

# Understanding Wastewater Treatment Systems

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UNIVERSITY OF GEORGIA

EXTENSION

# First!

## The Law of "Conservation of Mass":

*"Matter is neither created or destroyed"*



Antoine Lavoisier



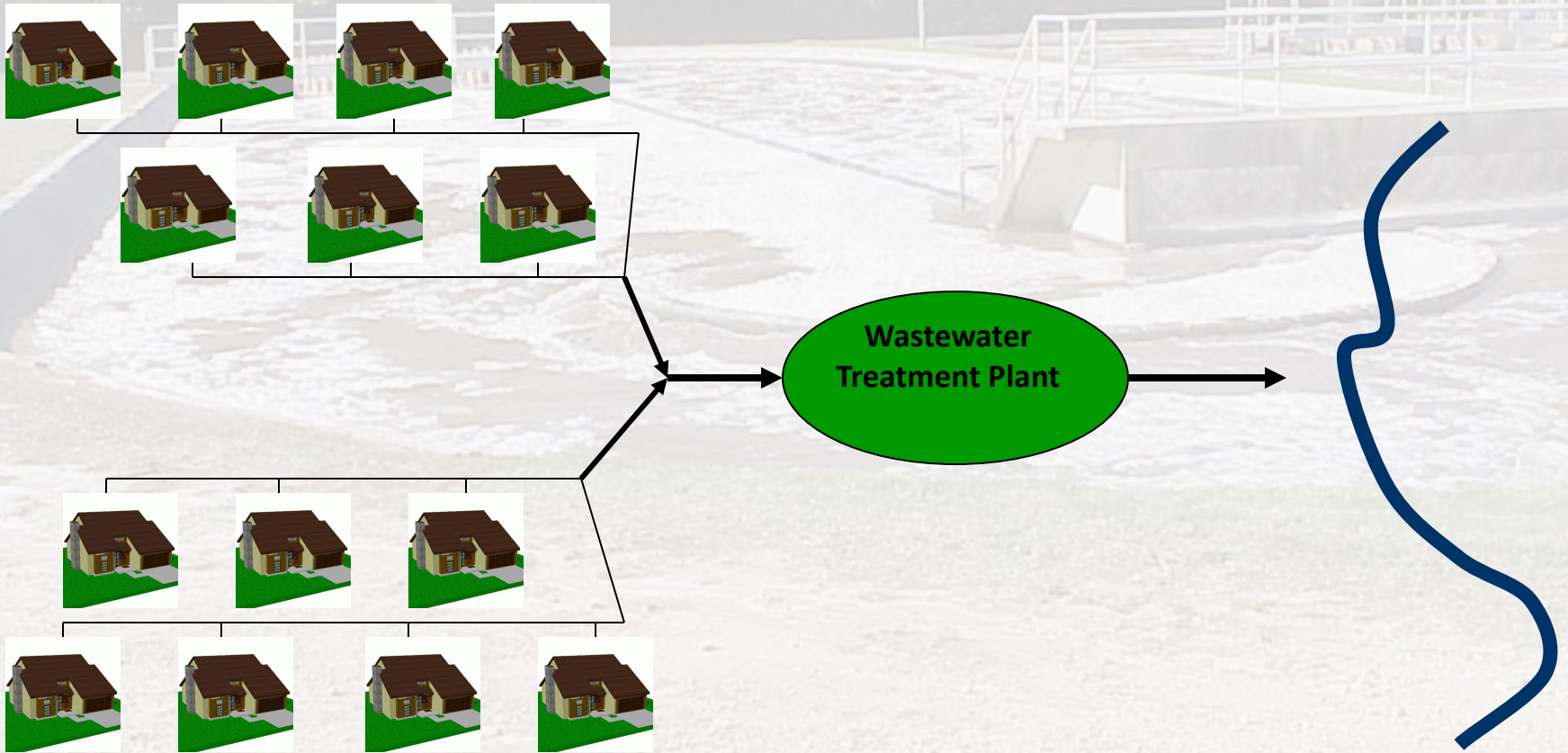
**ALWAYS REMEMBER:**

**When you flush,**

**It doesn't  
disappear!**

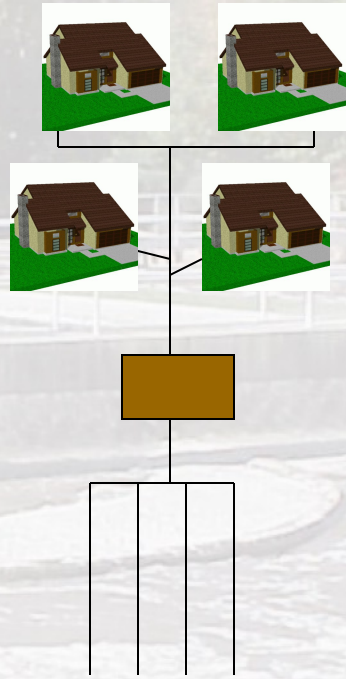
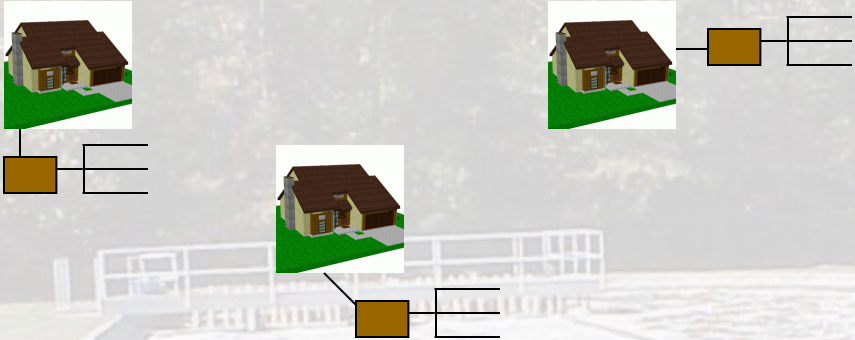
# To Centralize or Decentralize? That is the question!

## Centralized Treatment System

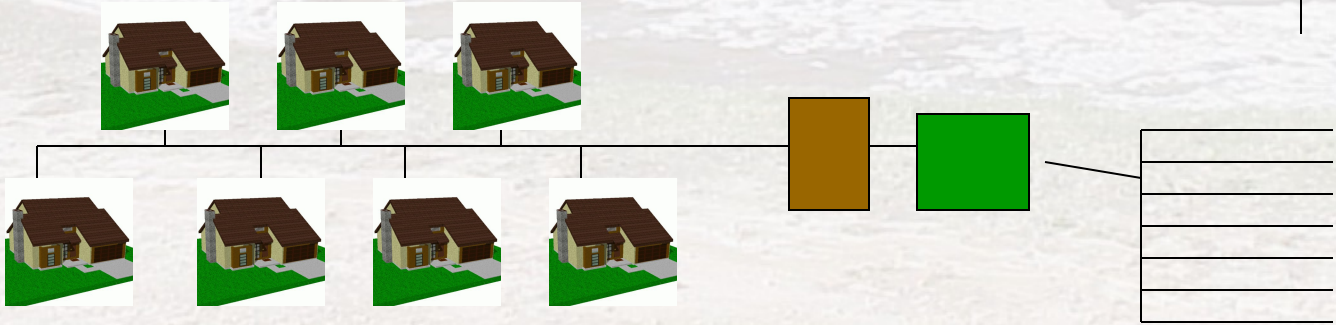


# Decentralized Treatment Systems

## Cluster Design



## On-Site Wastewater Treatment (Septic Systems)



## Large Community Systems

# Centralized

vs.

# Decentralized

- **Discharge system**
- **Capital intensive**
- **Personnel intensive, but labor efficient**
- **Provides higher degree of treatment**

- **Non-discharge system**
- **Less capital**
- **Less labor, but still needs maintenance (Who maintains?)**
- **Uses plant /soil soil system for treatment**



# Centralized System Treatment

- **Large Debris:**  
screened and sent to a landfilled
- **Grit Removal:**  
collected and sent to a landfill
- **Biological Treatment:**  
microbes use organic matter to grow
- **Clarifiers:**  
remove floating oil & grease and biosolids
- **Biosolids:**  
Treated and stabilized sludge containing microbe cells



