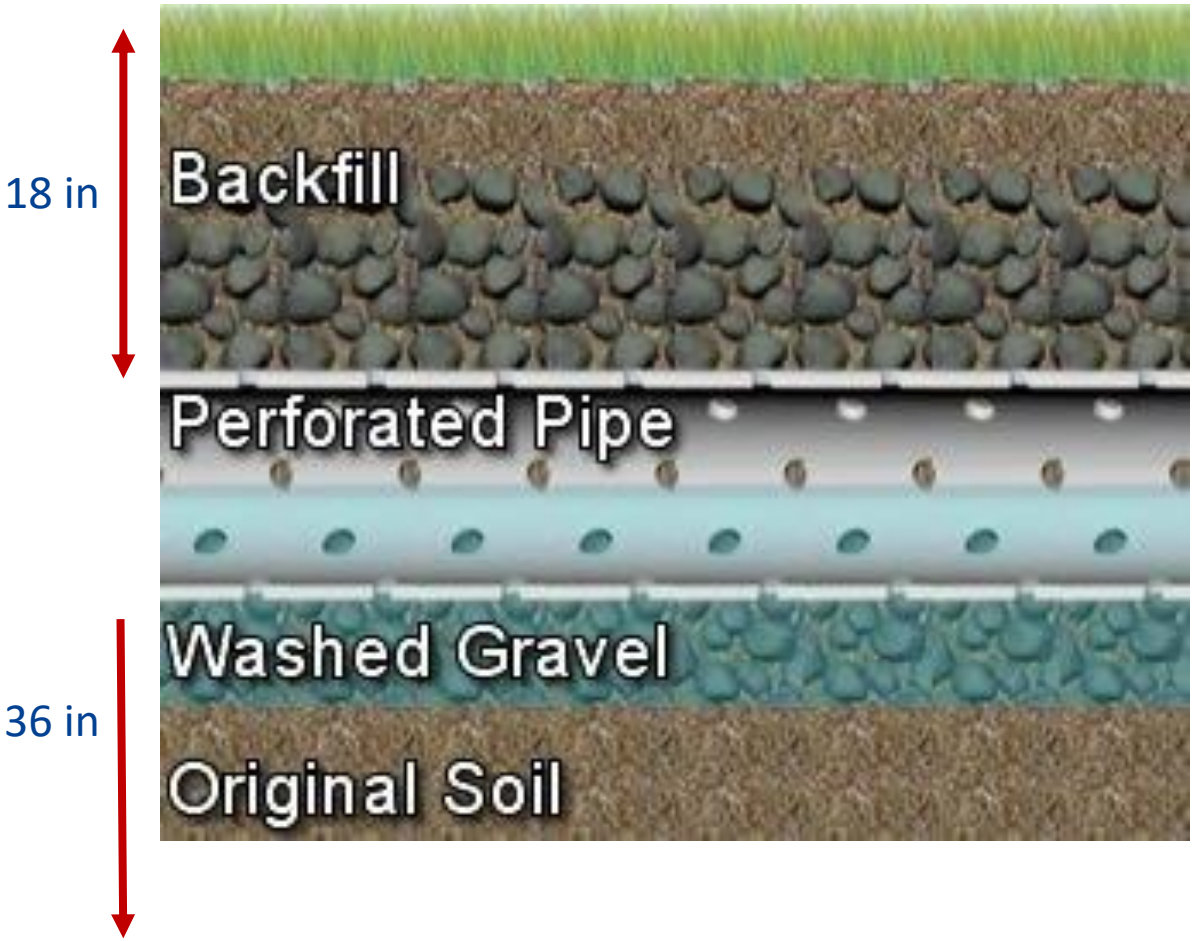
- Sand Filters
- Aerobic Treatment Unit
- Ultra Filtration
- Subsurface Flow Constructed Wetlands
- UV disinfection



