# Wastewater Treatment

## Its Journey to Treatment and Return to the Environment

# What is Wastewater?

- Wastewater is a term that is used to describe waste material that includes industrial liquid waste and sewage waste that is collected in towns and urban areas and treated at urban wastewater treatment plants.

# Wastewater treatment

- A process to convert wastewater - which is water no longer needed or suitable for its most recent use - into an effluent that can be either returned to the water cycle with minimal environmental issues or reused.

# Wastewater Contaminants

- Suspended solids
- Biodegradable organics (e.g., BOD)
- Pathogenic bacteria
- Nutrients (N & P)

# Where does wastewater come from?

- Residences

— human and animal excreta and waters used for washing, bathing, and cooking.

- Commercial institution
- Dairy and industrial establishment

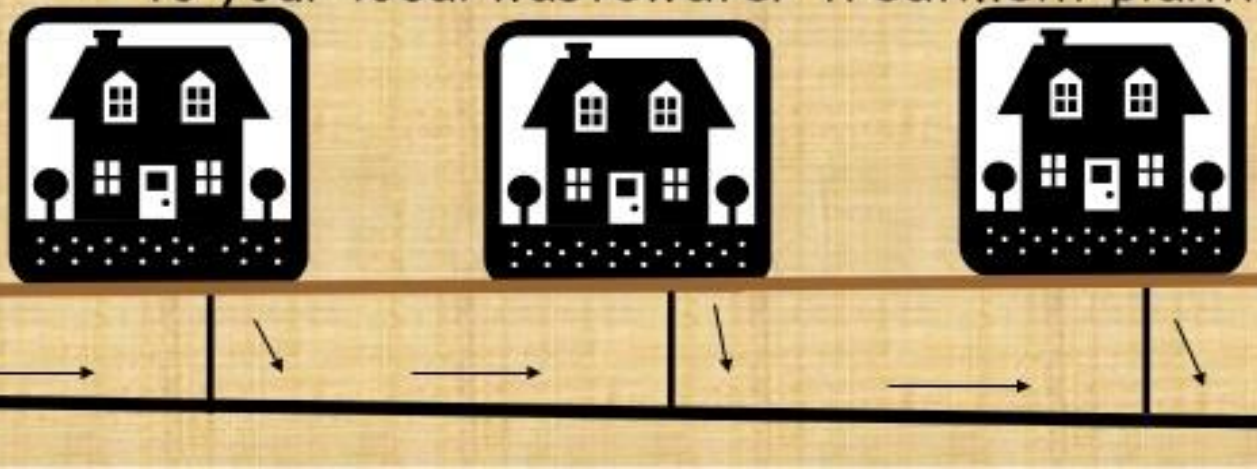
— slaughterhouse waste, dairy waste, tannery wastewater, etc.

# Where does it all go!

Where does the water from the washer go?

When you flush the toilet where does the contents go?

By gravity flow, the waste is on its way to your local wastewater treatment plant!




Auto exhaust
Motror oil
Lubricants
Gasoline
Tire wear
Leaves
Grass clippings
Pesticides, Pet wastes
Paint
Lead
Fertilizer
Bacteria, BOD
Toxic materials
Phosphorus, nitrogen, bacteria, BOD
Lead, cadmium, zinc, hydrocarbons
Sediments, BOD
Zinc, copper, chromium
Phosphorus, nitrogen
BOD, bacteria
Eroded soil
Metal corrosion
Street litter
To nearby surface water

# Why treat wastewater?

- Causes a demand for dissolved oxygen (lower DO levels of streams)
- Adds nutrients (nitrate and phosphate) to cause excessive growth
- Increases suspended solids or sediments in streams (turbidity increase)

# Objectives of WWT

- Reduce organic content i.e., BOD
- Removal/reduction of nutrients i.e., N,P
- Removal/inactivation of pathogenic microbes

# Levels of Treatment

## Primary

- removal by physical separation of grit and large objects (material to landfill for disposal)
- Sedimentation and screening of large debris

