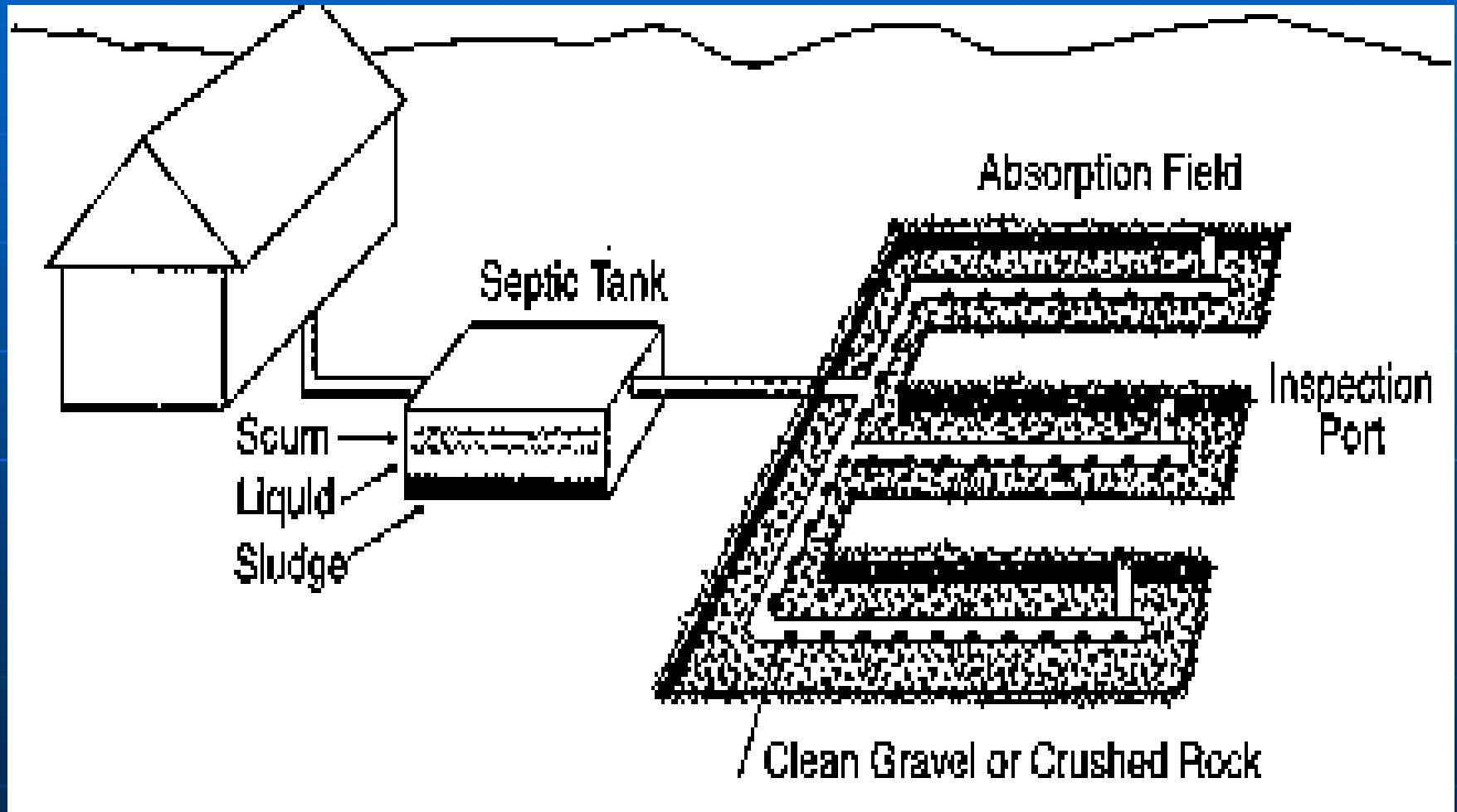


# Secondary Treatment Systems for the Onsite Industry

# Conventional Septic Tank Systems can be Problematic, Particularly in Areas exhibiting:

- High Ground Water Table
- Poor Soils
- Increasing Population Density

# Conventional Onsite



# Secondary Treatment Systems are used...

- **To Protect Public Health**
- **To Protect the environment**
- **When soils cannot provide adequate treatment or disposal**

# Secondary Treatment Systems...

- **Provide treatment that normally occurs in the soil column**
- **Are more performance based**
- **Excellent at reducing Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and Fecal Coliform Bacteria (FCC's)**
- **Can provide good nutrient reductions as well (N, P, NH<sup>3</sup>, etc...)**