Filtered before entering drainfield

Common Problems

Leach field detail



Leachfield Ponding

- Groundwater builds up preventing proper drainage - forces wastewater to surface
- Curtain drain – trench and drain around perimeter removes excess water in ground.
- Clogged mat or soil area
- Backfill entered and blocked water movement through gravel

Site evaluation

Site Evaluation

- Property set-backs
- Trees, rocks, interfering elements
- Contour and elevation of site
- Existing or proposed buildings, roads (10ft)
- Locations of streams, wells, etc. (50 ft +)

Soil (geological) evaluation

Soil type

Percolation testing (.4 to .7 gpd/ft²) 12 w 24 d

Depth to limiting factors

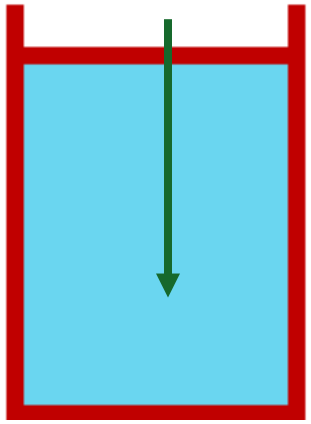
Cultural evaluations

- Distance from burial sites, etc.

Soil evaluation and percolation test results

Typical Perc Test Results

- Sandy soil – 1 to 8 inches percolation per hour
- Loams and silt - 1 to 2.4 inches per hour
- Clays – 0.17 inches per hour



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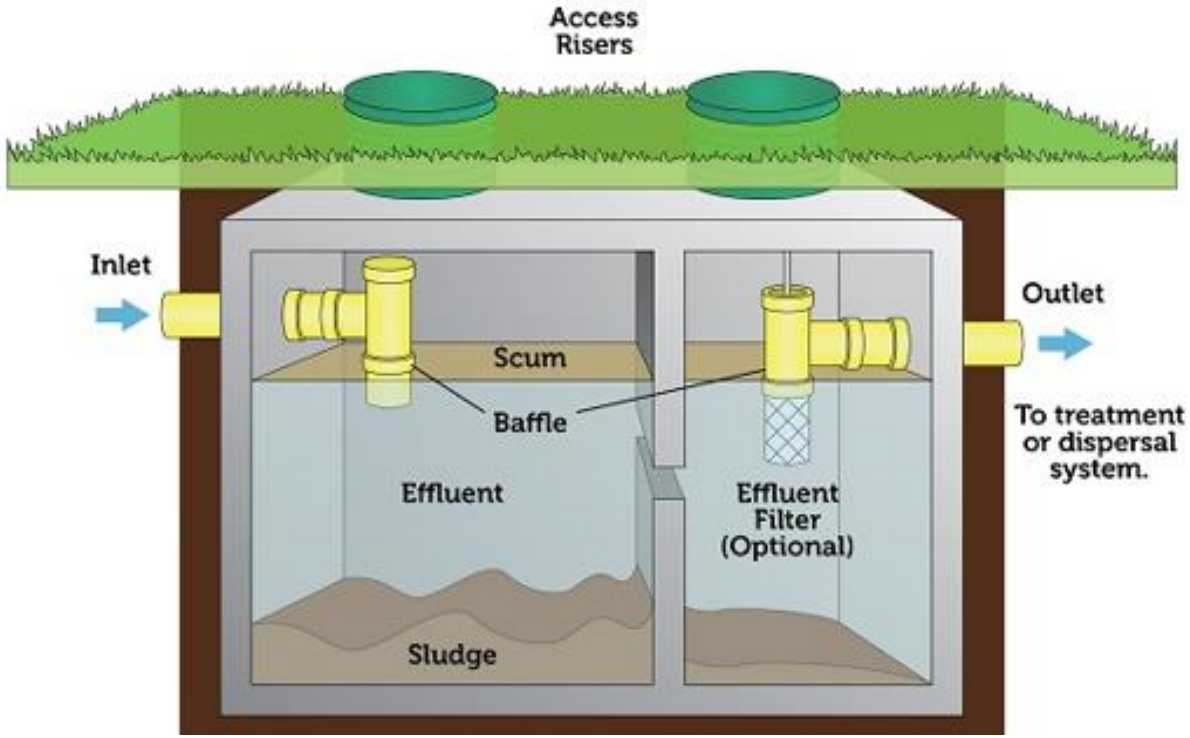
Poll #2