## Secondary

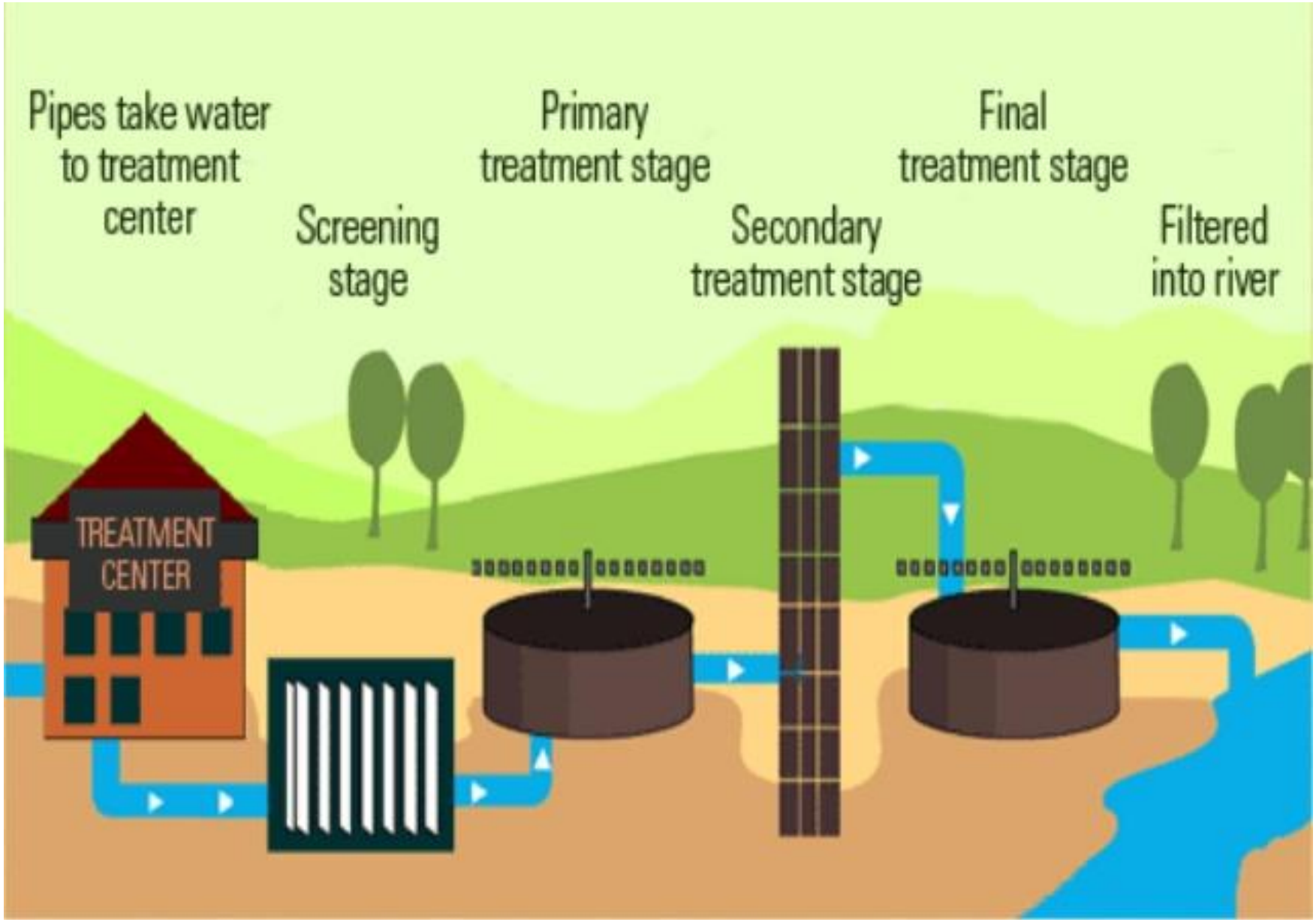
- Biological and chemical treatment

Mostly dead microbes

- aerobic microbiological process (sludge)

$$\text{organic matter} + O_2 \rightarrow CO_2 + NH_3 + H_2O$$

$$NH_3 \rightarrow NO_3^-$$ ← aquatic nutrient


Pipes take water to treatment center
Screening stage
Primary treatment stage
Secondary treatment stage
Final treatment stage
Filtered into river
TREATMENT CENTER

