Wastewater Management

Why?
Why are we concerned about wastewater?

- Public Health Protection
  - Waterborne diseases
- Environmental Protection
  - Our lands and waters
- Aesthetics
  - Smells, odors, flies, etc.
Public Health is #1 Issue

✓ In developing countries, 60% of children do not reach 6 years old.

✓ Due to improper wastewater management, and thus

✓ Contaminated drinking water
Wastewater Contains...

- Bacteria (some are pathogens!)
- Solids
- Carbon
- Nutrients (nitrogen & phosphorus)
- Oils and Grease
Conventional Municipal Wastewater

- High population density areas

- Miles and miles of sewer pipes collect and transport wastewater and **all** its components to a "central" treatment plant

- Treatment consists of settling of solids, and biological treatment

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Treatment plants consist of:

- Screens (to remove large solids)
- Clarifiers (or sedimentation basins)
- Biological Treatment
  - Trickling Filters
  - Aerobic Treatment Systems (activated sludge)
- Digestors (where microbes degrade solids)
Screens
Clarifiers (for settling)
Solids removed, but... dissolved carbon material remains
Dissolved Carbon (BOD) is removed biologically

Carbon + O₂ >>>> CO₂ + H₂O + MORE

microbes

This is what purifies the water.
Microbes are attached to solid surfaces.
These treatment processes in big treatment plants correspond to onsite systems.

- Screens
- Clarifiers
- Digesters
- Bio. Treatment (TF)
- Effluent Filters
- Septic Tanks
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- Soil Disposal
Septic Tanks and Effluent Filters
( Clarifier/Digester/Screens )
In-Ground Disposal (*bio-treatment*)

like a trickling filter ... creates a biomat
Biomat

- Is made up of microbes feeding on wastes and solids in the disposal trench
- Will quickly clog a “tight” soil
- Can be minimized if solids are kept in tank and wastes are removed (treated) prior to disposal
- Thus, the reason for alternative treatment systems
More Food $\rightarrow$ More Microbes

- **Biomat** = microbes growing in the bottom of the trench (trench-soil interface)
- **Organic loading** important (food)
  - 1 gallon of ww per ft$^2$
  - 5 gallons of ww per ft$^2$
- Sidewall of Trench???
- Wide or **Narrow trenches**??
Alternative (or Advanced) Systems

Usually a biological treatment mechanism used to:

- biodegrade the organic wastes in wastewater
- protect public health
- protect the environment

...when soils cannot provide treatment or disposal

- Typically more complex, and engineered
- Used to alleviate problems:
  - High water table
  - Poor soils
  - Public Health Risk
Treatment Alternatives
(performance-based)

• Aerobic Treatment Units (ATUs)
  – Suspended Growth Processes

• Attached Growth (Packed Bed) Systems
  – Peat
  – Sand Filters
  – Constructed Wetlands
  – Foam
  – Etc.
Disposal Alternatives

- Mounds
- Pressure dosing
- Drip disposal
- Etc.
Treatment System Facts

- Treatment removes fecal coliform by 96%+
- Reduces Public Health risk
- Treatment systems replace soil treatment
- A necessity in poor or non-existent soils
- Treatment can enhance infiltration by up to 7x
- No biomat formation, enhances clay soil disposal