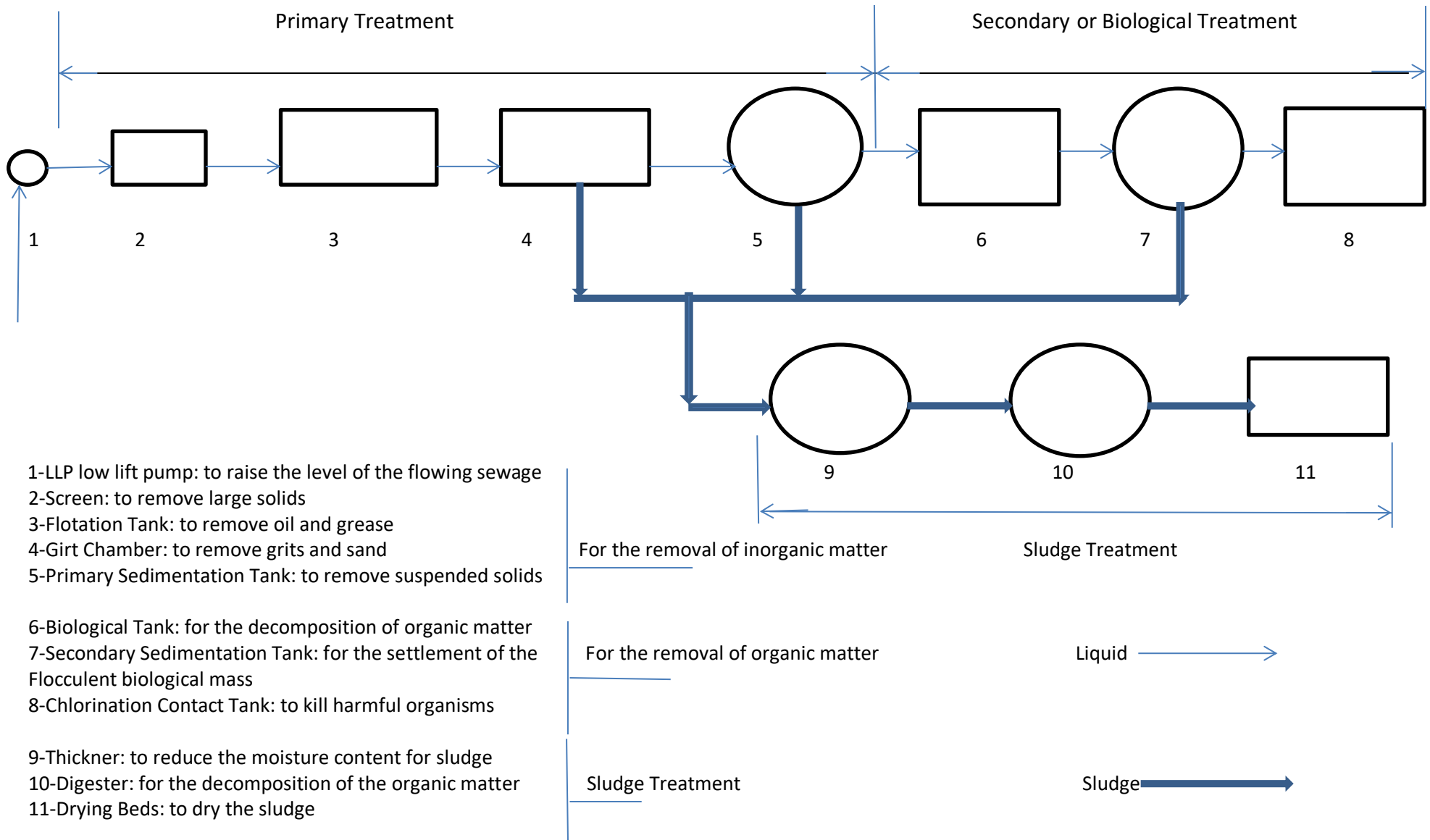


Sanitary and Environmental Engineering

PART 2: WASTEWATER ENGINEERING

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Lecture 6: Flow Diagram for a Wastewater or Sewage Treatment Plant (WWTP)



Wastewater treatment plant:

First: Primary treatment: a treatment process for wastewater (or sewage) is employed to remove inorganic material that floats or will settle, and pathogens that account for about 30 percent of biological oxygen demand (BOD). It involves:

1. Low lift station
2. Parshall flume.
3. Racks, screens and comminutors.
4. Floatation tank.
5. Grit removal.
6. Primary sedimentation tanks.

Second: secondary or biological treatment: is a treatment process for wastewater (or sewage) to remove organic matter and achieve a certain degree of effluent quality by using a sewage treatment plant with physical phase separation to remove settleable solids and a biological process to remove dissolved and suspended organic compounds.

1. Biological process.
2. Secondary sedimentation tank.
3. Chlorine contact tank (effluent disposal).

Biological process:

Attached growth process:

- a) Intermittent sand filter.
- b) Trickling filters.
- c) Rotating biological contactors.

Suspended growth process:

- a) Conventional process.
- b) Tapered aeration process.
- c) Step aeration process.
- d) Completely mixed process.
- e) Extended aeration process.
- f) Contact stabilization process.