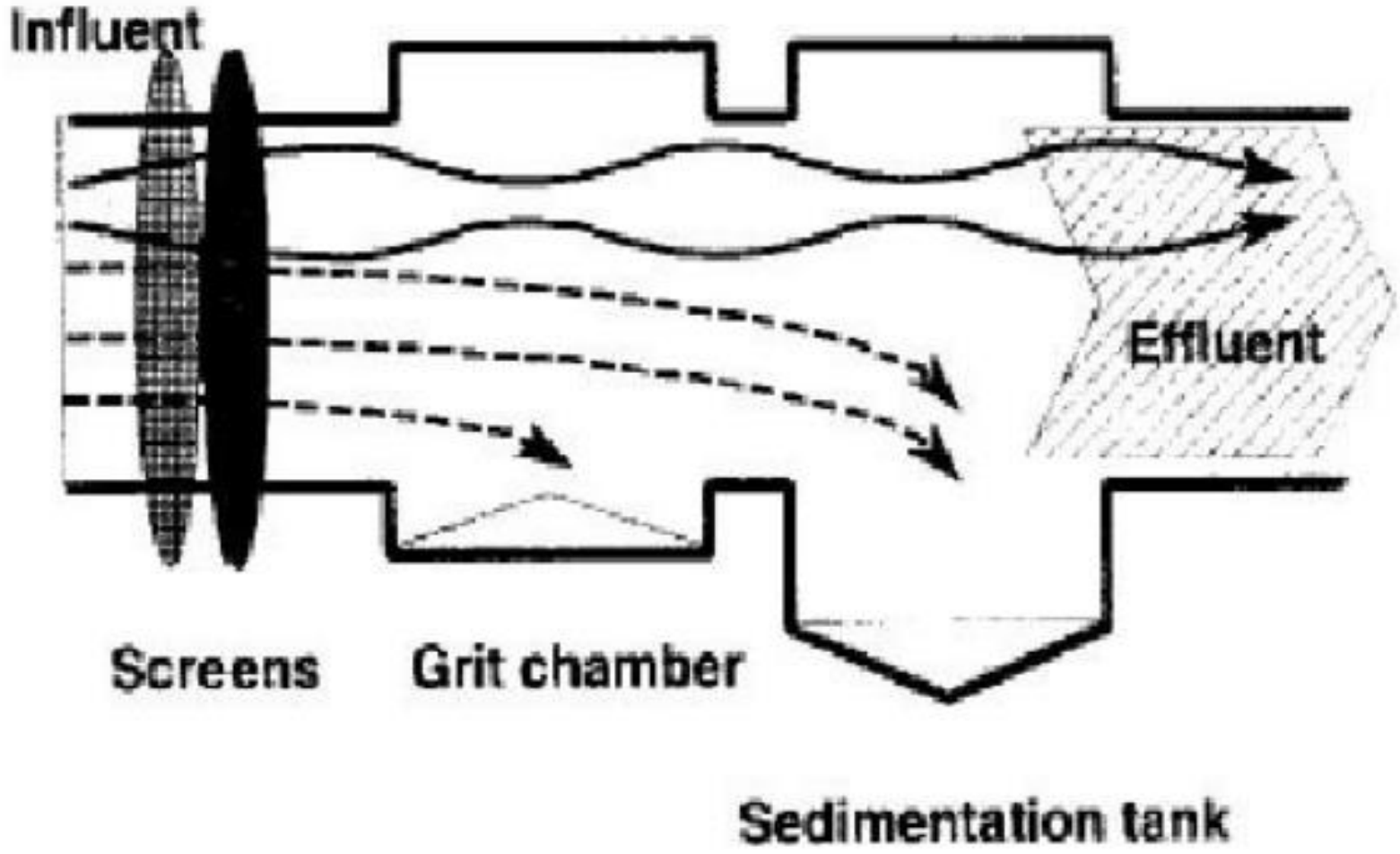
# Treatment stages - Primary treatment

- typical materials that are removed during primary treatment include
  - fats, oils, and greases
  - sand, gravels and rocks
  - larger settle-able solids including human waste, and
  - floating materials