# Centralized Wastestreams

**Treated  
Wastewater**



**Sludge  
or  
Biosolids**

# Decentralized Wastestreams

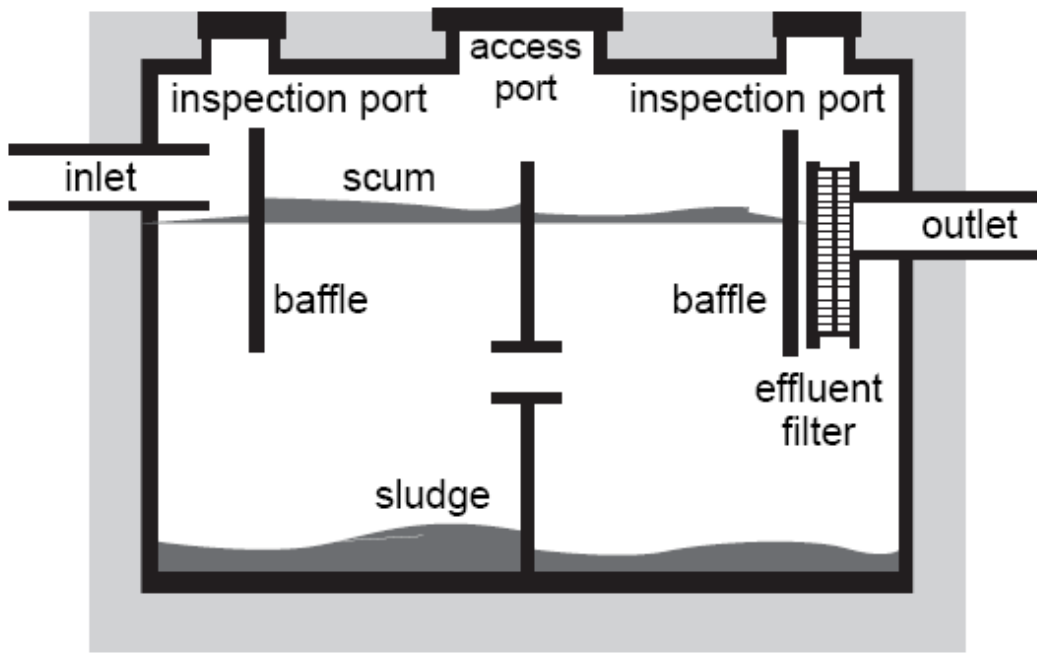
**Effluent**



**Sludge**



# Septic Tanks



# What Are We Talking About?

## Septic Tank Performance

<b>Parameter</b>	<b>Concentration (mg/L)</b>	<b>Percent Reduction</b>
<b>BOD<sub>5</sub></b>	<b>200 - 290</b>	<b>40 - 50 %</b>
<b>TSS</b>	<b>200 - 290</b>	<b>50 - 70 %</b>
<b>Nitrogen</b>	<b>35 - 100</b>	<b>20 - 30 %</b>
<b>Phosphorus</b>	<b>18 - 30</b>	<b>30 %</b>
<b>Fecal coliforms (#/L)</b>	<b>10<sup>8</sup> - 10<sup>10</sup></b>	<b>?</b>

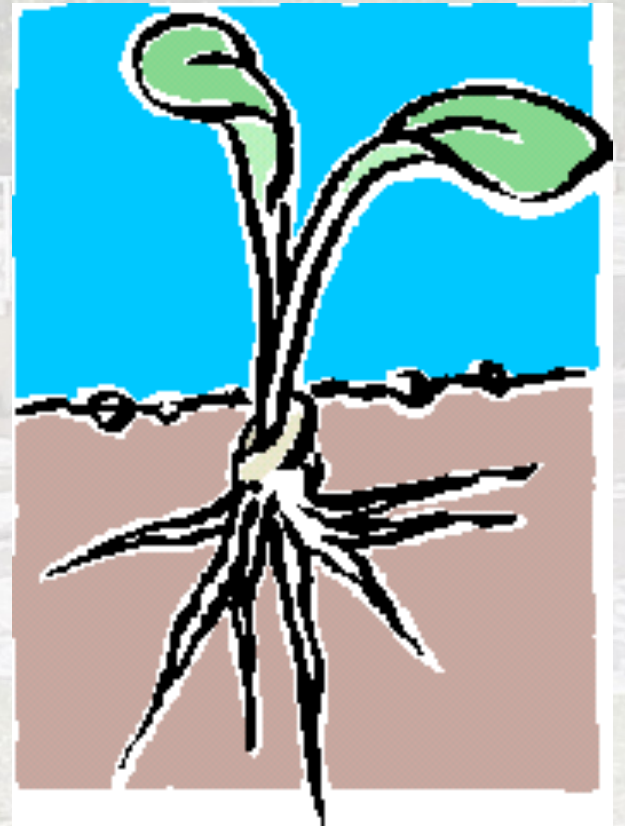
**BOD<sub>5</sub> - Biochemical Oxygen Demand; TSS - Total Suspended Solids**

