

# Chapter 7

## Onsite wastewater treatment technologies

2020

- *Technologies*

- Septic tank
- Constructed wetland
- Aerobic treatment unit
- Media filter
- Disinfection
- Lagoons
- Anaerobic up-flow filter

- *Final dispersal options*

- Subsurface disposal
- Atmospheric disposal
- Surface disposal

# • *1. Septic Tank*

– *What it is ?  
does it consist of ?*

*What*

- A pre-treatment component (i.e. concrete, fiberglass, plastic )
- Receive wastewater
- Partially treatment
- Solids removal to near the middle of the fluid

-A 1 or 2 compartment tank

-Prefab units possible

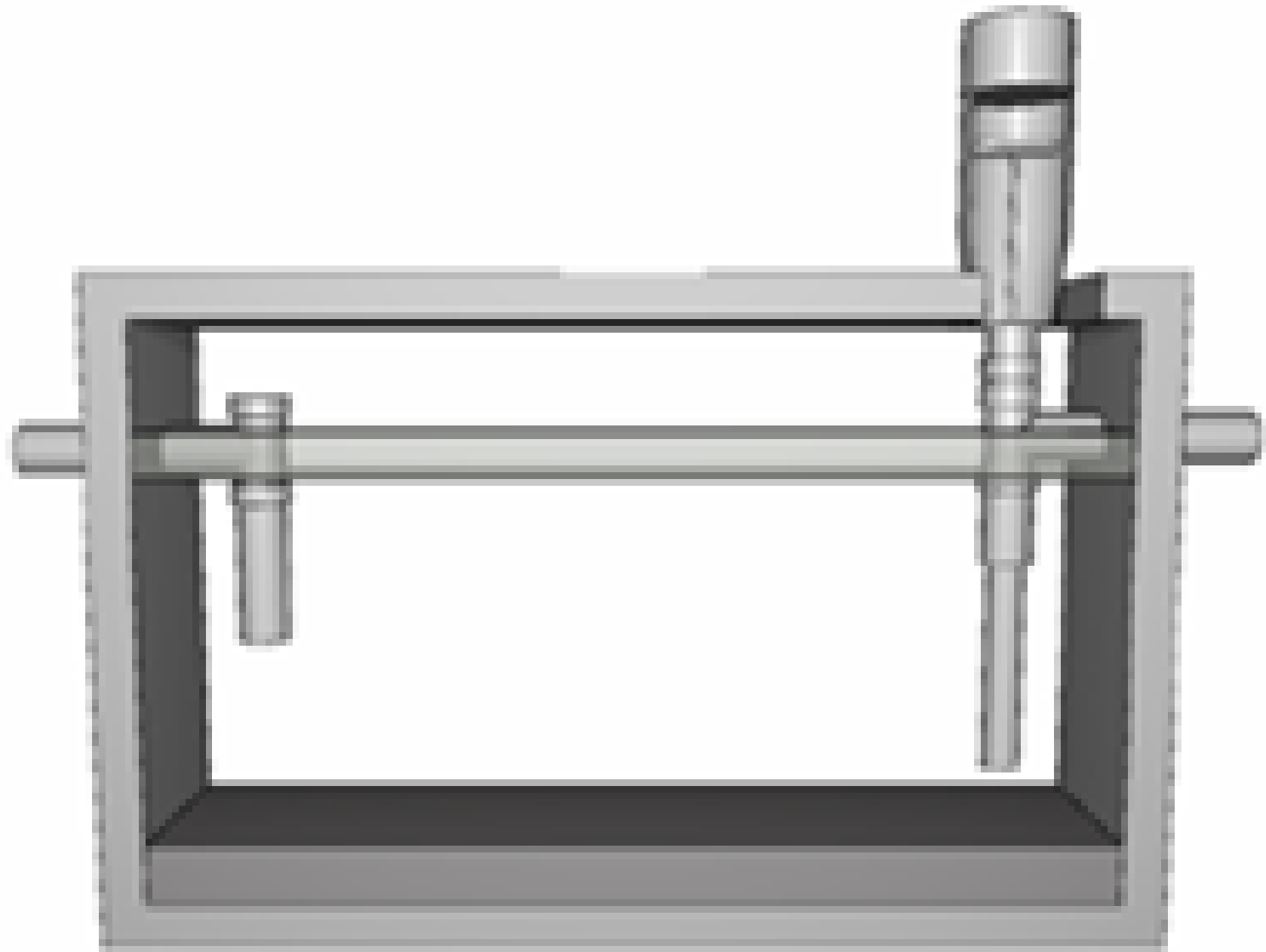
-Different geometry possible

-Outlet baffle or tee extending

-Inlet baffle

- Efficiency of solids removal related