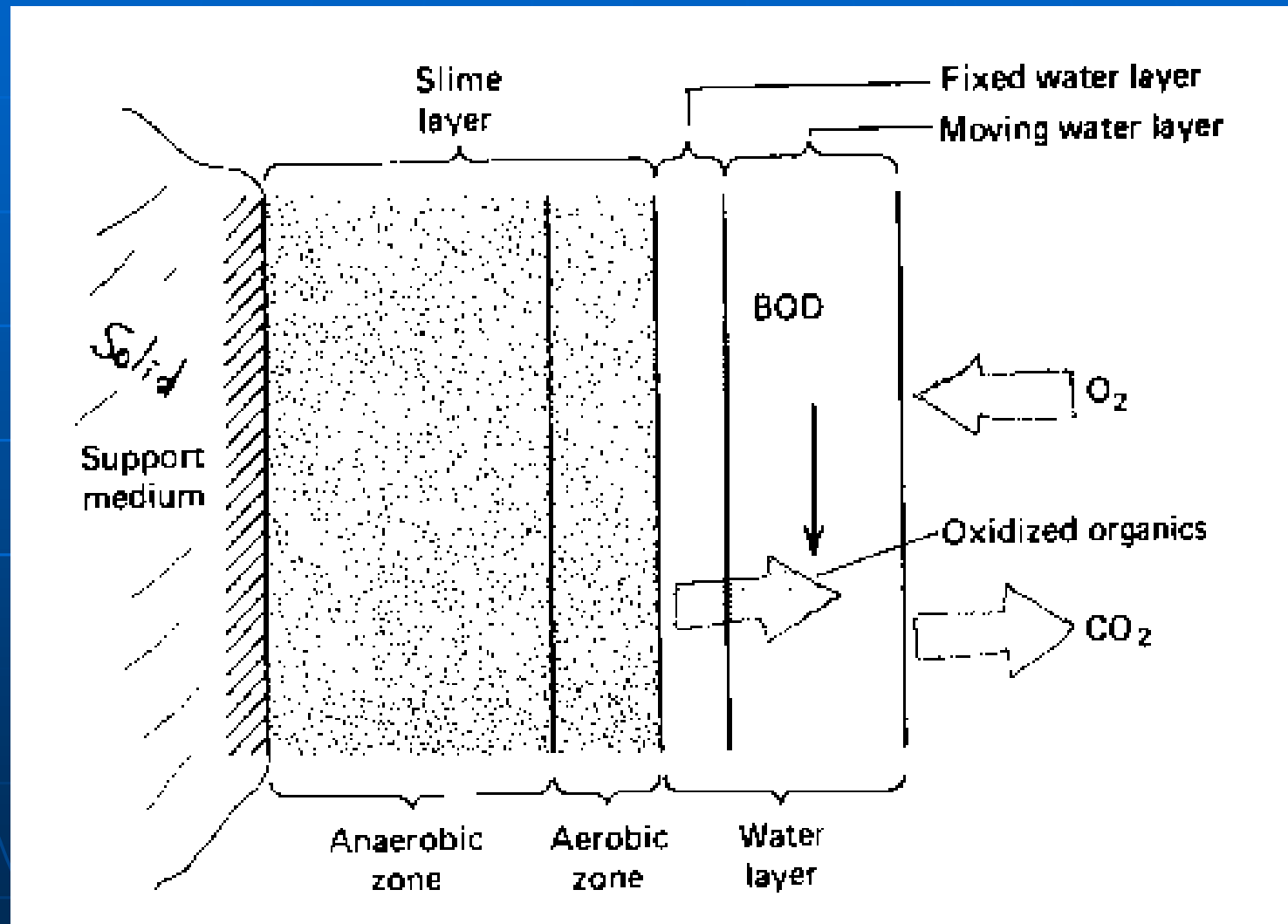
# Secondary Treatment Systems

- **Attached-Growth Treatment Systems**
  - a.k.a. media filters or packed-bed filters
  - Sand Filters
  - Peat Bio-Filters
  - Open Cell-Foam
  - Geo-textile Filters
  - Others
- **Suspended-Growth Treatment Systems**
  - Aerobic Treatment Units
  - Etc...