# Methods used in primary treatment

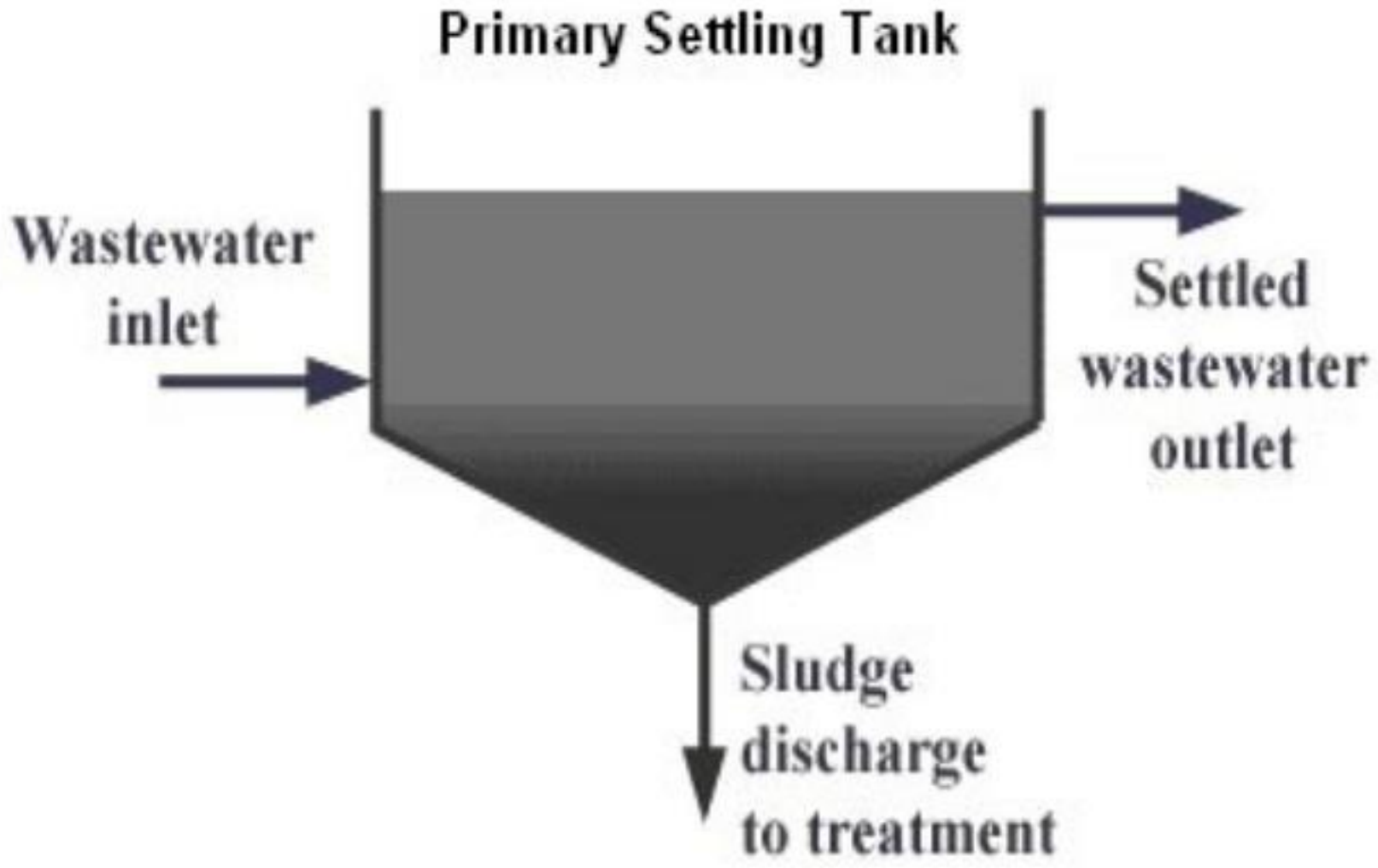
- Bar screens
- Grinding
- Grit Chamber
- Sedimentation Tank- primary Settling tank
- Chlorination of effluent