Why are records important for management of onsite wastewater systems?

a. Ability to locate system components.
b. Plan inspection activities.
c. Track repair and maintenance events
d. All of the above

Onsite System Maintenance and Inspection



Estimating pumping frequencies

Tank Size (gallons)	Household Size (number of people)									
	1	2	3	4	5	6	7	8	9	10
1000	12.0	5.9	3.7	2.6	2.0	1.5	1.2	1.0	0.8	0.7
1250	16.0	7.5	4.8	3.4	2.6	2.0	1.7	1.4	1.2	1.0
1500	19.0	9.1	5.9	4.2	3.3	2.6	2.1	1.8	1.5	1.3
1750	22.0	11.0	6.9	5.0	3.9	3.1	2.6	2.2	1.9	1.6
2000	25.0	12.0	8.0	5.9	4.5	3.7	3.1	2.6	2.2	2.0
2250	29.0	14.0	9.1	6.7	5.2	4.2	3.5	3.0	2.6	2.3
2500	32.0	16.0	10.0	7.5	5.9	4.8	4.0	4.0	3.0	2.6

Note: The frequencies estimated are based on a minimum 24-hour wastewater retention time and 50 percent digestion of the solids entering the tank. More frequent pumping would be needed if garbage disposals were utilized.

Example: For 1750 gallon septic tank with a household size of 4 people, the estimated pumping frequency is every 5 years.

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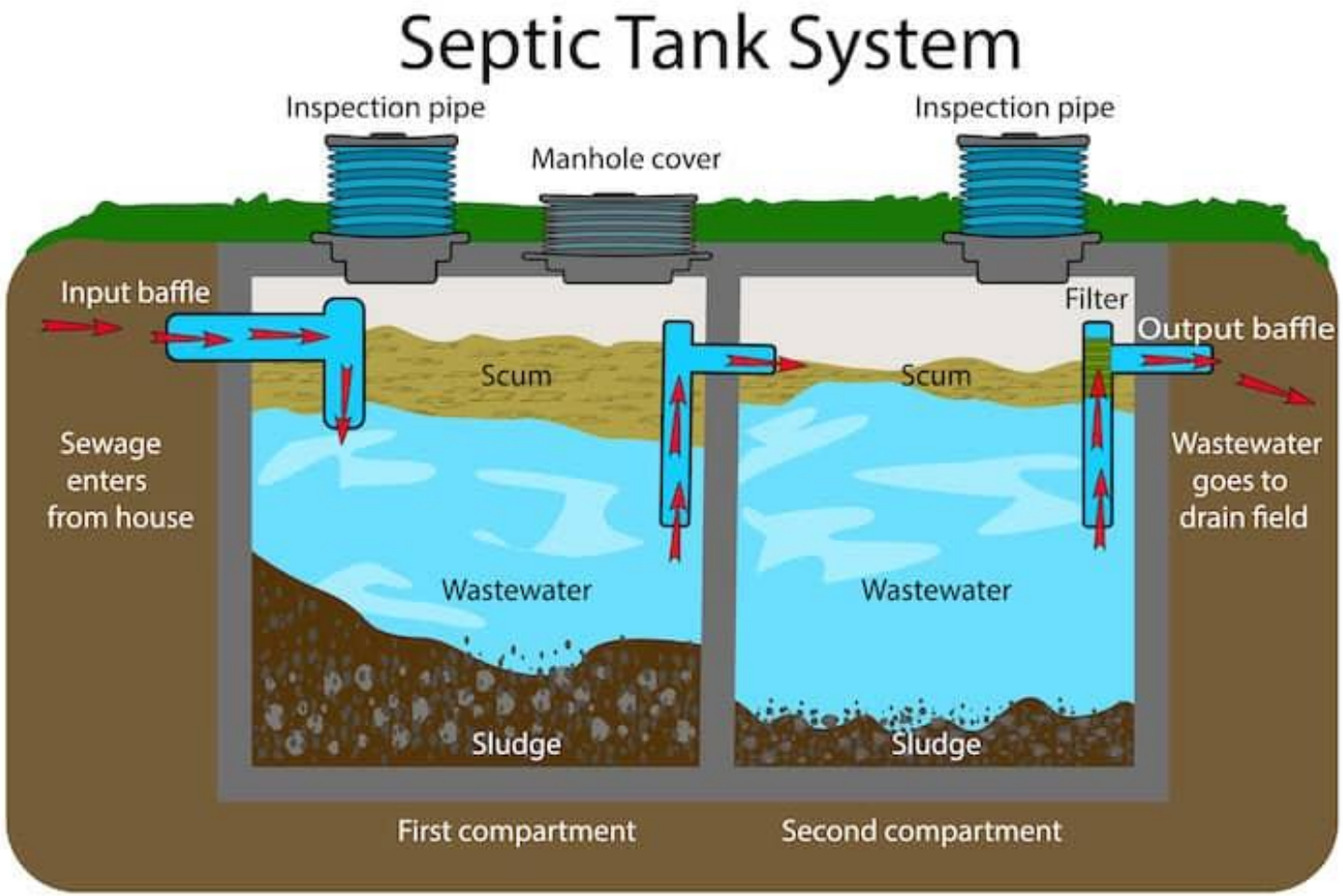