# Attached-Growth Systems

- Most are aerobic (ATU=somewhat of a misnomer)
- Filter bed provides material with high surface area per volume: easily passes water and oxygen
- Microbial ecosystem establishes itself on the media surface (a.k.a. "fixed film")
- Microflora include bacteria, protozoa (amoeba, etc.), rotifers, fungi, and other organisms
- These established micro-communities consume and digest much of the pathogens and organic constituents in the wastewater

# The Attached-Growth Process





# Attached-Growth Systems: Many Types of Natural and Synthetic Media!

## ■ ***Natural Media***

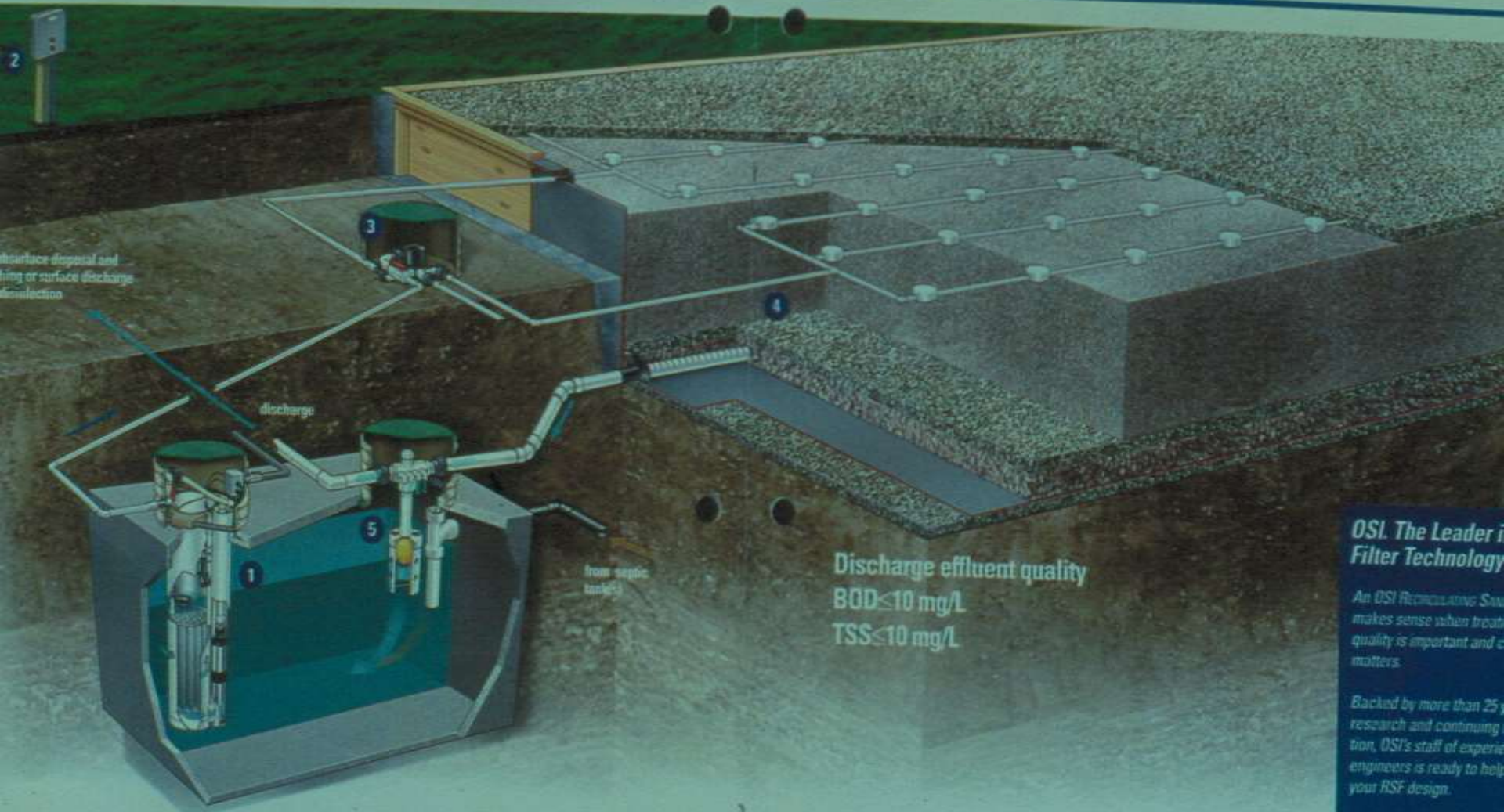
- Sand/Gravel
- Shale
- Limestone
- Activated Carbon
- Peat or Peat Fiber
- Coconut Fiber  
(Coir)

## ■ ***Synthetic Media***

- Open Cell Foam
- Geo-textile Fabric
- Crushed Glass
- Tire Chips
- Hard Plastic

# Sand Filters

- Single-pass or Recirculating
- Wastewater distributed evenly across sand bed
- Dosing (loading) important
- Size and quality of sand key to sand filter function
- Sand or gravel particles are screened to meet specific grain-size specifications
- Specifications are designed to provide surface area for bacterial attachment, with adequate void space for airflow to aerobic organisms and large voids to prevent clogging