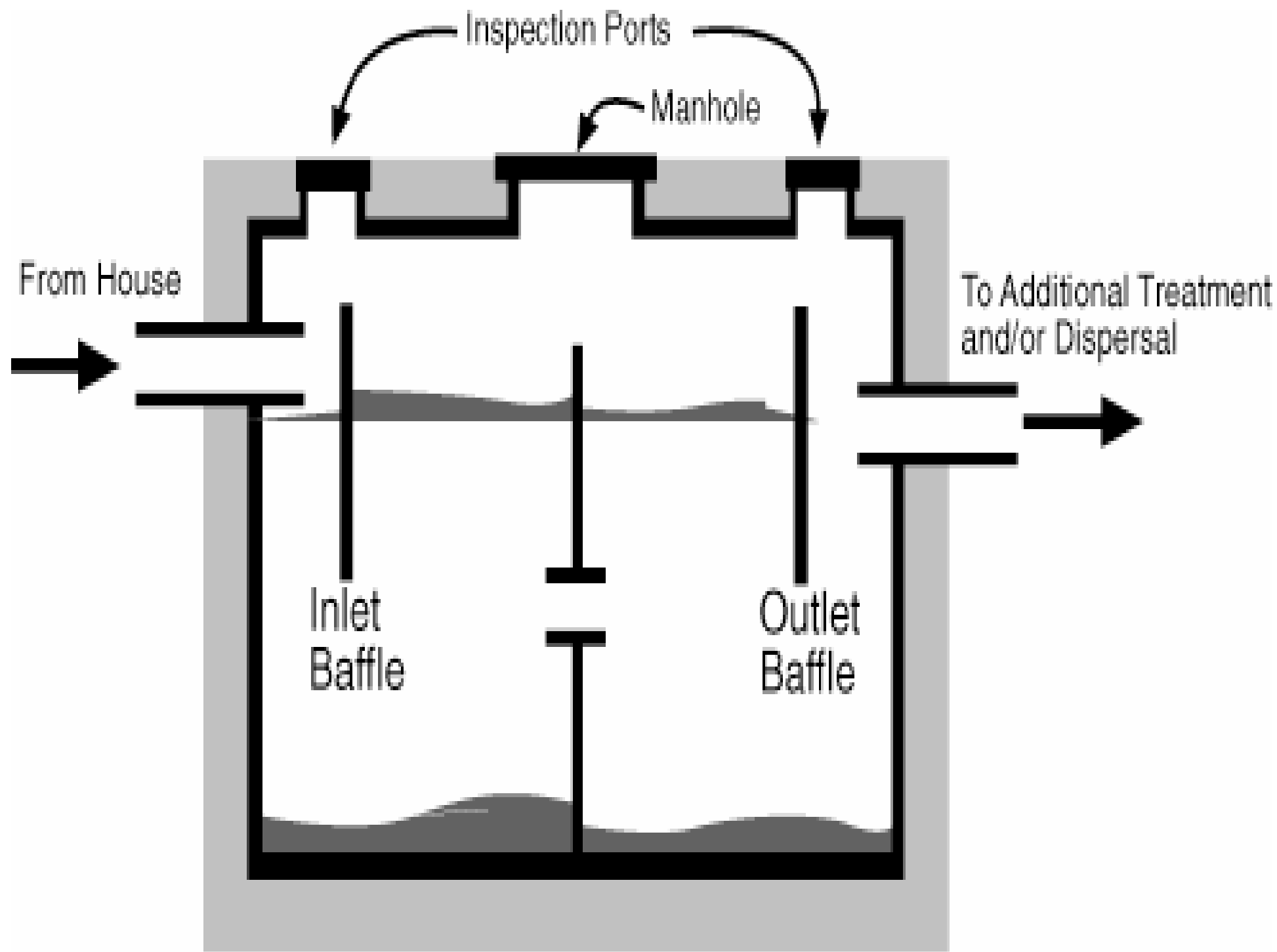
to compartment number



Typical One-Compartment Septic Tank

## *How does it work ?*

- Raw wastewater flows in to the tank
- Settleable and floating solids separated
- Settleable solids fall to the bottom
- Lightest material float ( scum layer)
- Gases generated vent through the building venting system.
- Environment extremely anoxic ( $H_2S$ , methane)
- Majority of total solids settle
- Tank design allows attenuation



*Typical applications  
septic tank should produce*

*following characteristics*

- Most common pretreatment option  
reduction in BOD

- Can be used alone or in combination with other  
80% reduction of settleable and SS

treatment or discharge components.