Septic Pumping

- Recommended when combined sludge and scum equals one-third(1/3) of tank volume
- Periodic measurements to predict sludge and scum accumulation
- Distance of sludge and scum to riser intake

Poll #3

Where does the majority of treatment occur in a standard septic system?

a. Indoor plumbing

b. Septic solids tank

b. Effluent tank

d. Leachfield

Record-keeping

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Database and Records

OWNER'S NAME & ADDRESS:

SYSTEMS SPECIFICATIONS		
Septic Tank/Holding Tank Capacity	Gals.	☐ N/A
Septic Tank/Holding Tank Manufacturer		☐ N/A
Effluent Filter Manufacturer		☐ N/A
Effluent Filter Model		☐ N/A
Pump Tank Capacity	Gals.	☐ N/A
Pump Tank Manufacturer		☐ N/A
Pump Manufacturer		☐ N/A
Pump Model		☐ N/A

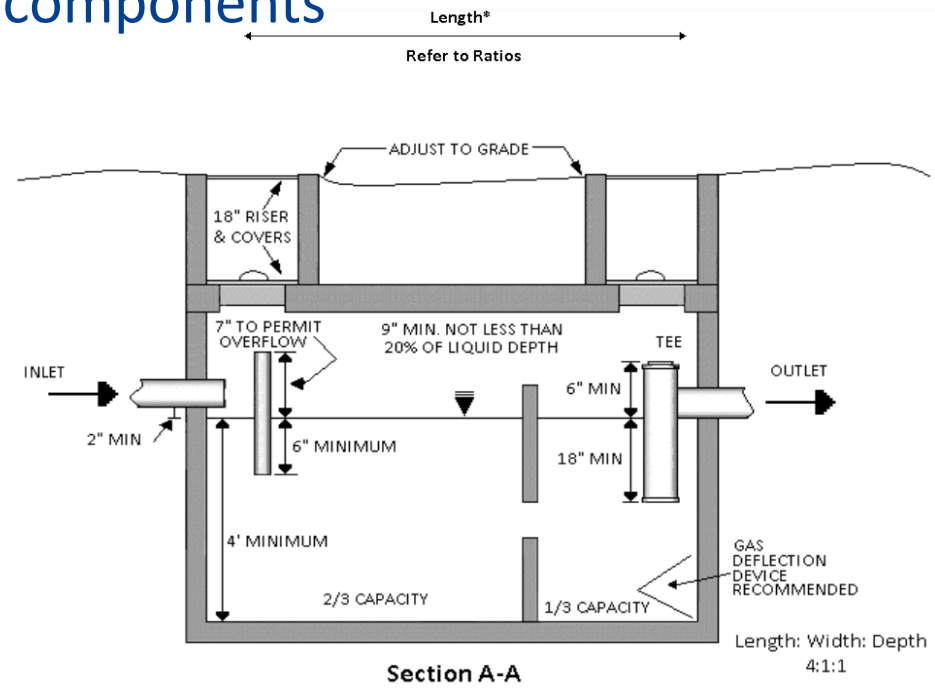
Pretreatment Unit ☐ N/A _____ Manufacturer