**1 System\***  
 Revolutionary Biotube® Pump  
 protects downstream  
 plants and the sand filter bed.  
 Lightweight, stainless steel  
 is designed for high cycle  
 (wide the numerous small  
 microdosing) that make the

**2 Control Panel**  
 No need for an elaborate control  
 room! The control panel has a  
 programmable timer to control the  
 dosing, meters to track the flow,  
 and a current sensor to actively  
 monitor pump operation. System  
 status can be monitored on site or

**3 Distributing Valve Assembly**  
 In larger systems, distributing  
 valves automatically direct flow for  
 sequential dosing of small zones in  
 the sand filter. The valve requires  
 no electricity and the assembly is  
 configured to make its mainte-

**4 Manifold\* and Underdrain**  
 Manifold is designed and custom-  
 built to achieve maximum scouring  
 velocity and to spread the flow  
 evenly over the filter bed. Sturdy,  
 pre-slotted underdrain pipe col-  
 lects the filtered effluent for con-

**5 Recirculating Splitter Valve\***  
 Works in conjunction with timer  
 controls to maintain a constant  
 recirculation rate, regardless of the  
 rate of incoming flow. Patented  
 design with only one moving part.

Discharge effluent quality  
 $BOD \leq 10 \text{ mg/L}$   
 $TSS \leq 10 \text{ mg/L}$

**OSI. The Leader in  
 Filter Technology**

An OSI Recirculating Sand Filter  
 makes sense when treatment  
 quality is important and cost  
 matters.

Backed by more than 25 years of  
 research and continuing  
 innovation, OSI's staff of experienced  
 engineers is ready to help  
 your RSF design.

And to help guarantee the  
 design becomes a quality  
 there is no better insurance  
 an RSF package from OSI.  
 every equipment order, you  
 depend on OSI for free—

- Design assistance
- Standard drawings
- On-site commissioning











# Geo-textile Filters

- Recirculating
- Modular...installed as a unit (450 gpd, etc.)..."plug and play"
- Increased surface area and large void volume per unit bulk volume of material while maintaining high water-holding capacity
- Increased surface area-thus filter size can be smaller for a given wastewater flow
- Aerobic conditions maintained due to large volume of pore space through which air can flow even while material is wetted





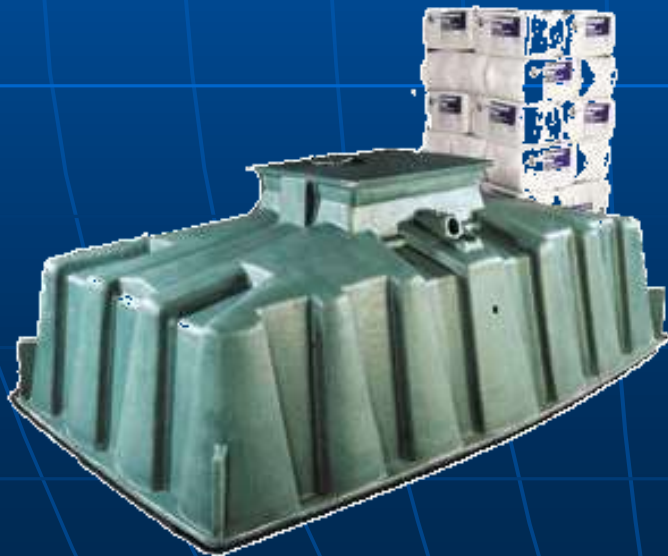




# Peat Bio-Filters

- Typically single-pass
- Modular, “plug and play”
- Can be pressurized or gravity fed
- Natural media-Canada, Ireland, and northern Europe
- High surface area and high void volume
- Microflora range from bacteria to nematodes
- Treated effluent often tea colored due to contact with organic humus in the filter
- Peat fiber deteriorates-must be periodically replaced (8-20 years).