of pathogens

- In most cases, the most pretreatment step  
30% reduction in total nitrogen

*A properly operating*

*effluent of the*

-30 to 35%

-60 to

-Some removal

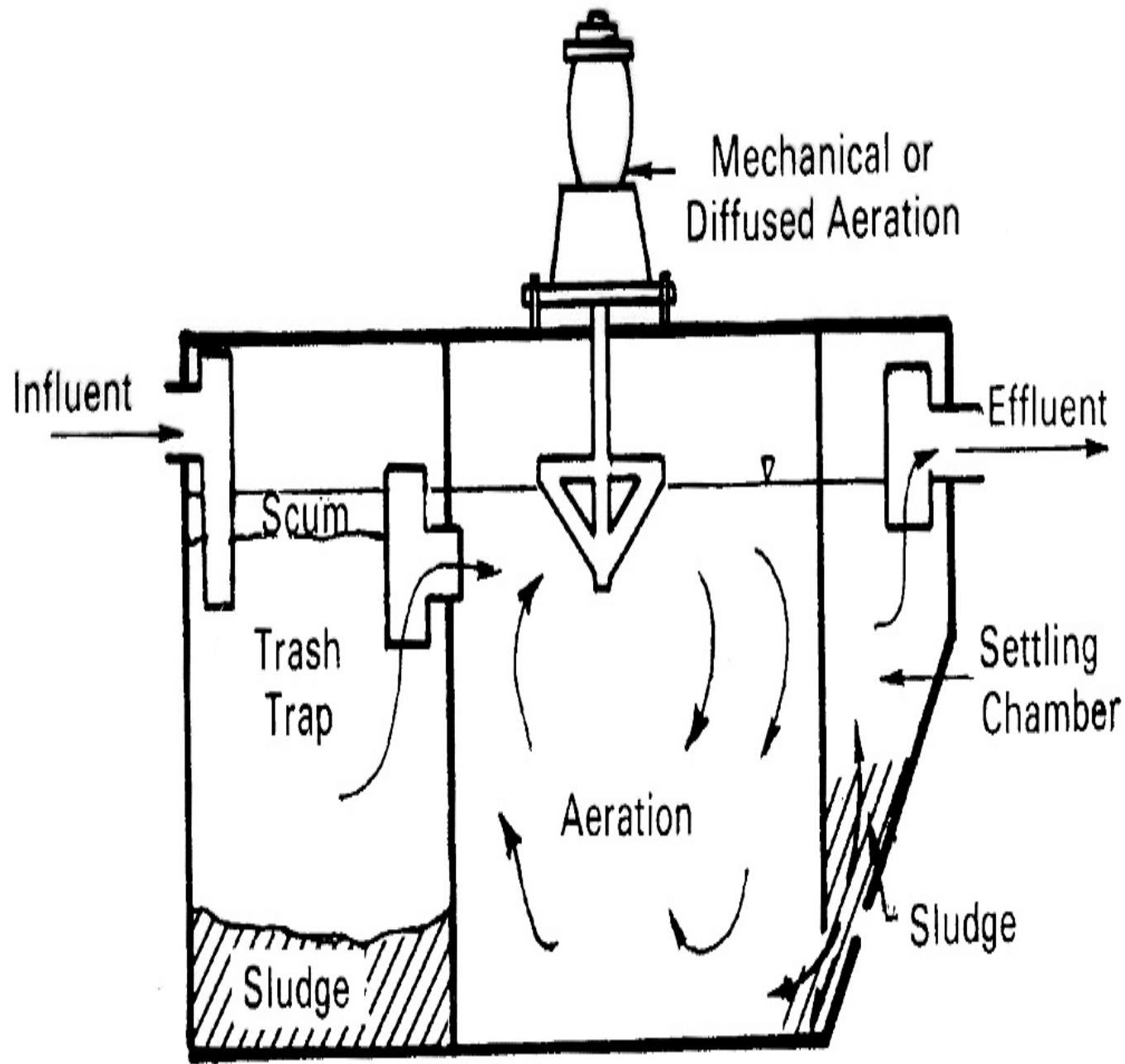
-20 to



## *Design considerations*

- Compartment size
- Tank material
- Construction quality
- Inlet and outlet arrangements
- Volume of tank
  - *hydraulic retention time*
  - *Sludge retention*

- ***2. Aerobic Treatment Unit ( ATU )***
  - What it is ?
    - Down sized version of secondary sewage treatment processes
    - Stand alone or can be used with septic tank
    - Treatment – aerobic decomposition
      - *Saturated ( suspended growth media)*
      - *Unsaturated ( fixed growth media)*
    - Removal – BOD, TSS, and micro-organisms.



## *What does it consist of ?*

- A tank  
wastewater brought in to contact.
- Components :
  - trash trap
  - aeration chamber  
growth
  - A clarification chamber

reactor

## *How does it work ?*

Dissolved oxygen , micro-organisms and

Contact :

Suspended  
attached

Flow scheme:

More of a batch

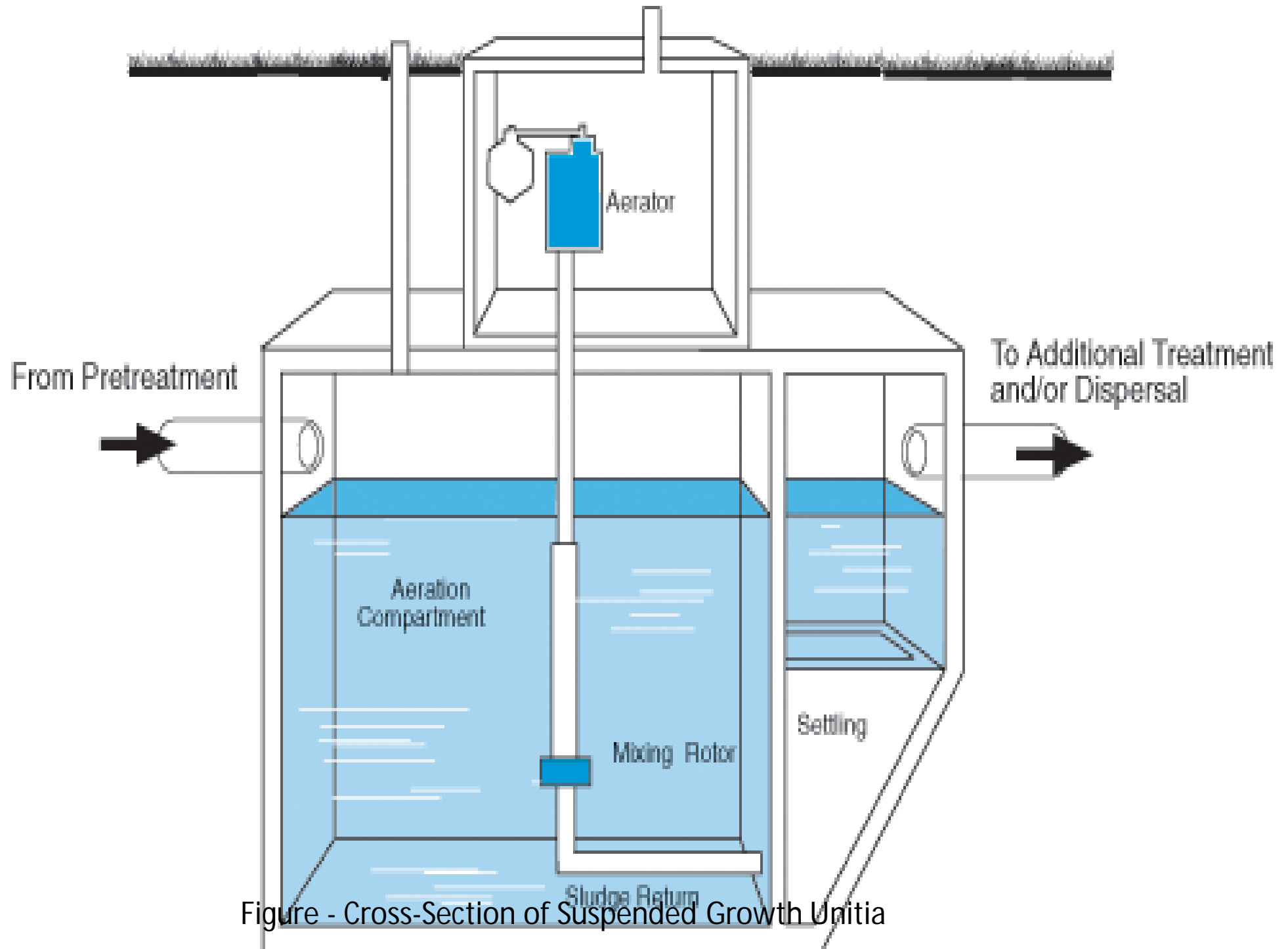


Figure - Cross-Section of Suspended Growth Unit



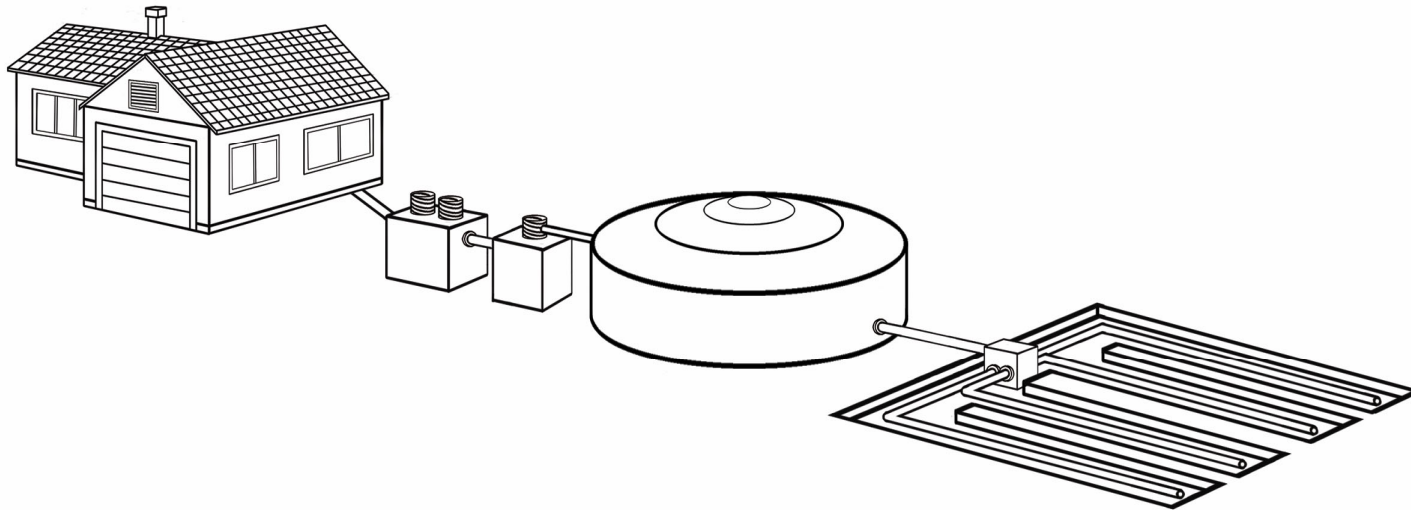
Figure - Cross-Section of Fixed Growth Media

## *Design/performance consideration considerations*

- Similar to secondary treatment units design
- Handle small flows
- Design basis
  - *Hydraulic loading*
  - *Biological loading*
- Pretreatment required
- Final treatment/dispersal components preceded by ATUs  
may differ from septic tanks

## • *3. Media Filter*

- An aerobic , fixed film bioreactor
- Treatment process usually consist of a lined excavation or watertight structure filled or packed with media to which aerobic micro-organisms are attached or fixed





### *What does it consist of ?*

- A container for medium distribution network
- Distribution or dosing system anaerobic environment via
- A filtering medium
- An under drain system
- Other components depending on type of the filter used. processes