# **Natural Wastewater Disposal Systems**

- **Uses natural plant/soil processes to clean up wastewater.**
- **Recycling!**

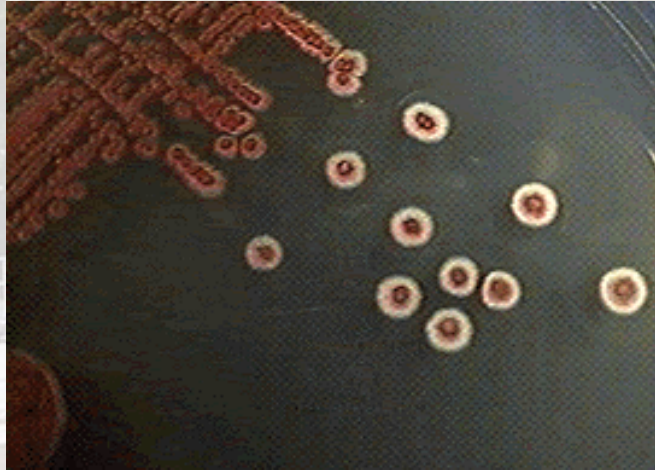
# Plant/Soil System

- **Soil organisms and plants – absorb nutrients, breakdown organics**
- **Soil chemical characteristics – hold metals**
- **Removing aboveground plants - removes nutrients**