# Peat Bio-Filters





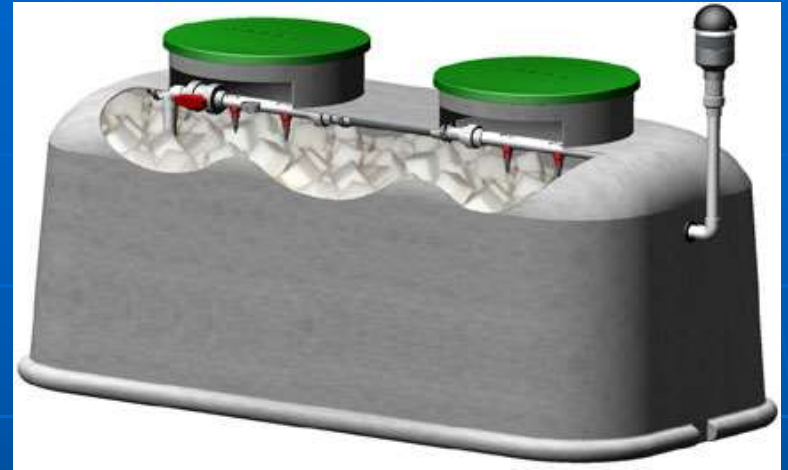


# Open Cell Foam Systems

- Single Pass or Recirculating
- Modular-"plug and play"
- Utilizes polyurethane foam material in 2" cubes
- Combines large surface area for microbial attachment and long retention times with high void volumes and separate paths for wastewater and air=loading rates up to 10X greater than sand
- Helical spray nozzles for uniform distribution
- Like other AGS's-media must be periodically replaced



# Open Cell Foam



# Open Cell Foam



# Suspended-Growth Treatment Systems (a.k.a. Aerobic Treatment Units)

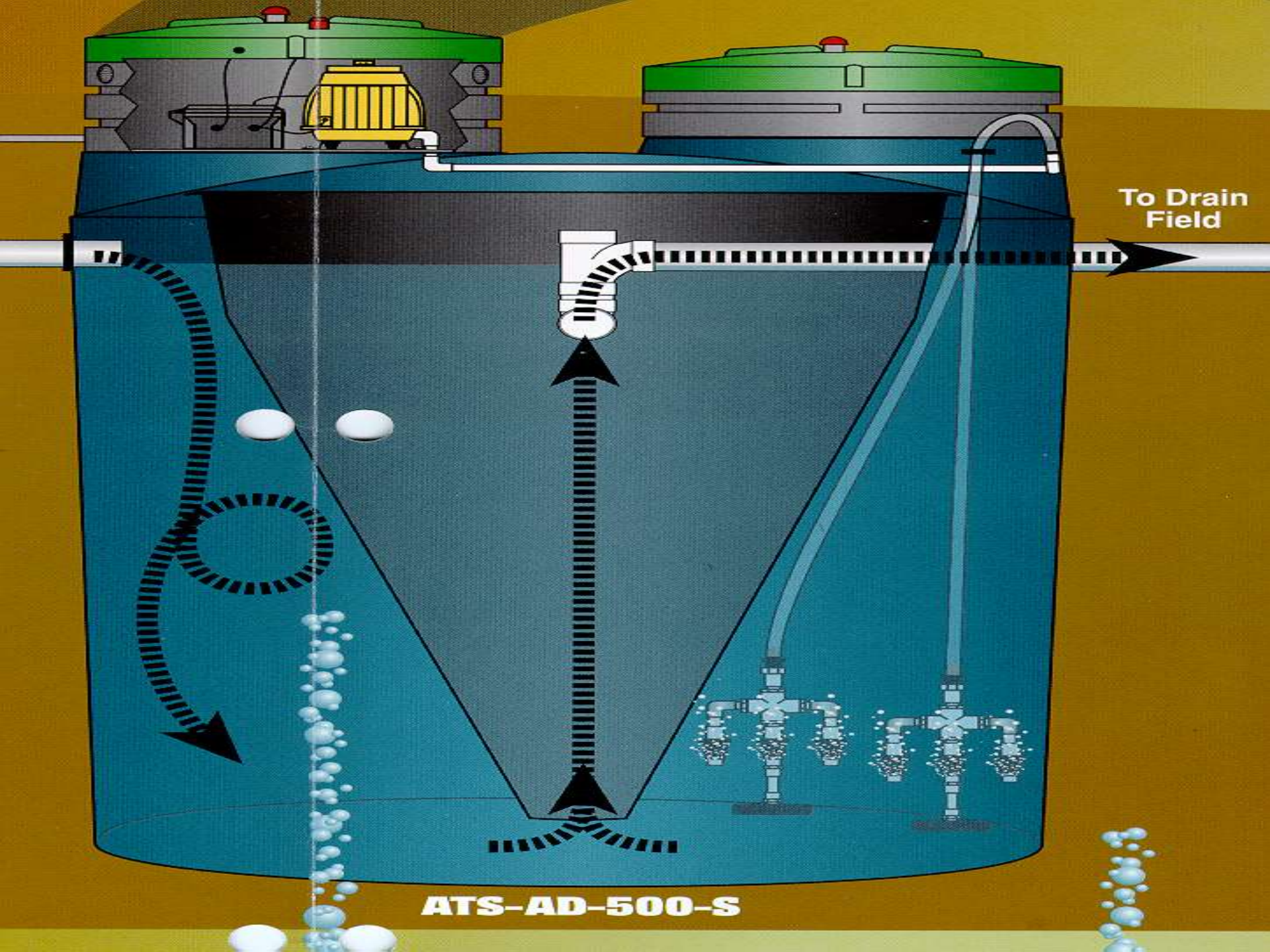
- Think fish aquarium! Microbes in these systems much the same as in attached-growth systems
- Essentially miniature wastewater treatment plants (a.k.a. activated sludge)
- Often come as packages (trash trap, aeration chamber, and pump chamber in one unit) for residential applications.
- Commercial units often have additional chambers that promote removal of nutrients, suspended solids, and pathogens from effluent
- Some units utilize attached-growth processes along with suspended-growth processes (ex: rotating biological contactor, Biolclere unit, Delta Biopod, Multi-flo Unit).



