

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

\$\$\$

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



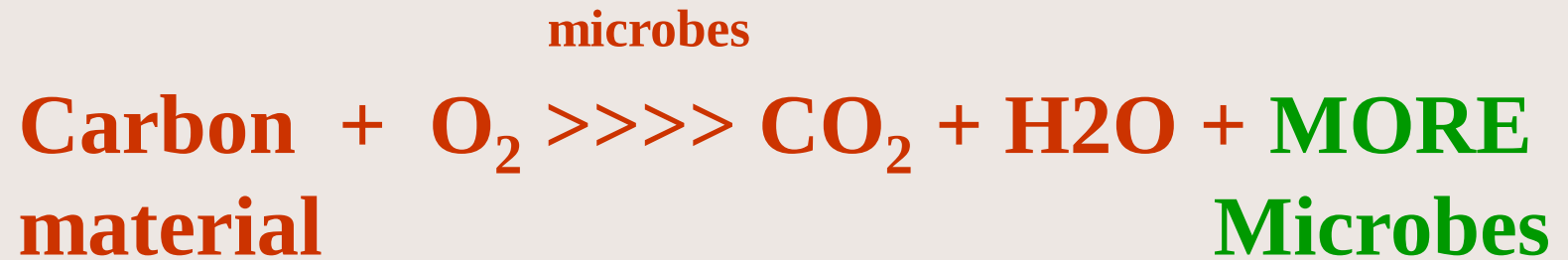
Clarifiers (for settling)



**Solids removed, but...
dissolved carbon material remains**



Dissolved Carbon (BOD) is removed biologically



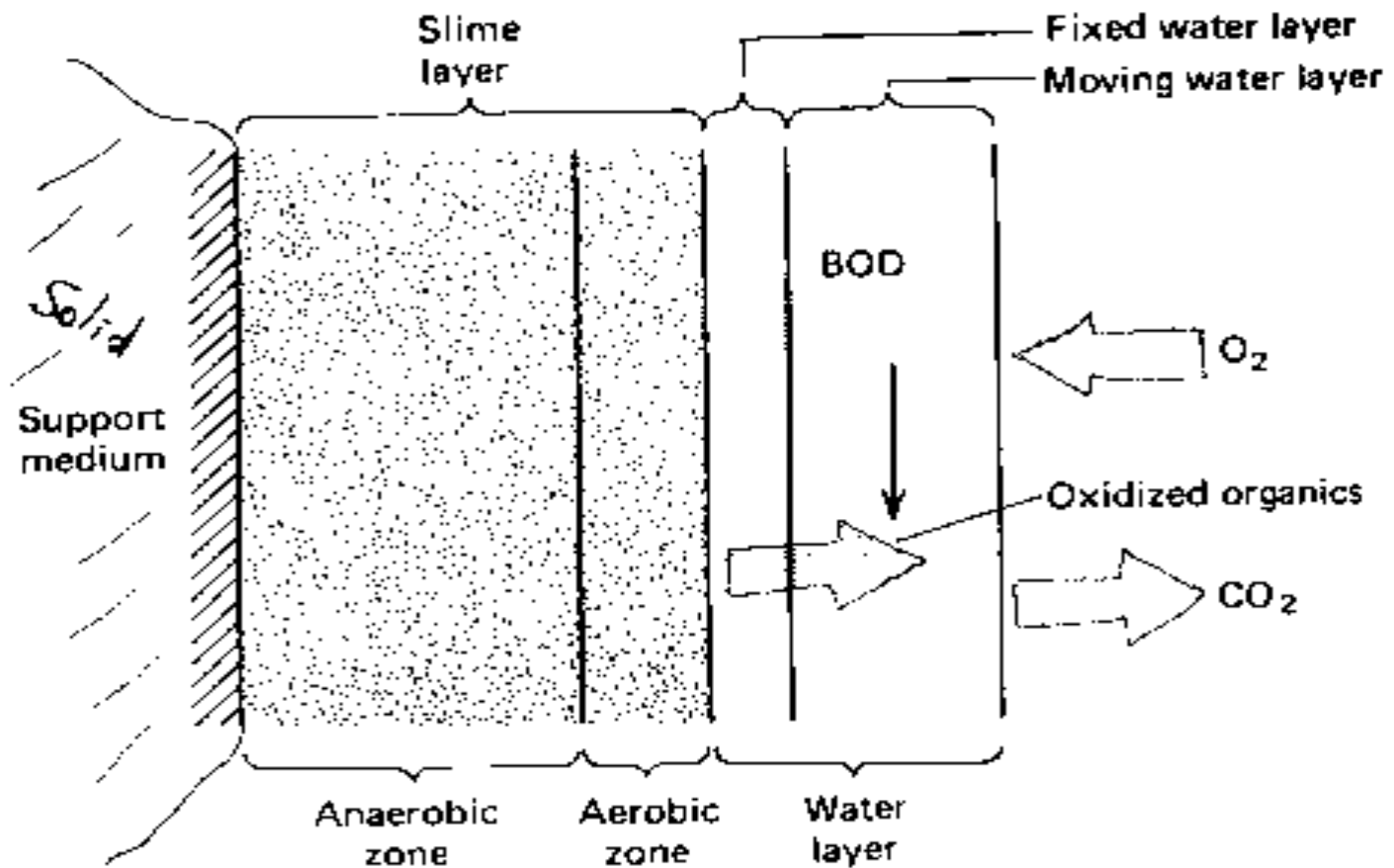
This is what purifies the water.