# What Makes It All Work

*Actinomycetes*



*Protozoa*



*Mites*



*Mycorrhizae*  
*Roots*

# What Makes It All Work!



Annual Rye



Bermudagrass



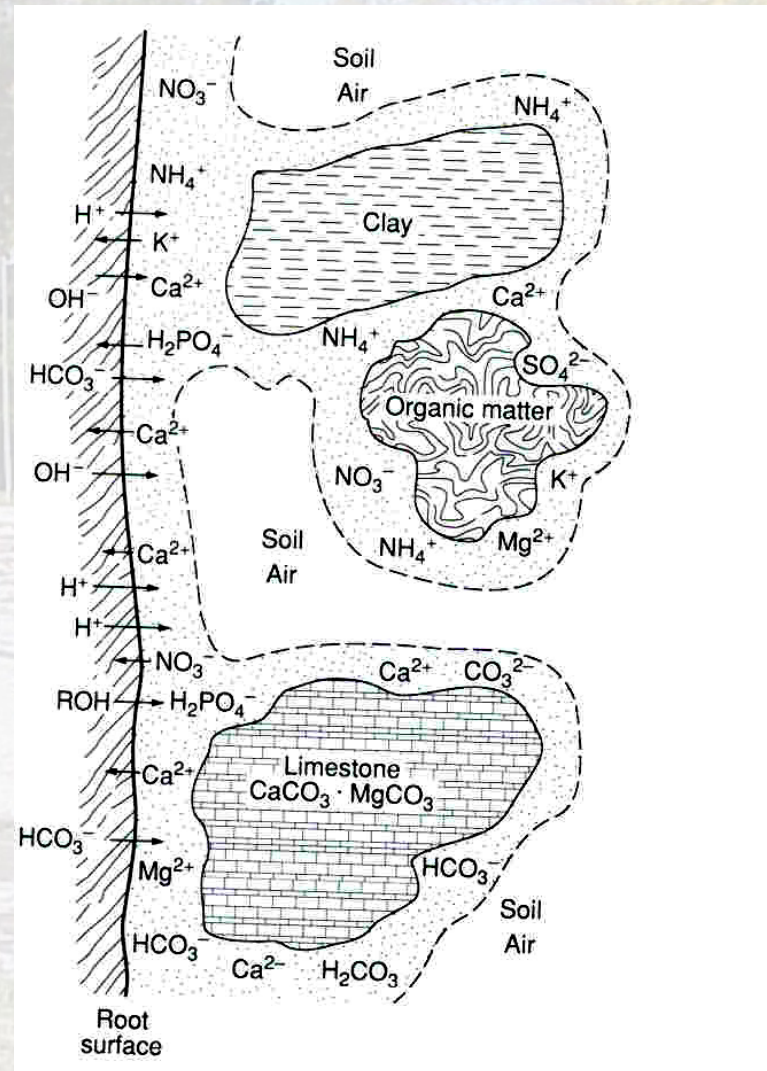
Forests

***Plants!***

# What Makes It All Work!

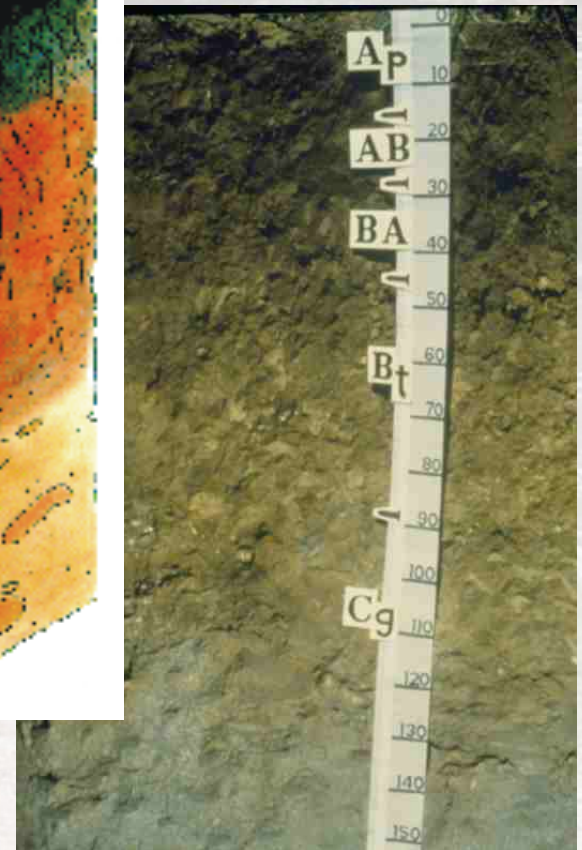
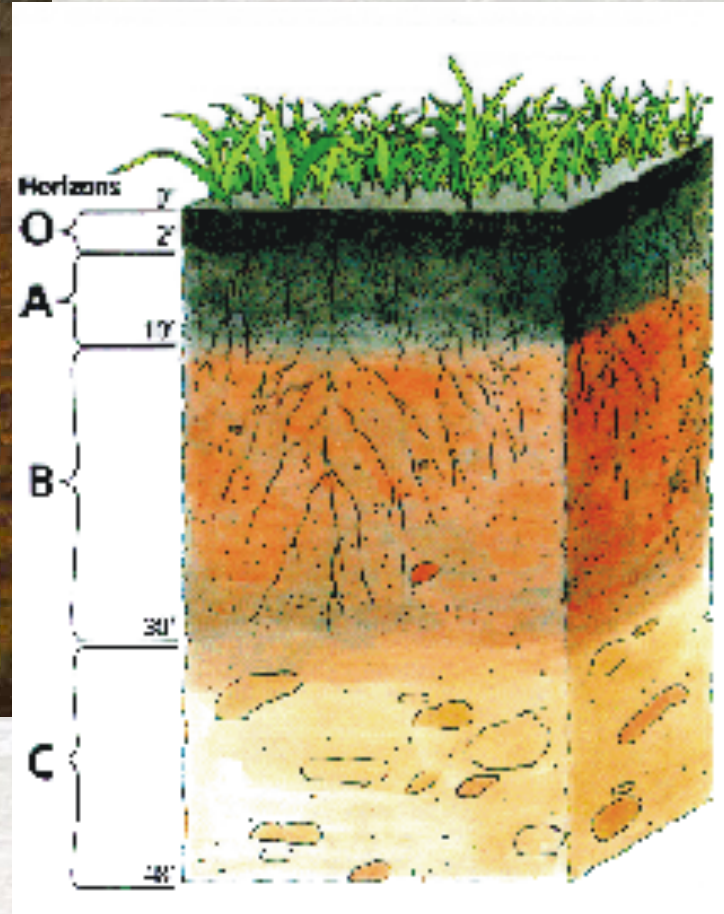
## Soil!

