

Sustainable Water
Integrated Management (SWIM) -
Support Mechanism



Project funded by
the European Union

Water is too precious to waste

The EU funded SWIM-SM: developing capacity for Sustainable and Integrated Wastewater Treatment and Reuse

Online Course on Natural Treatment Systems: Preliminary & Primary Treatment

Physical treatment: Preliminary and Primary treatment



SWIM OLC
on
Natural Treatment Systems

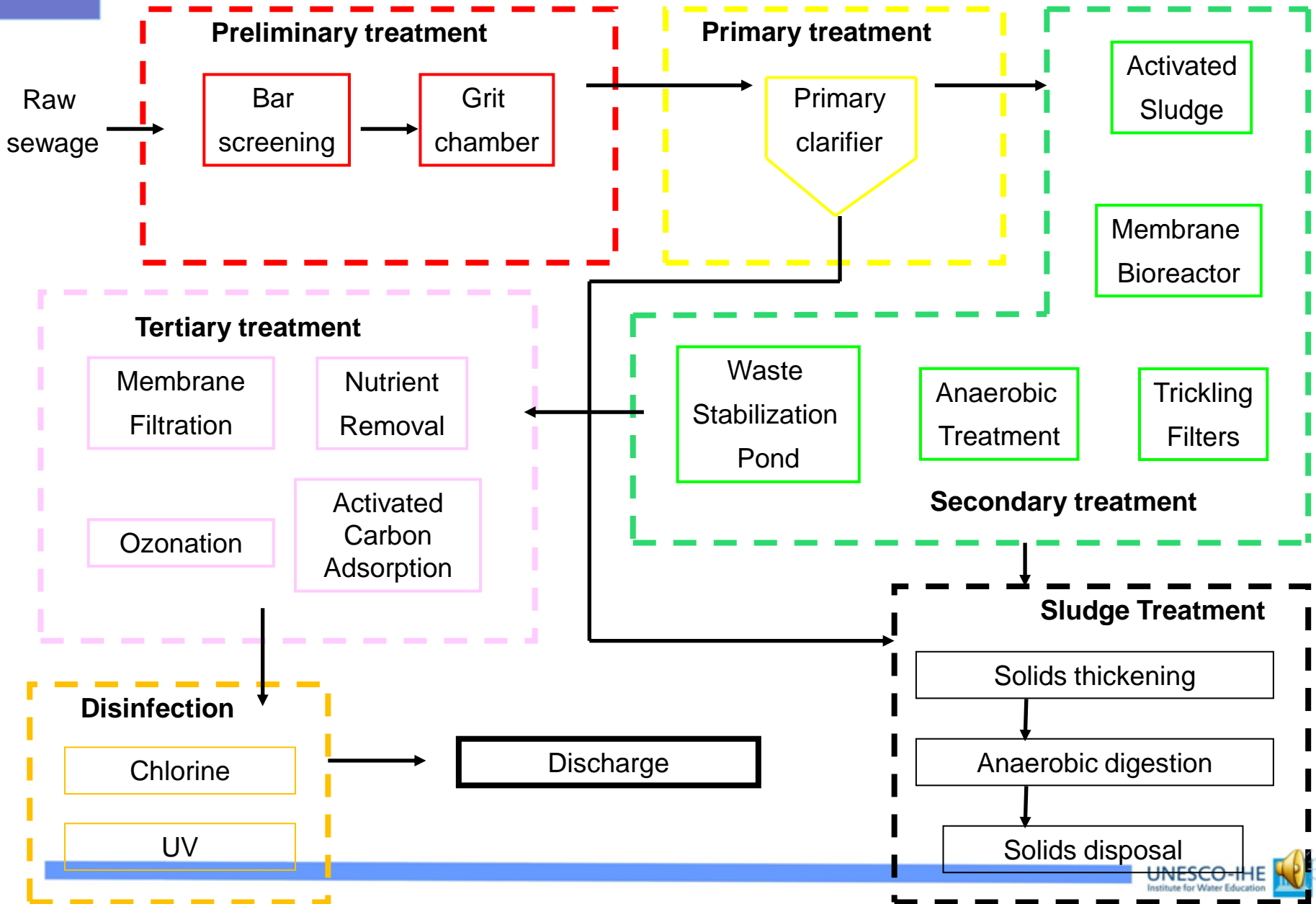


Degrees of treatment

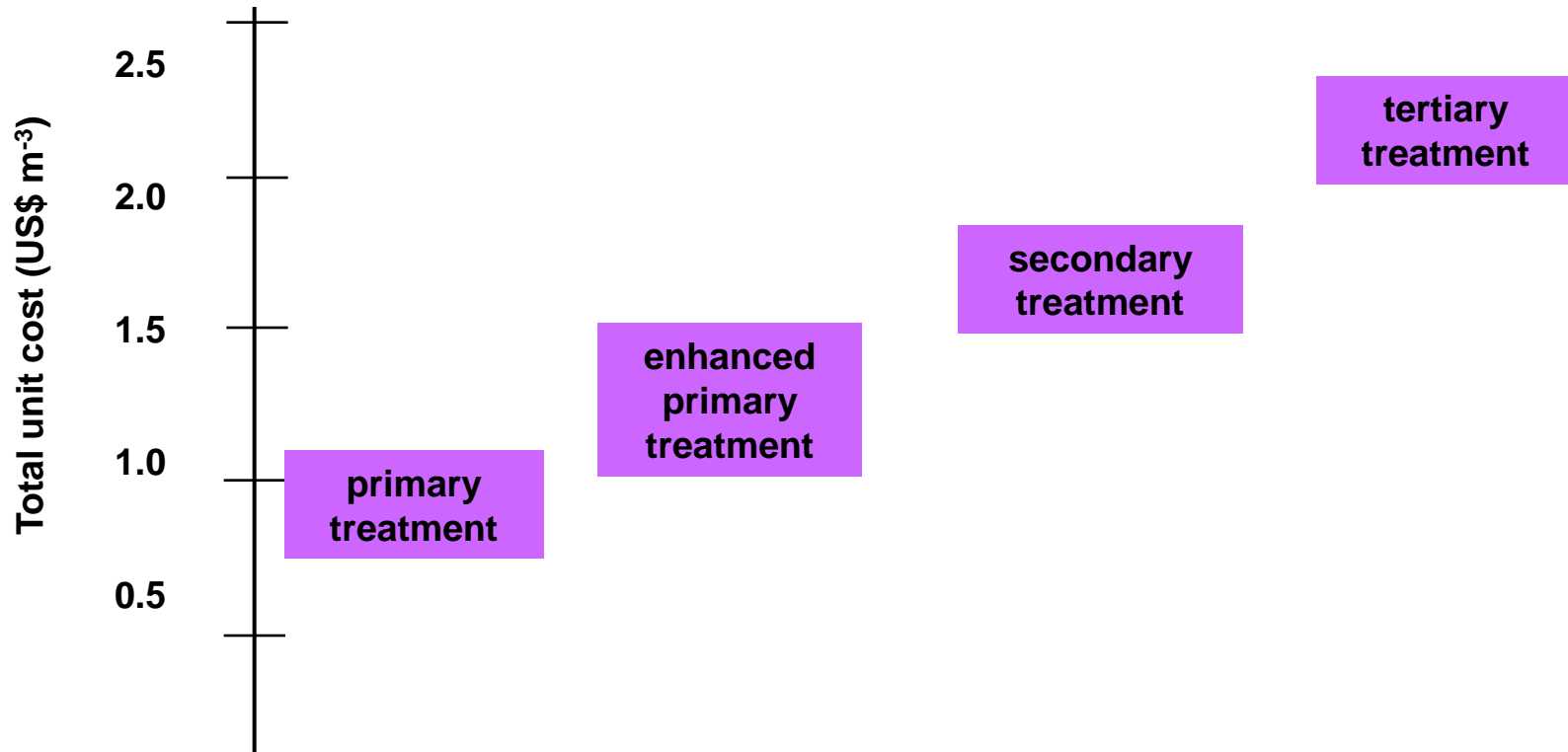
| | Removal of ... | Technologies |
|-----------------------------------|---|--|
| 1 - Preliminary treatment | Coarse solids (cans, plastic bags, ...) | Bar screens, Grit chambers |
| 2 - Primary treatment | Removal of fine particles (large food particles, ...) | Primary clarifier |
| Enhanced primary treatment | Extra removal of particles by addition of chemicals | Coagulation/flocculation |
| 3 - Secondary treatment | Removal of organics (mostly dissolved BOD) | Activated sludge, Anaerobic treatment, ... |
| 4 - Tertiary treatment | Removal of nutrients (N and P) | Activated sludge, Chemical precipitation, ... |
| 5- Disinfection | Pathogens | Ozonation, Chlorination, ... |
| 6 – Sludge Treatment | Reduction of solids organic/volatile content | Anaerobic Digestion, Aerobic Digestion |