### *How does it work ?*

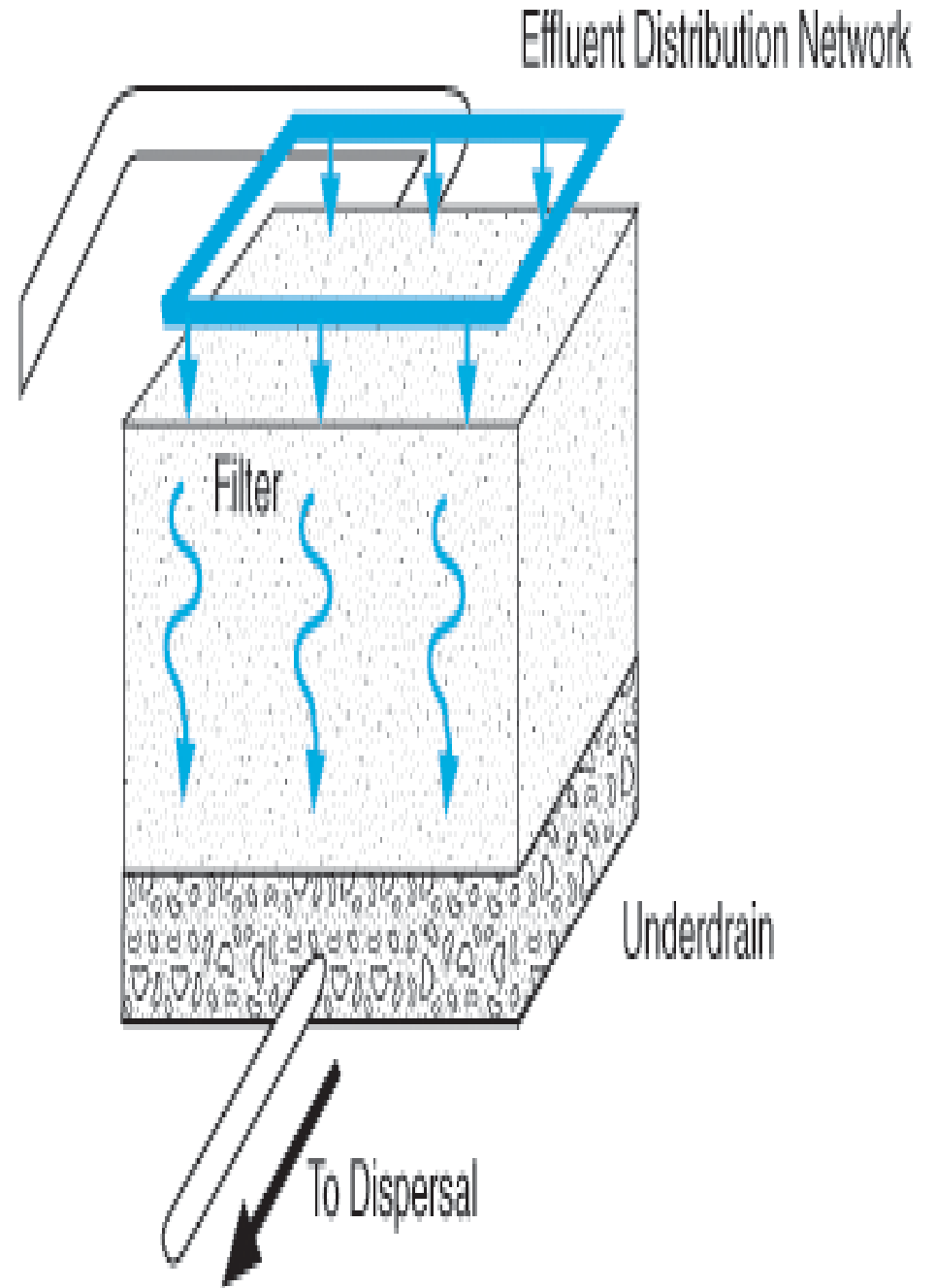
- Effluent dosed out of the
- Treatment occurs in
  - Microbiological
  - Physical processes
  - Chemical

Figure - Typical System using Media Filter

*Typical Applications*

- High level of treatment
- Single family residences, small communities, and commercial facilities
- Used when higher level of pretreatment is required
- Used when sufficient area is not available