- Habitat (mixture of solid, water, and air)
- Holds minerals and metals
- Acts as filter



Adapted from Tisdale et al,  
1993

# Soils





# Natural systems affected by the environment

- **Weather**
- **Insect pests**
- **Stresses**

**-too much water,**

**-not enough of certain nutrients**

# **Effluent or Wastewater Slow Rate Irrigation**

**Irrigation onto land to  
support vegetative growth,  
with *no direct discharge* to  
surface water**

# Spray Irrigation

**Municipal,  
commercial,  
or cluster  
residential**

**Forest or crops (Bermudagrass/rye)**

**Forest less management, more land**



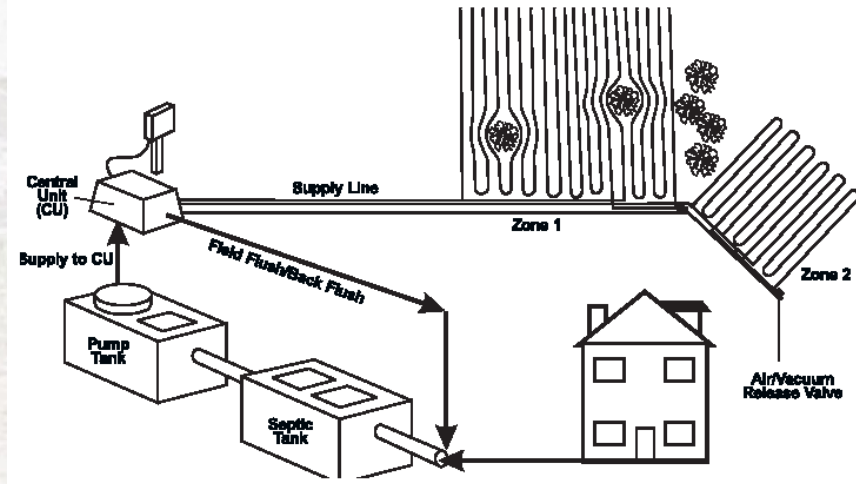
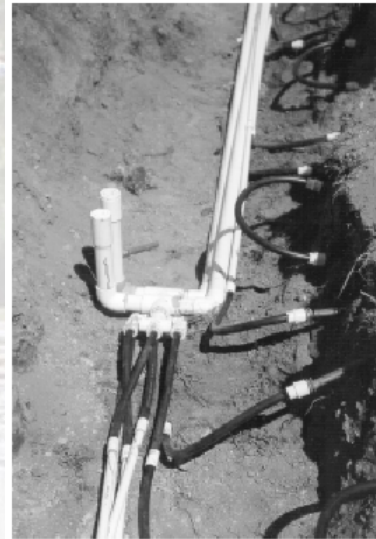
# **Spray Irrigation**

**With filtering and disinfection can be used to irrigate parks or golf courses.**



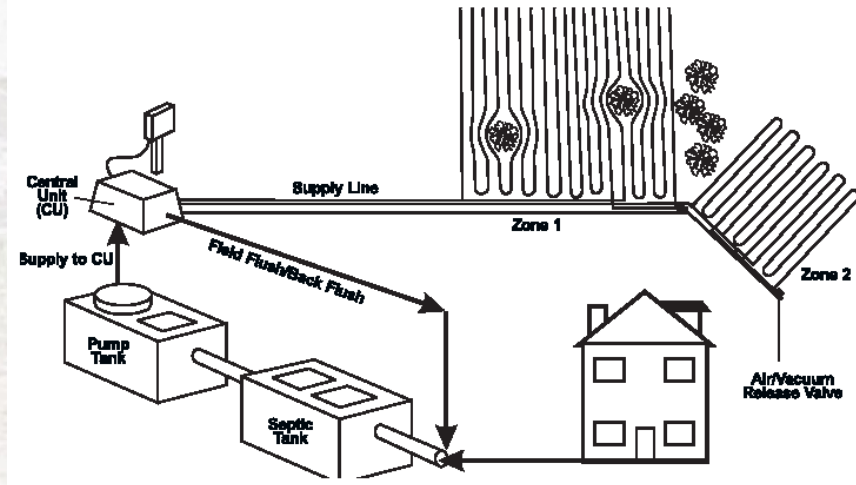
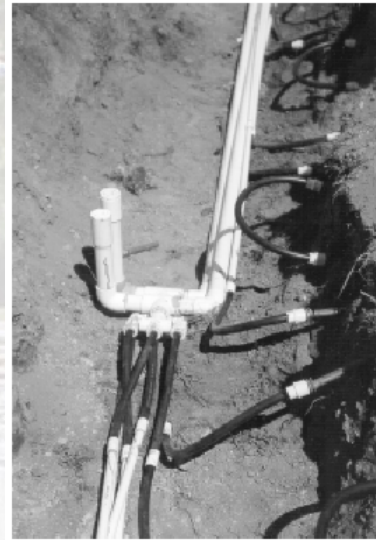
# Drip Irrigation