☐ Sand/Gravel Filter	☐ Peat Filter
☐ Mechanical Aeration	☐ Wetland
☐ Disinfection	☐ Other

Dispersal Cells (s)

☐ In-Ground (gravity)	☐ In-Ground (pressurized)
☐ At-Grade	☐ Mound
☐ Drip-Line	☐ Other

Bonus tip! Record original as-built drawings, construction details, and locations of onsite system components



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Database and Records

DESIGN PARAMETERS

Number of Bedrooms		☐ NA
Number of Public Facility Units		☐ NA
Estimated (average) flow		gal/day
Design (peak) flow = (Estimated × 1.5)		gal/day
Soil Application Rate		gal/day/ft^2
Standard Influent/Effluent Quality	Monthly average	
Fats, Oil & Grease (FOG)	≤30 mg/L	
Biochemical Oxygen Demand (BOD_5)	≤220 mg/L	☐ NA
Total Suspended Solids (TSS)	≤150 mg/L	
High Strength Influent/Effluent	Monthly average*	
Fats, Oil & Grease (FOG)	≥30 mg/L	
Biochemical Oxygen Demand (BOD_5)	≥220 mg/L	☐ NA
Total Suspended Solids (TSS)	≥150 mg/L	
Pretreated Effluent Quality	Monthly average	
Biochemical Oxygen Demand (BOD_5)	≤30 mg/L	
Total Suspended Solids (TSS)	≤30 mg/L	☐ NA
Fecal Coliform (geometric mean)	≤10^4 cfu/100ml	
Maximum Effluent Particle Size	⅛ in dia.	☐ NA
Other:		☐ NA

- Information about how system was originally designed can help managers determine if modifications are needed for future property development
- Helps to determine maintenance and inspection frequencies
- More able to assist the system owner when there are problems