Trickling Filters





Microbes are attached to solid surfaces

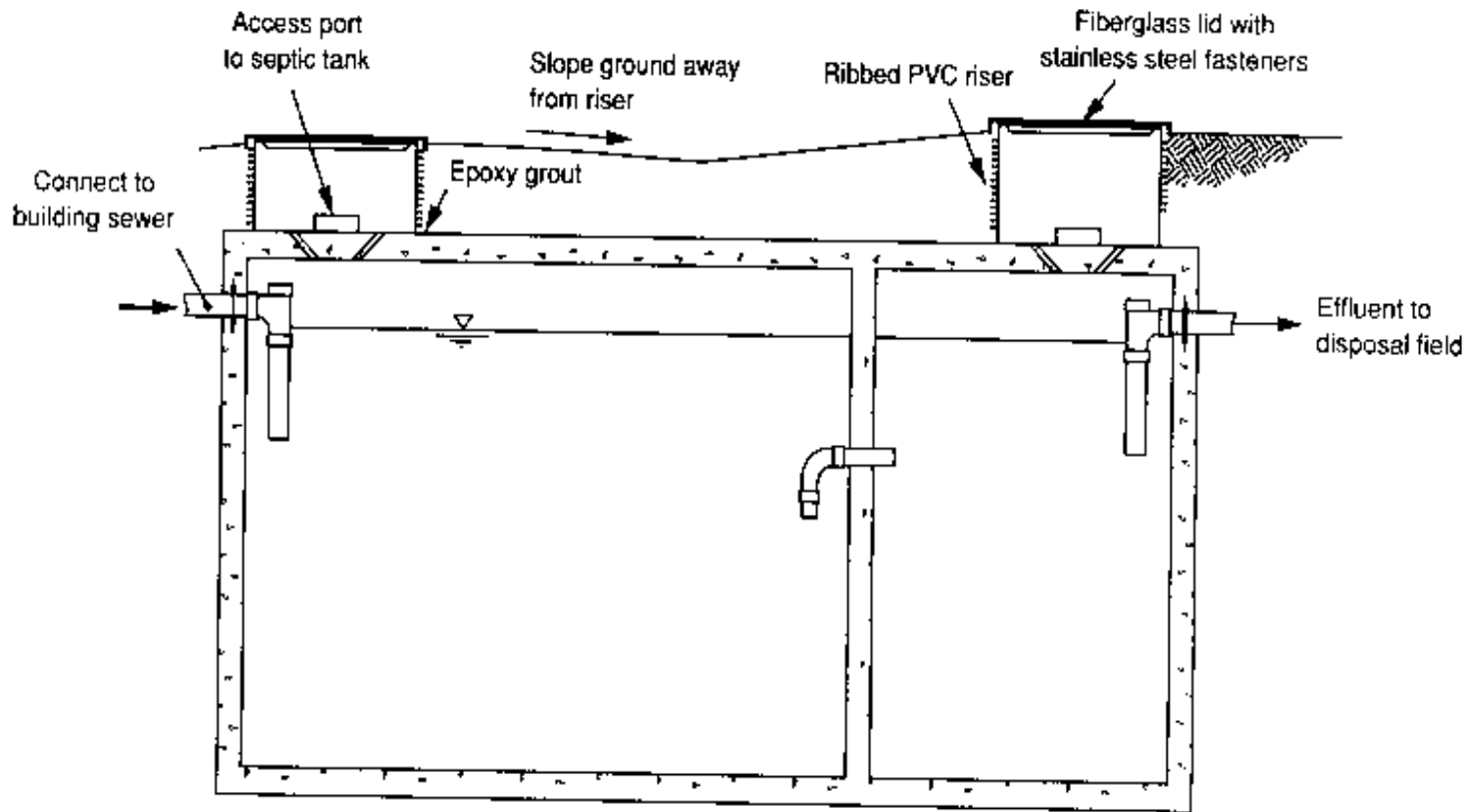


These treatment processes in big treatment plants correspond to onsite systems

Screens	Effluent Filters
Clarifiers	Septic Tanks
Digesters	Septic Tanks
Bio. Treatment (TF)	Soil Disposal