- **Commercial or cluster residential**
- **Some surface drip lines, mostly buried 8-12 in.**
- **Have to have good filters for particulates**
- **Usually septic tank then ATU package plant**



# Drip Irrigation

- Anecdotal evidence:
  - Larger systems >10 acres tend to experience more problems
  - Shopping center systems tend to have more problems

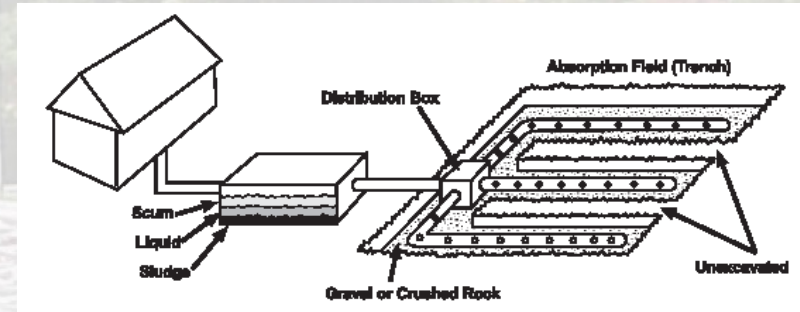
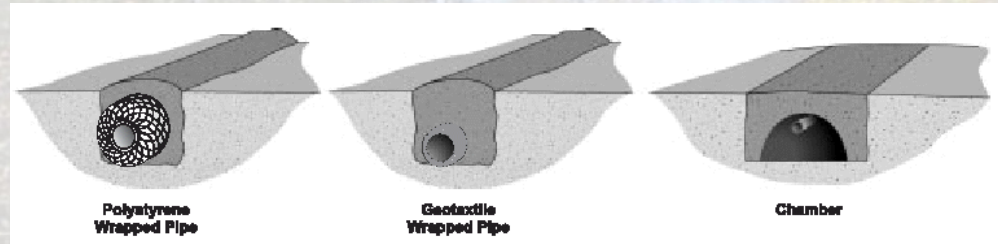