Sludge treatment and disposal:

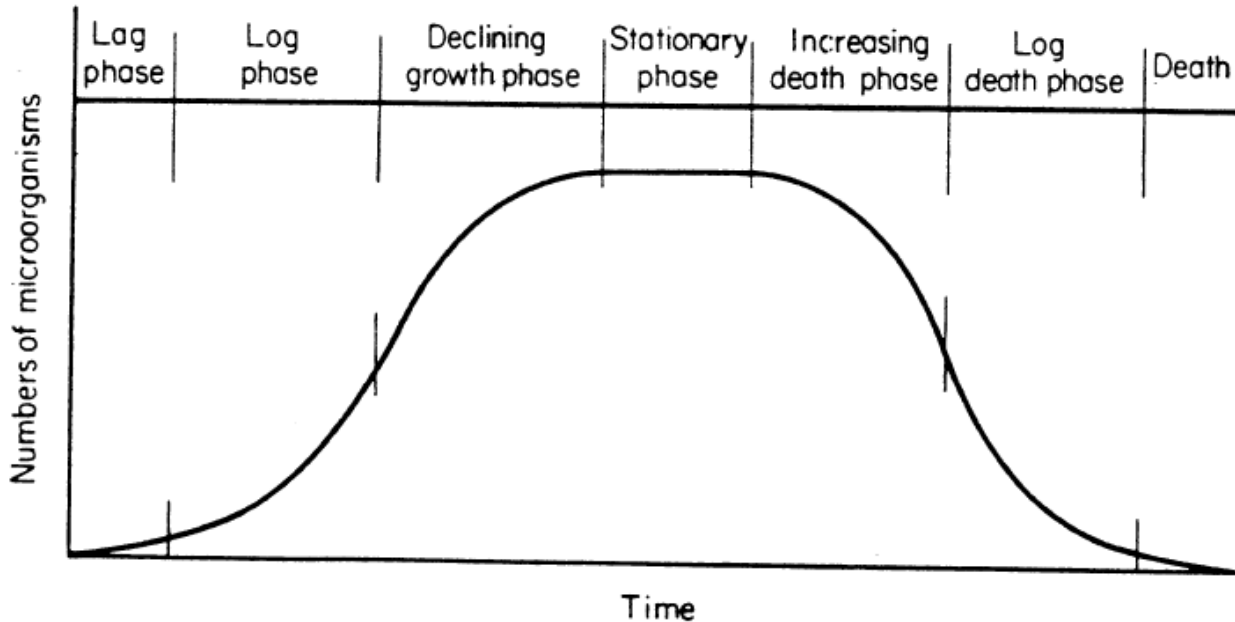
- a) Thickener tank.
- b) Digester tanks.
- c) Dewatering process (drying beds, vacuum filter, pressure filter, centrifuges, pressed filters, drying and combustion).

Third: Tertiary treatment is the final cleaning process that improves wastewater quality before it is reused, recycled or discharged to the environment. The treatment removes remaining inorganic compounds, and substances, such as the nitrogen and phosphorus.

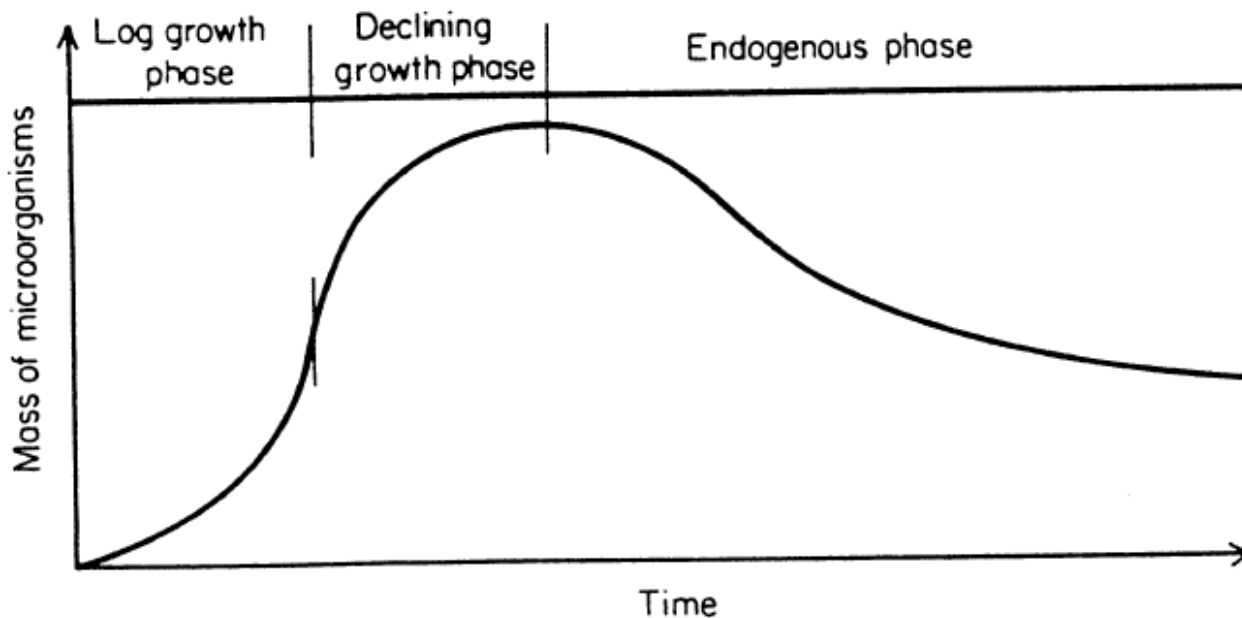
Microbiology of sewage treatment:

Domestic sewage contains enormous quantities of microorganisms which depending upon its age and the quantity of dilution water, bacterial counts in raw sewage may be expected to range ($0.5 \times 10^5 \rightarrow 5 \times 10^6$) /mL. Viruses, protozoans, worms, etc., are also present but their concentration is seldom important enough to require measurement.

Bacteria are single-celled plants which metabolize soluble food and reproduce by binary fission.



Growth pattern based on number of organisms.



Growth pattern based on mass of organisms.

The declining growth phase is generally used for biological treatment systems.