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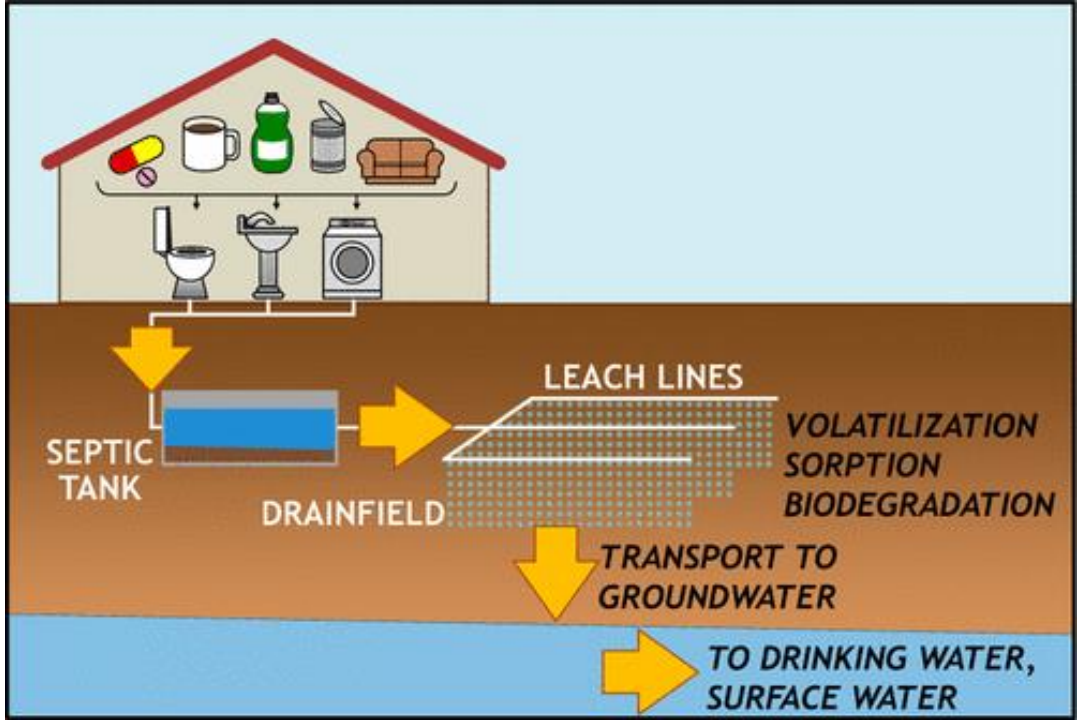
Maintenance Planning

MAINTENANCE SCHEDULE

SERVICE EVENT	SERVICE FREQUENCY			
Inspect Condition of Tank(s)	At Least Once Every	Months	Year(s) **Maximum 3 Years**	
Pump Out Contents of Tank(s)	When combined sludge and scum equals one-third(1/3) of tank volume			
Inspect Dispersal Cell(s)	At Least Once Every	Months	Year(s) **Maximum 3 Years**	
Clean Effluent Filter	At Least Once Every	Months	Year(s)	
Inspect Pump, Pump Control & Alarm	At Least Once Every	Months	Year(s)	☐ N/A
Flush Lateral and Pressure Test	At Least Once Every	Months	Year(s)	☐ N/A
Other:	At Least Once Every	Months	Year(s)	☐ N/A
Other:	At Least Once Every	Months	Year(s)	☐ N/A

Inspection Triggers

- Initial construction before backfill
- Property purchase by new owner
- Property additions, expansions
- Complaints or groundwater issues
- Time-based planned inspections