From Septic Tank



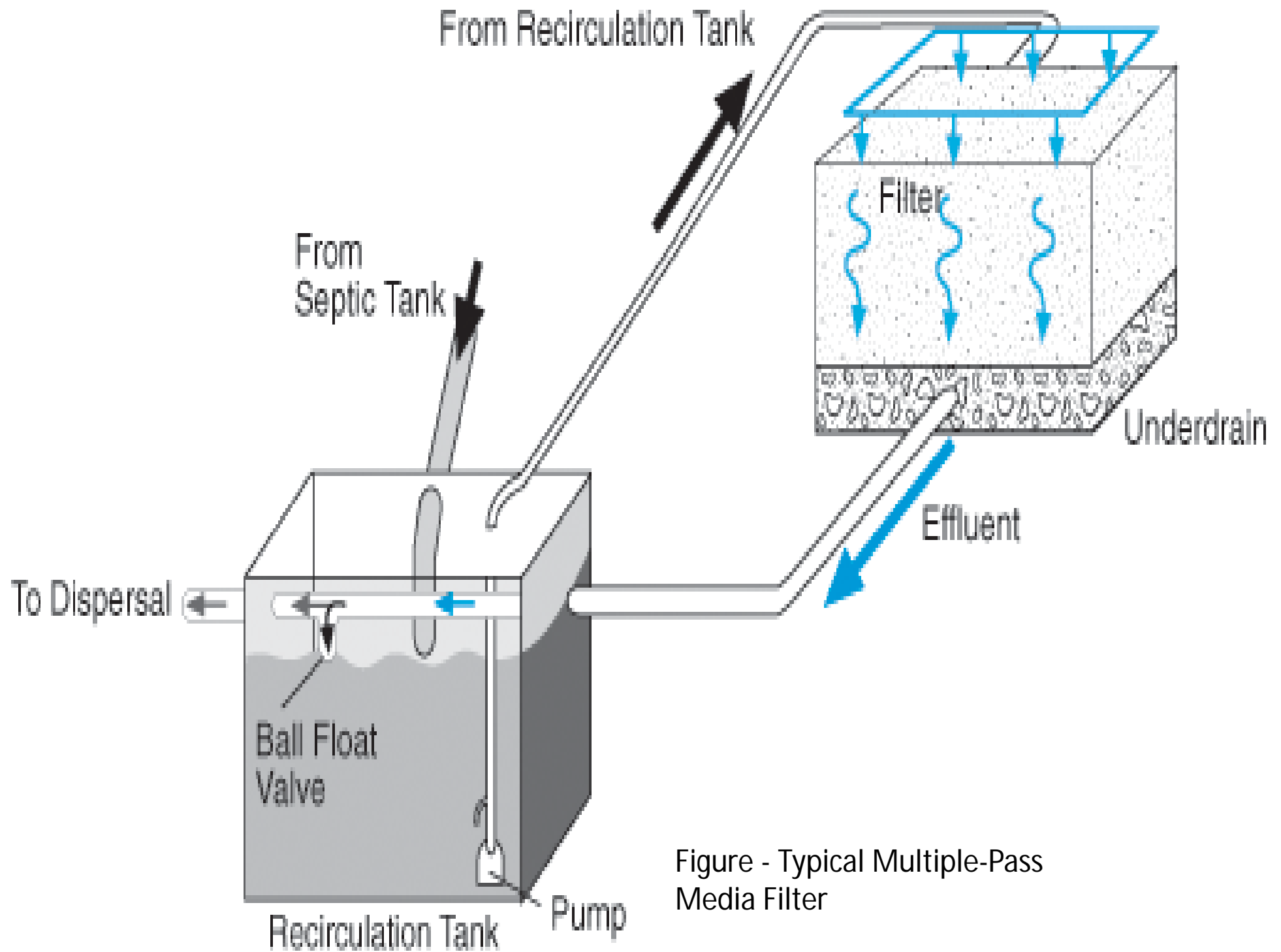


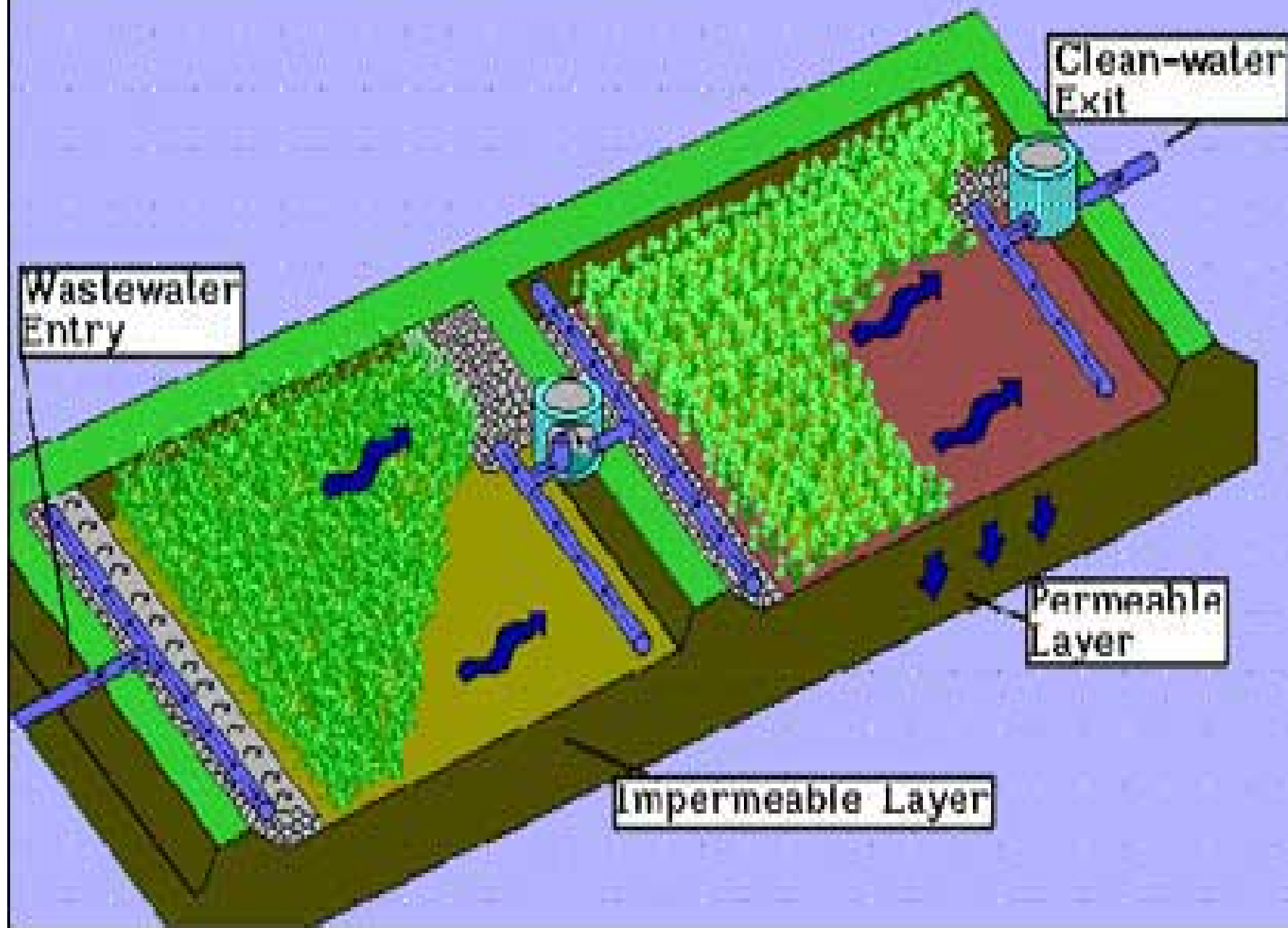
Figure - Typical Multiple-Pass Media Filter