# PRIMARY TREATMENT



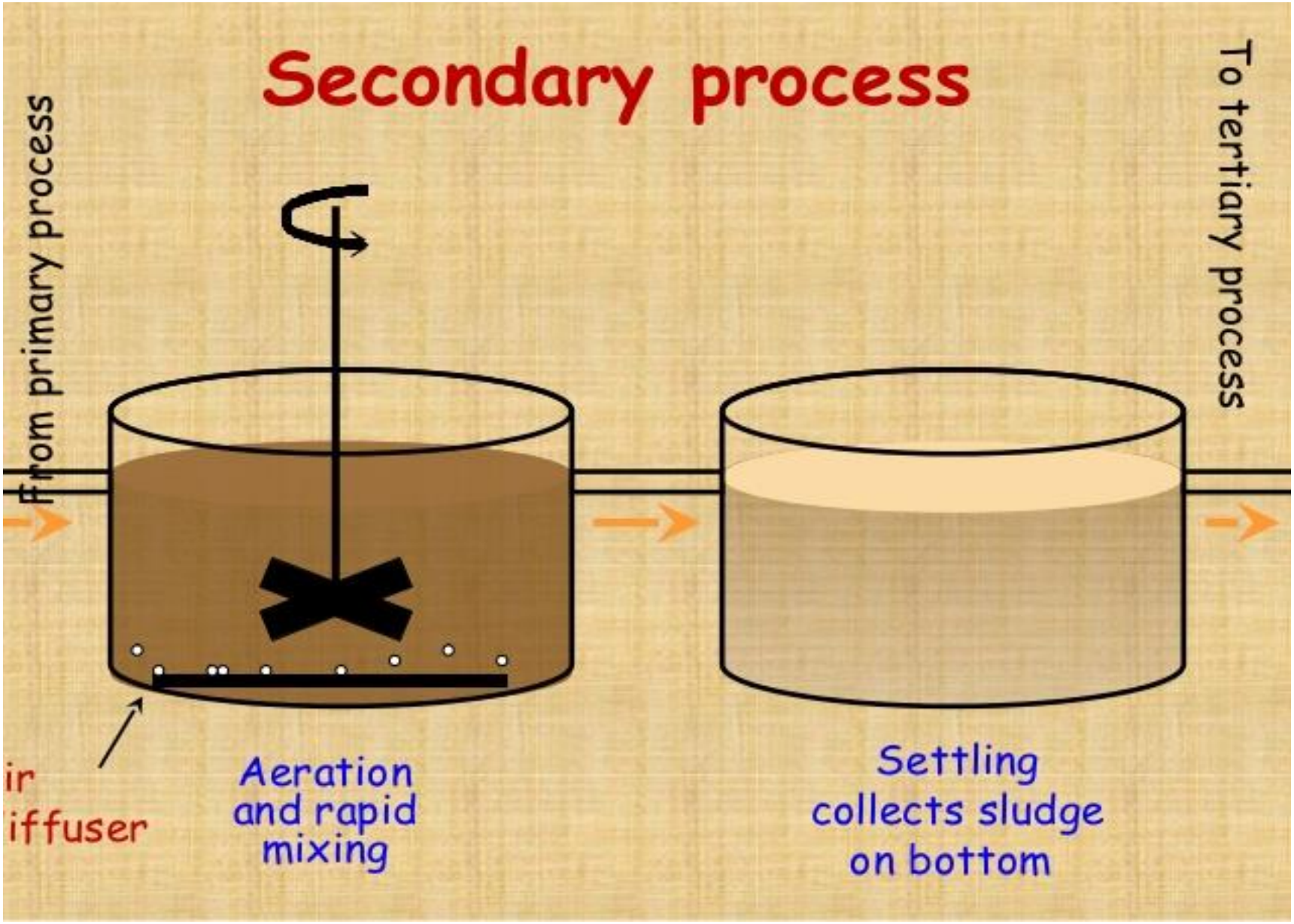
# Sedimentation Tank- primary Settling tank

- Remove grease, oil
- Fecal solid settle, floating material rise to the surface
- Produce a homologous liquid for later biological treatment
- Fecal sludge are pumped to sludge treatment plant


Primary Settling Tank
Wastewater inlet
Settled wastewater outlet
Sludge discharge to treatment

# Secondary treatment

- Biological treatment
  - activated sludge
  - trickling filter
  - oxidation ponds


Secondary process
From primary process
To tertiary process
ir
iffuser
Aeration
and rapid
mixing
Settling
collects sludge
on bottom

# Continued…

- Stabilization ponds are the preferred wastewater treatment process in developing countries due to low cost, low maintenance. This is balanced by larger land requirement.