# Suspended-Growth Treatment Process

- Primary treatment is provided by a “trash tank” or septic tank that is sized for shorter retention time than a standard ST
- Wastewater enters the aeration chamber and is mixed with dissolved oxygen (from an air compressor, etc..) and **suspended** or attached microbes, or both
- Microbes convert organic compounds into energy, new cells, and residual matter
- Treated water moves into a clarifier, where remaining solids are separated and returned to the aeration compartment for further treatment
- Treated wastewater flows out of the clarifier for in-ground disposal





**ATS-AD-500-S**

# Suspended-Growth Treatment Processes: Things to Consider

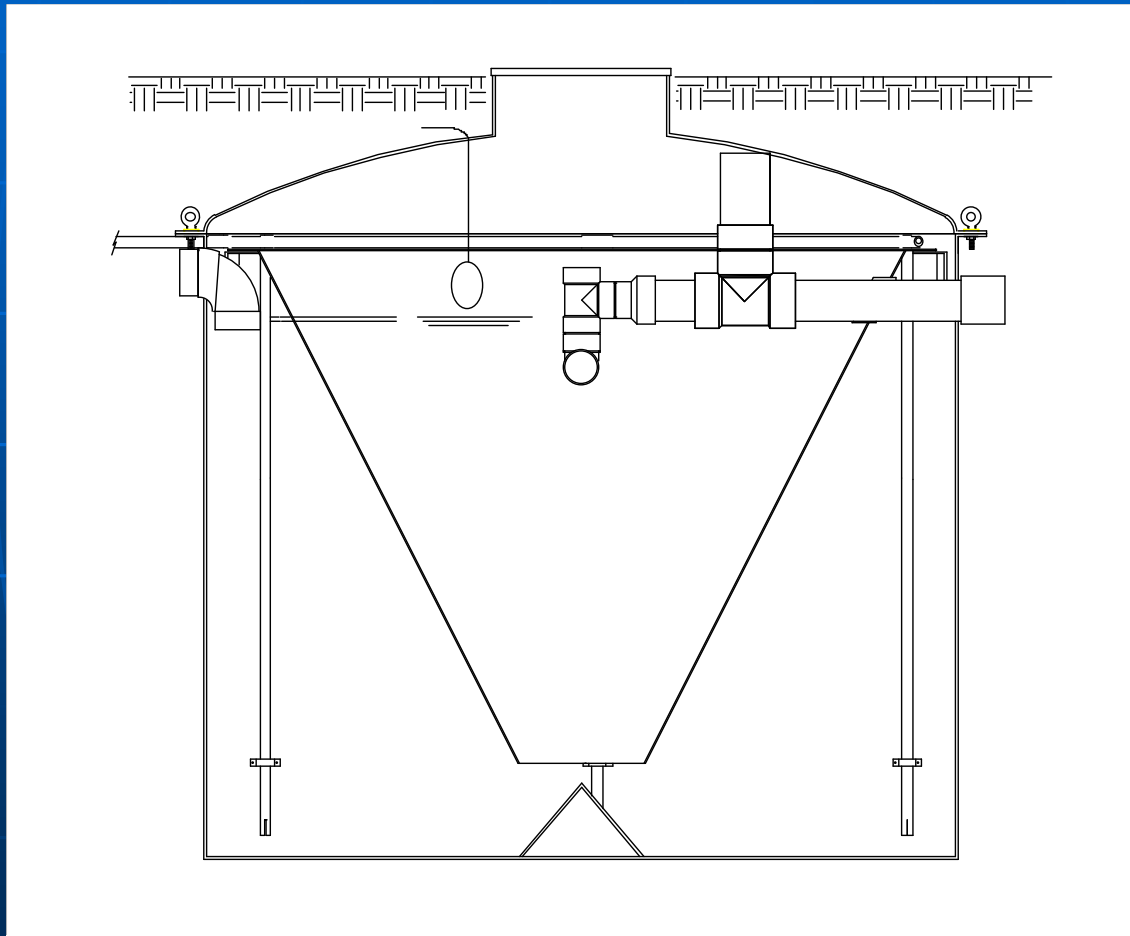
- Organic and hydraulic loading is important!
- If there is more “food” than microbes, effluent quality will be poor
- If there are more microbes than food, effluent quality will be high
- High hydraulic loading (ex: from washing machines=low in soluble BOD) can cause “wash-out” of microbes
- No food (i.e. lots of H<sub>2</sub>O)= microbes cannibalize themselves
- Population of microbes is dynamic in SGTS's