Permitting, Regs, Standards

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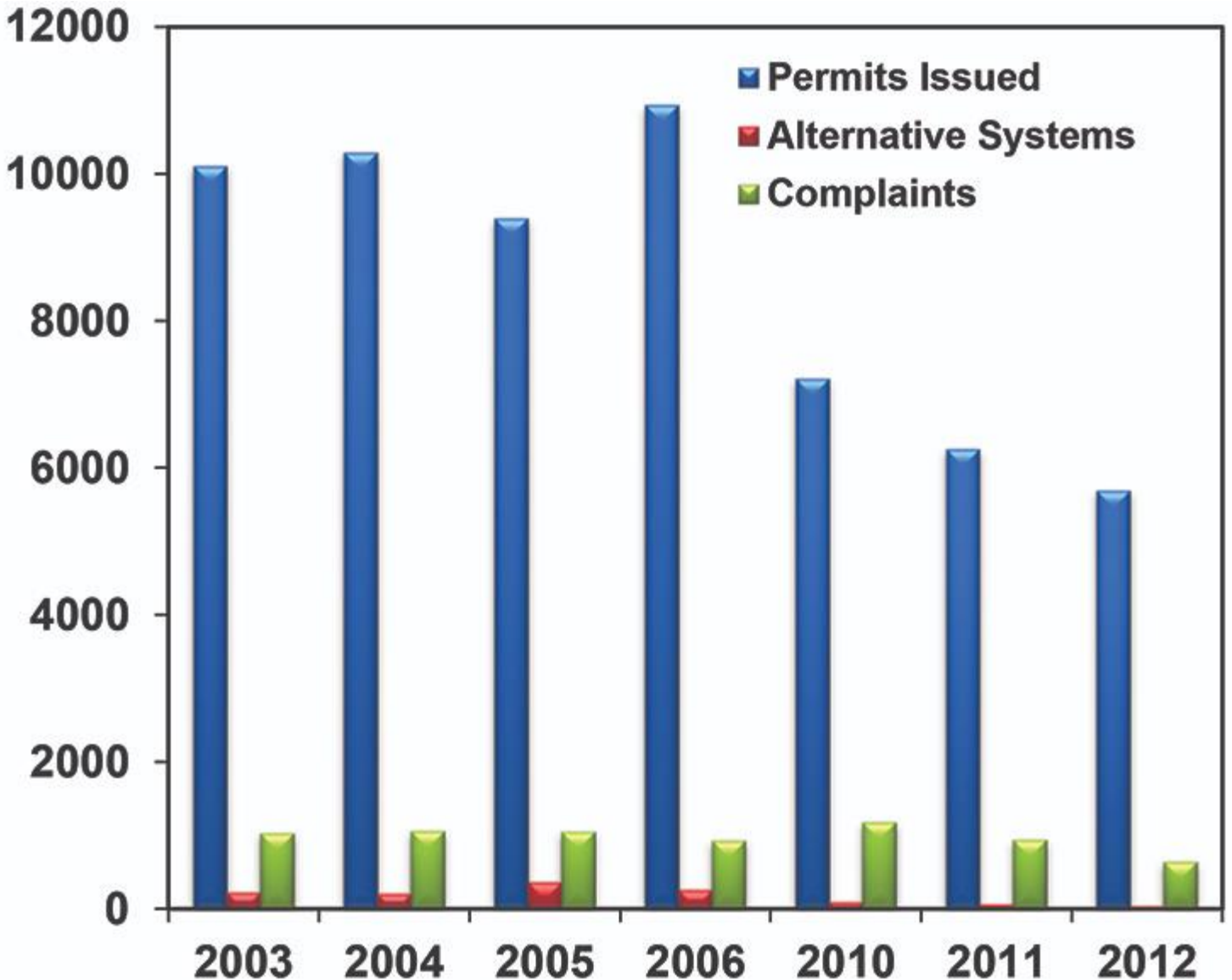
Permit and regulatory items

1. **Minimum distance** of septic to water sources, buildings
2. **Design specifications** of onsite systems – sizing, pretreatment
3. **Site evaluation and soil analysis** requirements
4. **Violations** for malfunctioning systems
5. **Notification requirements** for installations and modifications

Management Programs

- Should also educate private owners what is safe and not safe to put into onsite systems

Track program performance



Metrics

- Onsite problems per year
- Complaints per year
- Ground water monitoring results
- Number of inspections
- Maintenance completed
- Planned maintenance Ratio

PMR = Hours planned maintenance / Total Hours of Maintenance

800 hours planned. = 0.57
1,400 hrs. total

Poll #4

Which item below is typically a recommendation and not a regulatory requirement?

a. Minimum distance of septic to drinking water source.

b. Pump septic tanks every 3 to 5 years.

c. Design specifications of onsite systems.

d. Site evaluation.

Change in culture

Data-based decision-making supported by management practices can transform program culture

What can we conclude?

Summary statements – final remarks?