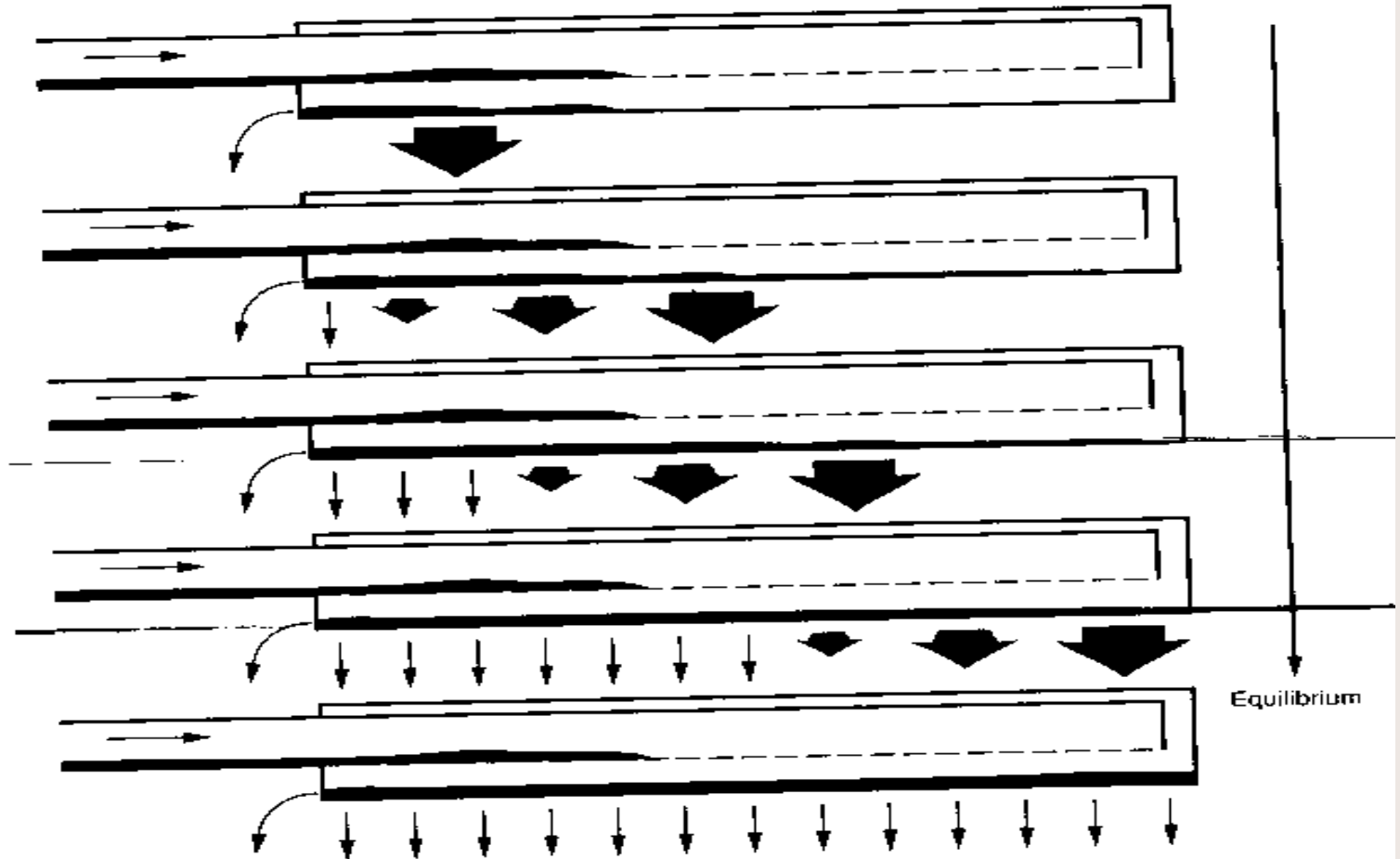
Septic Tanks and Effluent Filters

(Clarifier/Digester/Screens)



(a)

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 → More Microbes

- **Biomat** = microbes growing in the bottom of the trench (trench-soil interface)
- **Organic loading** important (food)
 - 1 gallon of ww per ft²
 - 5 gallons of ww per ft²
- Sidewall of Trench???
- Wide or **Narrow trenches**??

Alternative (or Advanced) Systems

Usually a biological treatment mechanism used to.....

- a. biodegrade the organic wastes in wastewater
- b. protect public health
- c. 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