# Suspended-Growth Treatment Processes: Things to Consider

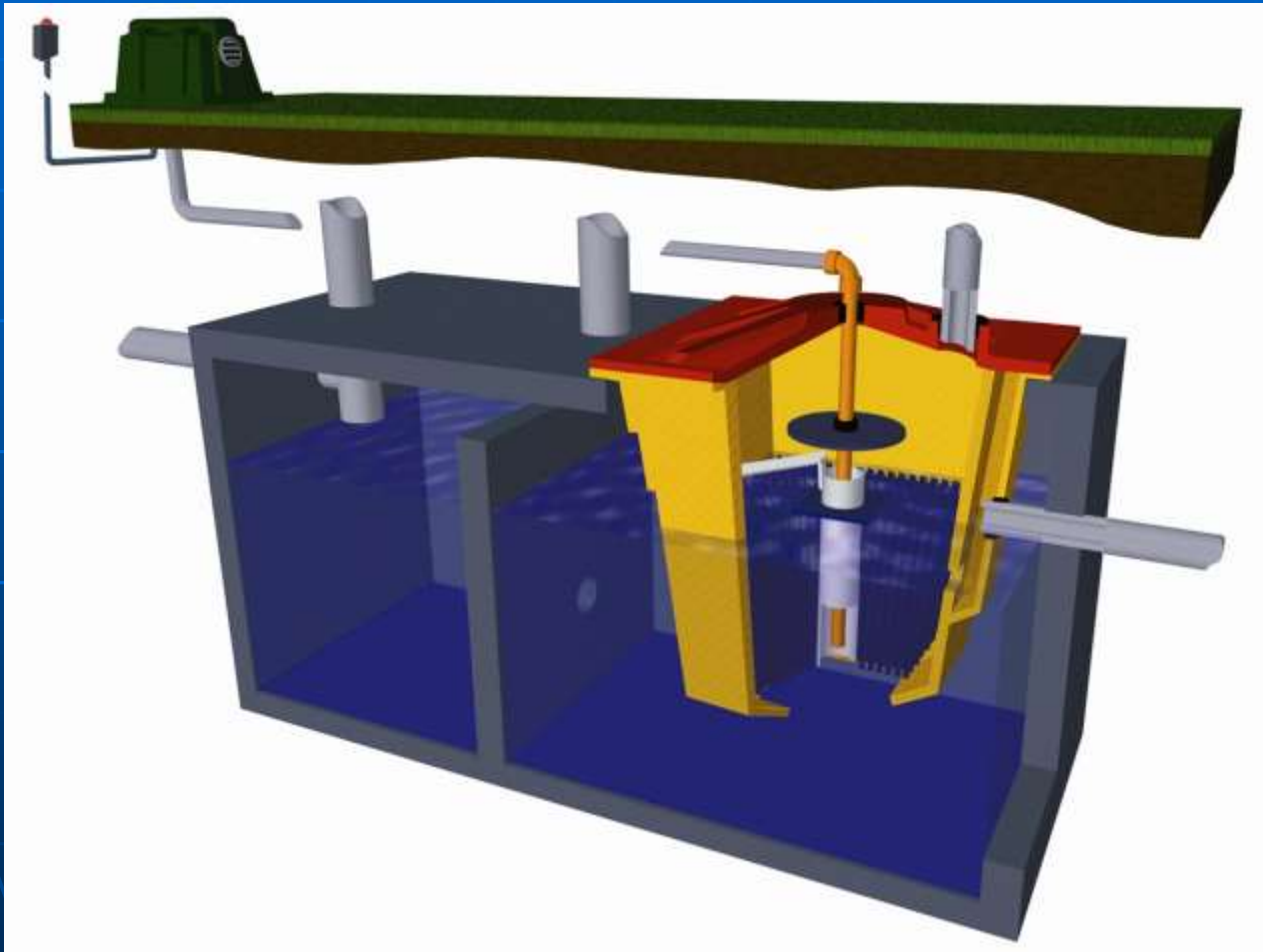
- All of these factors are important when using SGTS's in decentralized applications
- AGTS's are easier to "phase" in (ex: when you have only 4 homes in what will ultimately be a 100 home subdivision)
- Therefore, design is critical with SGTS's!