1. **Establish a process to evaluate new installations** – site surveys, etc.
2. **Maintenance and Inspection Frequencies -** based on data
3. **Permitting Process** – Develop standards, ordinances, and triggers
4. **Facilitate** a culture of continuous improvement

Thank you for participating

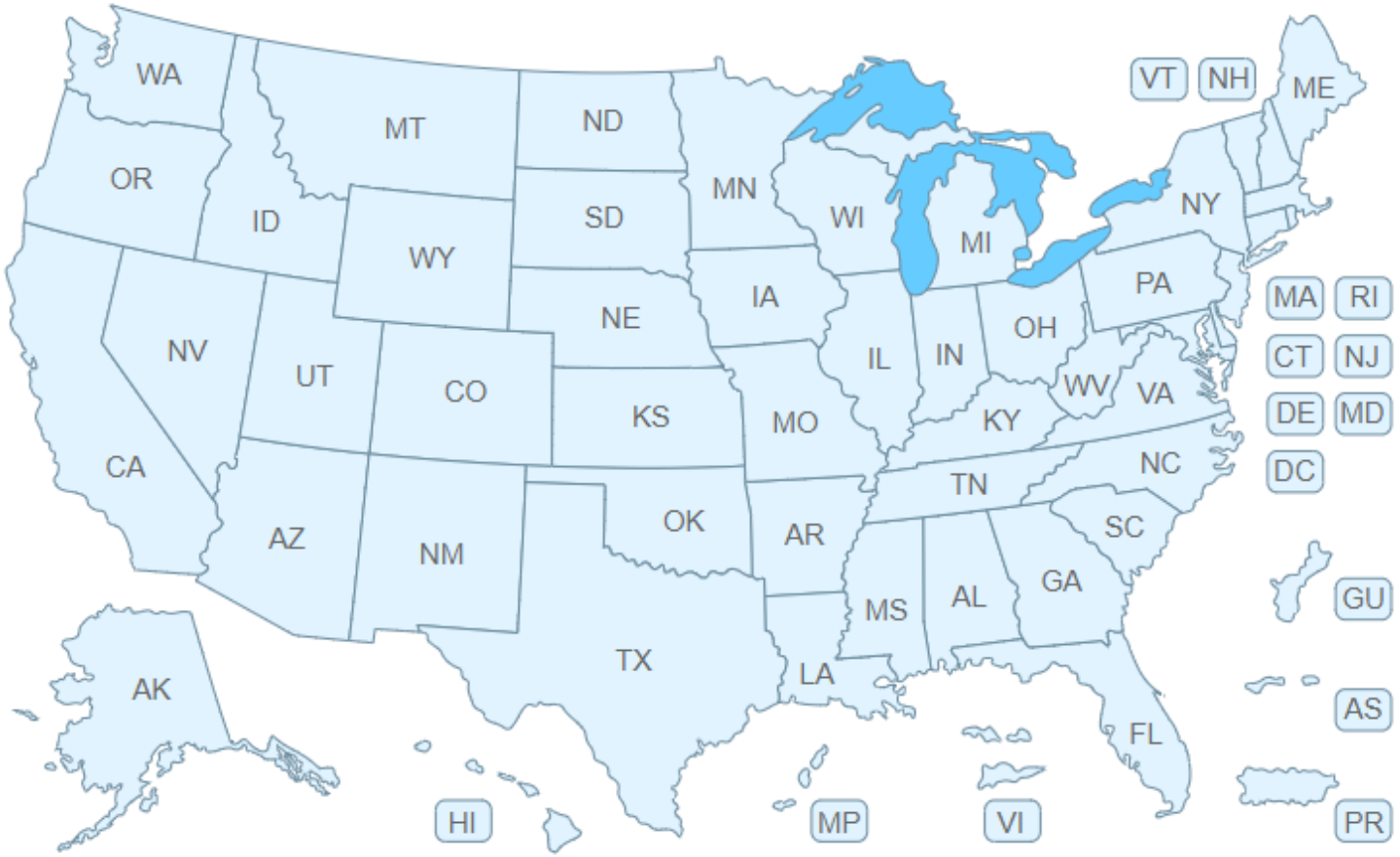
Share 1 thing you enjoyed learning about today in the chat

EFCN Funding Sources by State or Territory

https://efcnetwork.org/resources/funding-tables/

Provides

- Current loan and grant programs
- Eligibilities and terms
- Contact information



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