# Drainfields

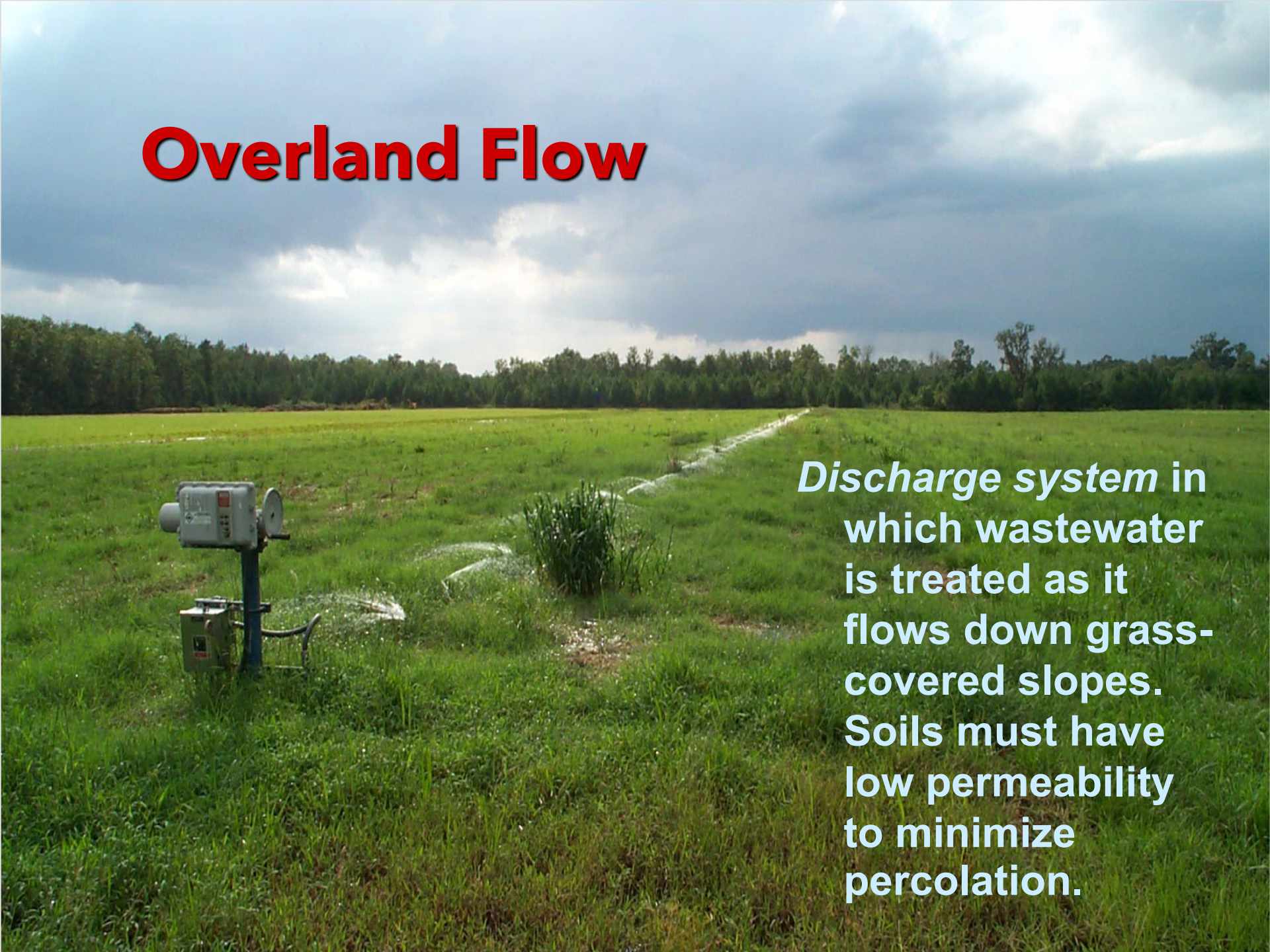
Commercial, cluster  
residential, single  
residential

2,000 - 150,000 gpd

Septic tank and  
trenches



# Overland Flow



*Discharge system in which wastewater is treated as it flows down grass-covered slopes. Soils must have low permeability to minimize percolation.*



# Constructed Wetlands



**Discharge system  
where wastewater  
treated by plant/soil  
system then  
discharged to stream.**

**Non-discharge system  
where treated water  
infiltrates or  
evaporates.**

# Constructed Wetlands

- **Municipal, commercial, cluster residential, or single residential**
- **Septic tank or other treatment, then wetland**
- **Free water surface and vegetated submerged bed.**



# Choosing the Right System

## Site Characteristics

Waste strength

Flows

Soils

Hydrology

Geology

Topography

Sensitive areas

## Capital Costs

Land

Equipment

Construction

## Operating Costs

Electricity

Maintenance

Periodic Cleaning

# **Who Maintains?**

**County?**

**Homeowners association?**

**Third party?**

**Need long-term planning.**

**May need long-term bonding for failures.**

# Who Maintains?

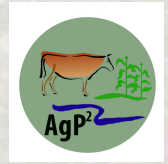
- **County - Set up public utility & charge sewer fees**
- **Third party utility - Private entity set up as utility, Electric Membership Cooperative (EMC) provide this service in some areas**
- **Homeowners Assoc. - Harder to maintain**

# Public Education

Everyone should know the type of treatment systems they are on  
**AND** things that create problems



**This information was developed with help from the**  
**AGRICULTURAL POLLUTION**  
**PREVENTION PROGRAM**



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