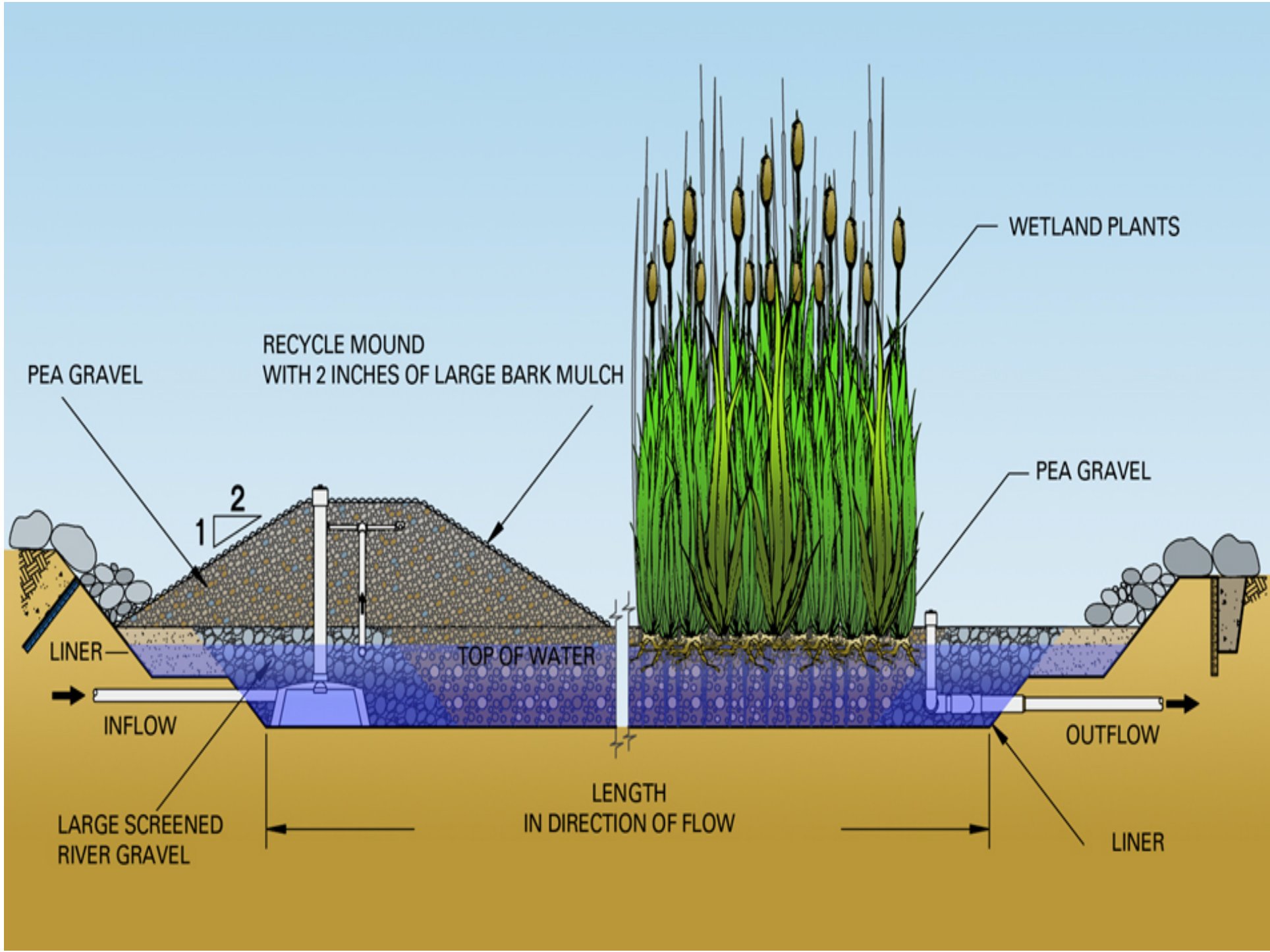
## • *4. Wetlands*

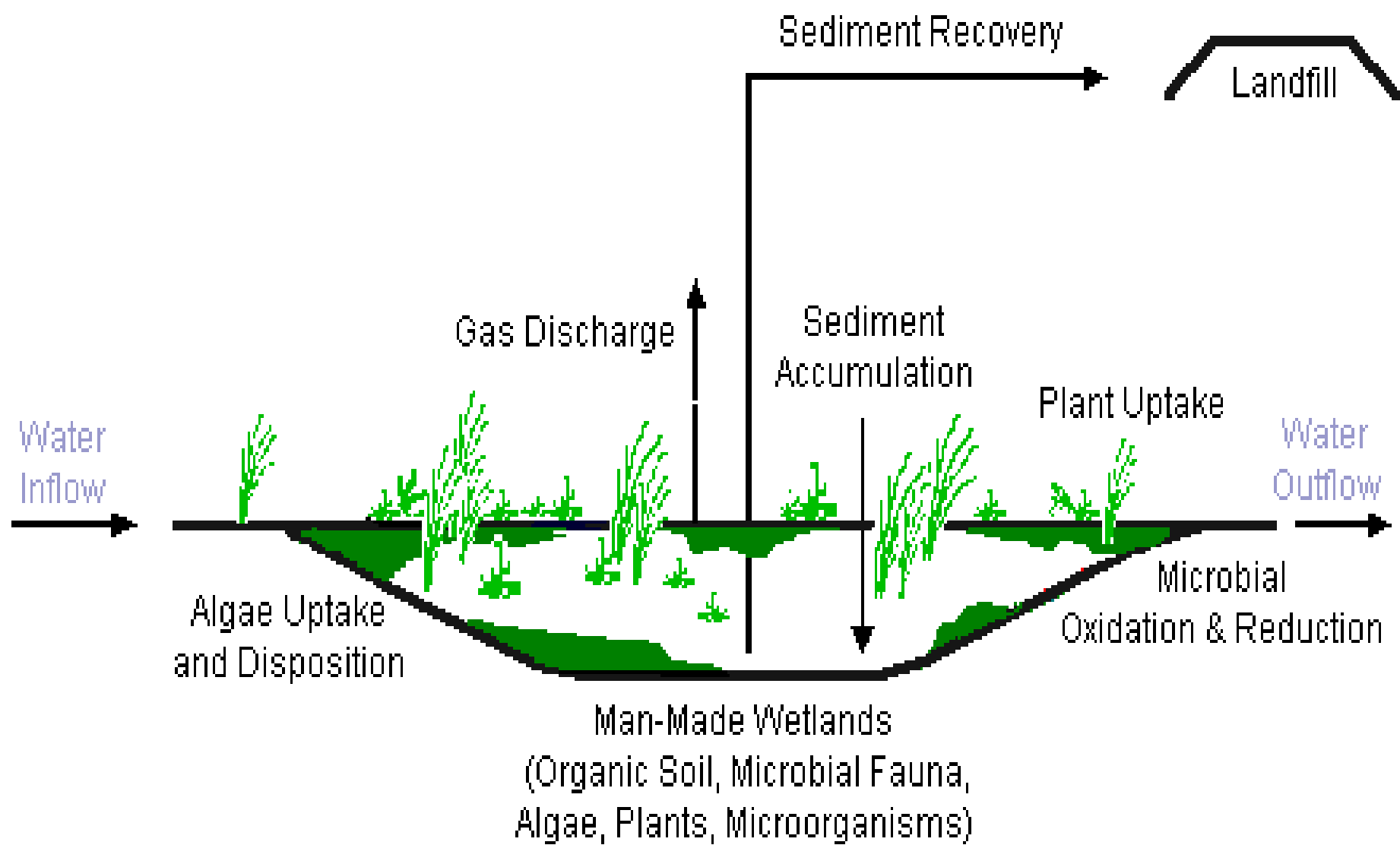
- An artificial swamp
- Use aquatic plants to treat wastewater
- They serve as biofilters : Remove sediments and pollutants
- Two types:-
  - 1. Free water surface: it resembles natural wetlands in appearance and function, with a combination of open water areas, vegetation, varying water depths.*

*2. Subsurface flow wetlands:-they do not resemble natural wetlands because they have no standing water. they contain a bed of media (such as crushed stones, gravel, sand, or soil)*

# Constructed Wetland







## *What does it consist of ?*

- A liner
- Bed or channel of porous media
- Plants
- A distribution means at the inlet end of the bed channel
- A collection and outlet mechanism



## *How does it work ?*

- Septic tank effluent flows into the inlet
- Effluent slowly flows to the outlet end of the channel
- As the effluent moves
  - Plants provide oxygen to the channel
  - Microbes attached to the bed and the plant root provide treatment
  - Other treatment include : filtration and adsorption

## *Typical applications*

?

- They can produce effluent that meets secondary standard of 30mg/l BOD<sub>5</sub> and 30 mg/l TSS.
- Where sufficient area exists to install the system
- Provide minimal removal of nitrogen and phosphorus



**End of chapter Seven**