Typical Wastewater Treatment Train



Costs and efficiency of various degrees of treatment



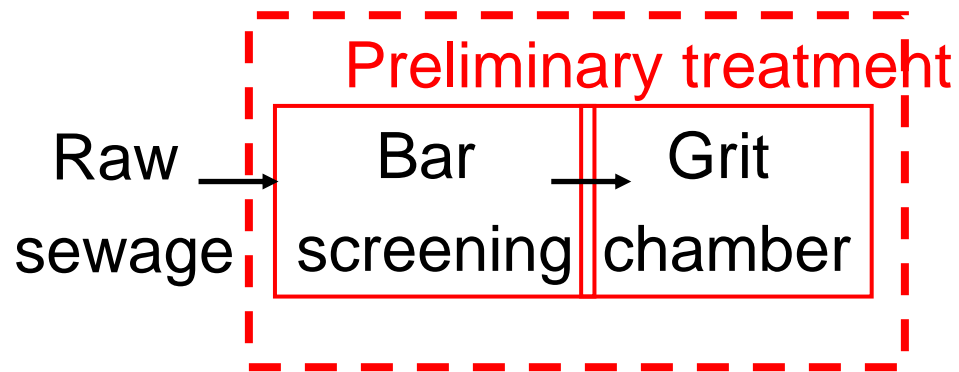
% removal

| | | | | |
|-----|----|-------|-------|------|
| BOD | 30 | 50-70 | 90-95 | > 95 |
| TSS | 60 | 80-90 | 90-95 | > 95 |
| N | 15 | 25 | 40 | > 80 |
| P | 15 | 75 | 90 | > 90 |

Preliminary and Primary Treatment

- Prepares wastewater for biological treatment
- Large solids removed by screening and grit allowed to settle out
- Removes suspended solids by sedimentation

Typical Wastewater Treatment Train



Preliminary Treatment

- Purpose
 - Protect WWTP equipment (e.g., pumps, valves)
 - Does NOT decrease BOD much
- Unit operations (physical treatment)
 - *Bar Screening*
 - Removal of coarse solids (e.g., rags, logs) by interception
 - *Grit Chamber*
 - Removal of grit (heavy solids): sand, broken glass, silt, pebbles

Bar Rack Screening



- Bar rack screening pretreatment of the sewage at the inlet of the WWTP.
- This removes rags, paper, sticks, etc. that would jam moving parts.



- Trash rack
 - » 4-15 cm opening
- Mechanically-cleaned rack
 - » 0.5-4 cm opening



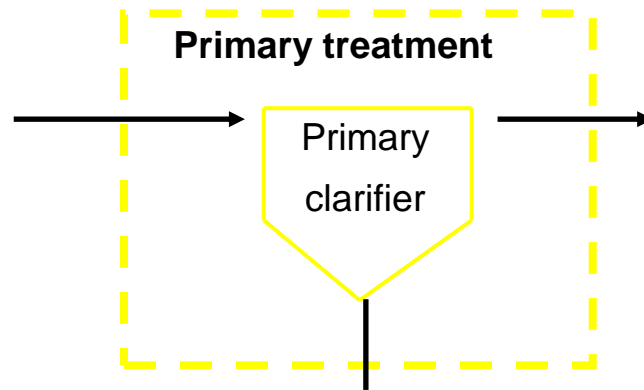


Grit Chambers

- WW flows into chambers where heavy solids (grit) sink to bottom
 - Detention time ~ minutes
- Solids washed to remove organics before deposited in landfill.
 - Organics
 - Disagreeable odor
 - Attract rodents/insects
- Remove solids $>0.3\text{mm}$ in diameter