# Suspended-Growth Treatment Processes:



# Suspended Growth with Fixed Film



# Other Secondary Treatment Systems

# Constructed Wetlands

- “Man-made” ecosystems designed to optimize natural wetlands functions, particularly those associated with wastewater treatment.

# Constructed Wetland Design

## ■ **Treatment Cell**

- based on treatment (2.5 days HRT)
- lined (butyl rubber, 45 mil)

## ■ **Disposal Cell**

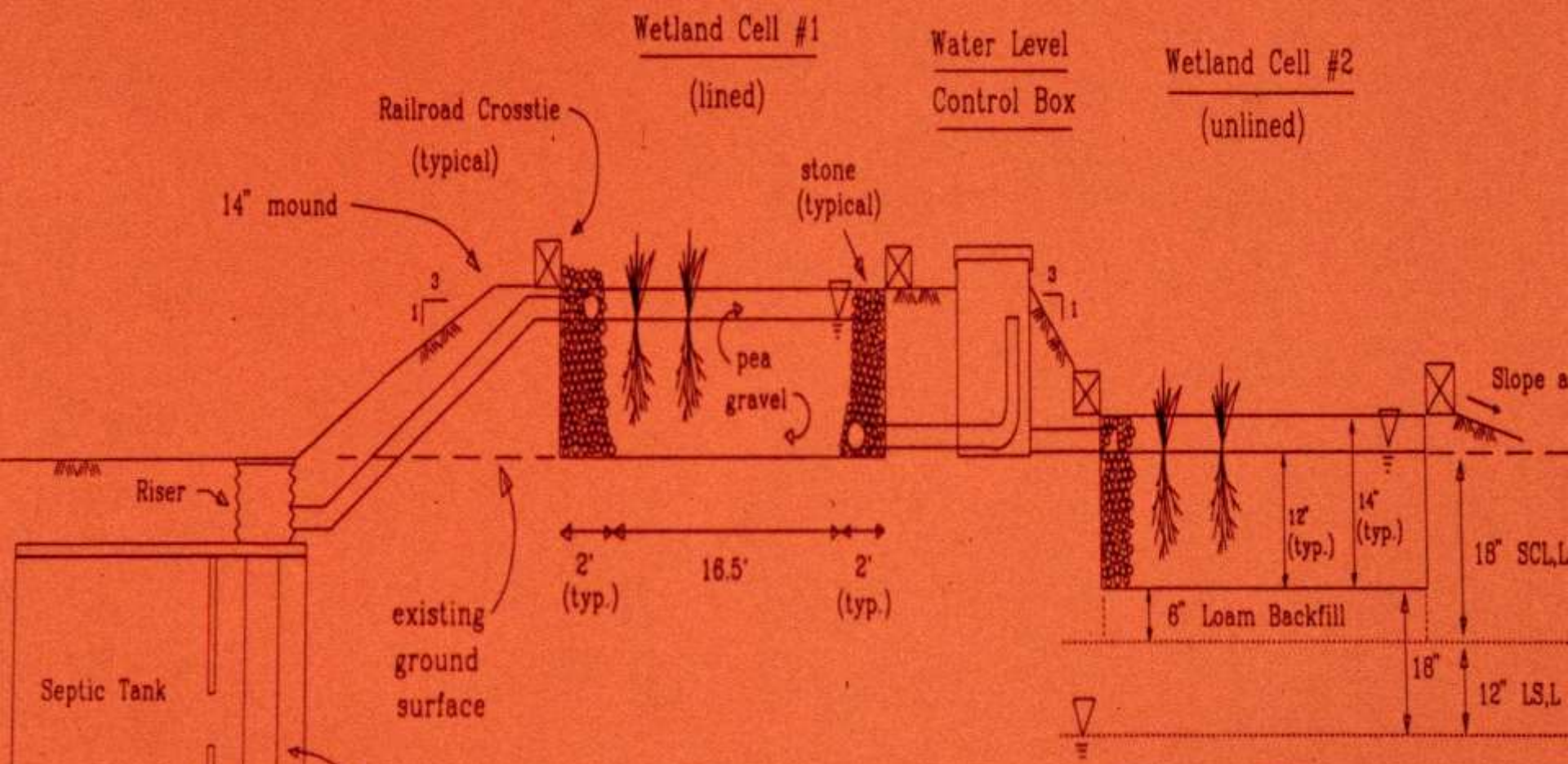
- Size based on standard soil loading rates
- 18-inch separation from restriction
- no liner
- 8 to 12 inches of #57 gravel





1 2 96





Lined cell 1

Unlined Cell 2

Hydraulic Profile View (no scale)





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