Primary treatment



Primary treatment: settler/ sedimentation or settling basin/tank/ clarifier

- Purpose: to remove suspended solids by sedimentation.
- The low flow velocity in a settler allows settle-able particles to sink to the bottom, while constituents lighter than water float to the surface.
- The liquid phase continues to further treatment steps after a relatively short hydraulic retention time, while the sludge is kept in the tank for several months to years.

Source: TILLEY et al. (2014), <http://www.sswm.info>

Primary treatment: settlers

- Reduction in suspended solids (50-70% removal) and organic material (20-40% BOD removal).
- Settlers : independent tanks or integrated into combined treatment units:
 - Septic tank
 - Anaerobic filter/ baffled reactor
 - Biogas reactor
 - Imhoff tank
 - UASB
 - Anaerobic pond

Source: TILLEY et al. (2014), <http://www.sswm.info>

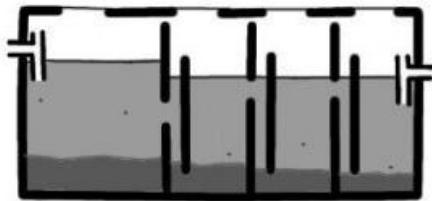
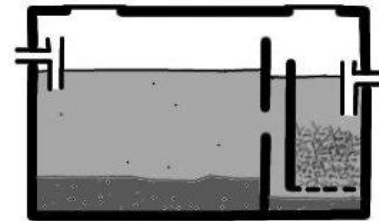
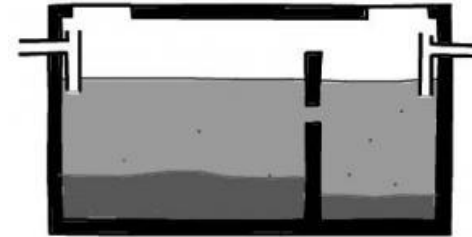
Primary treatment: settling + treatment

- The choice of a technology: governed by the size and type of the installation, the wastewater strength, the management capacities and the desirability of an anaerobic process, with or without biogas production.
- Technologies that already include some type of primary sedimentation do not need a separate settler.
- Many treatment technologies, however, require preliminary removal of solids in order to function properly

Source: TILLEY et al. (2014), <http://www.sswm.info>

Primary treatment

- Septic tank
- Anaerobic filter
- Baffled reactor

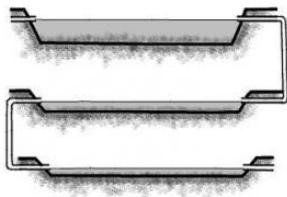
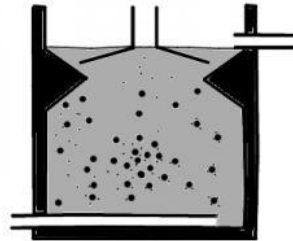
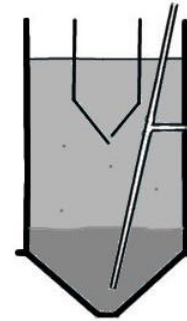
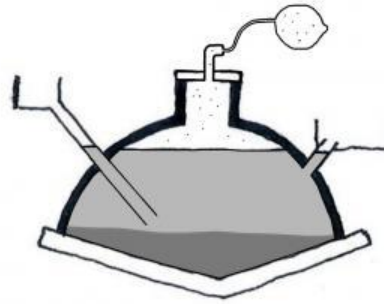


Source: TILLEY et al. (2014), <http://www.sswm.info>



Primary treatment

- Biogas reactor
- Imhoff tank
- UASB
- Anaerobic pond



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