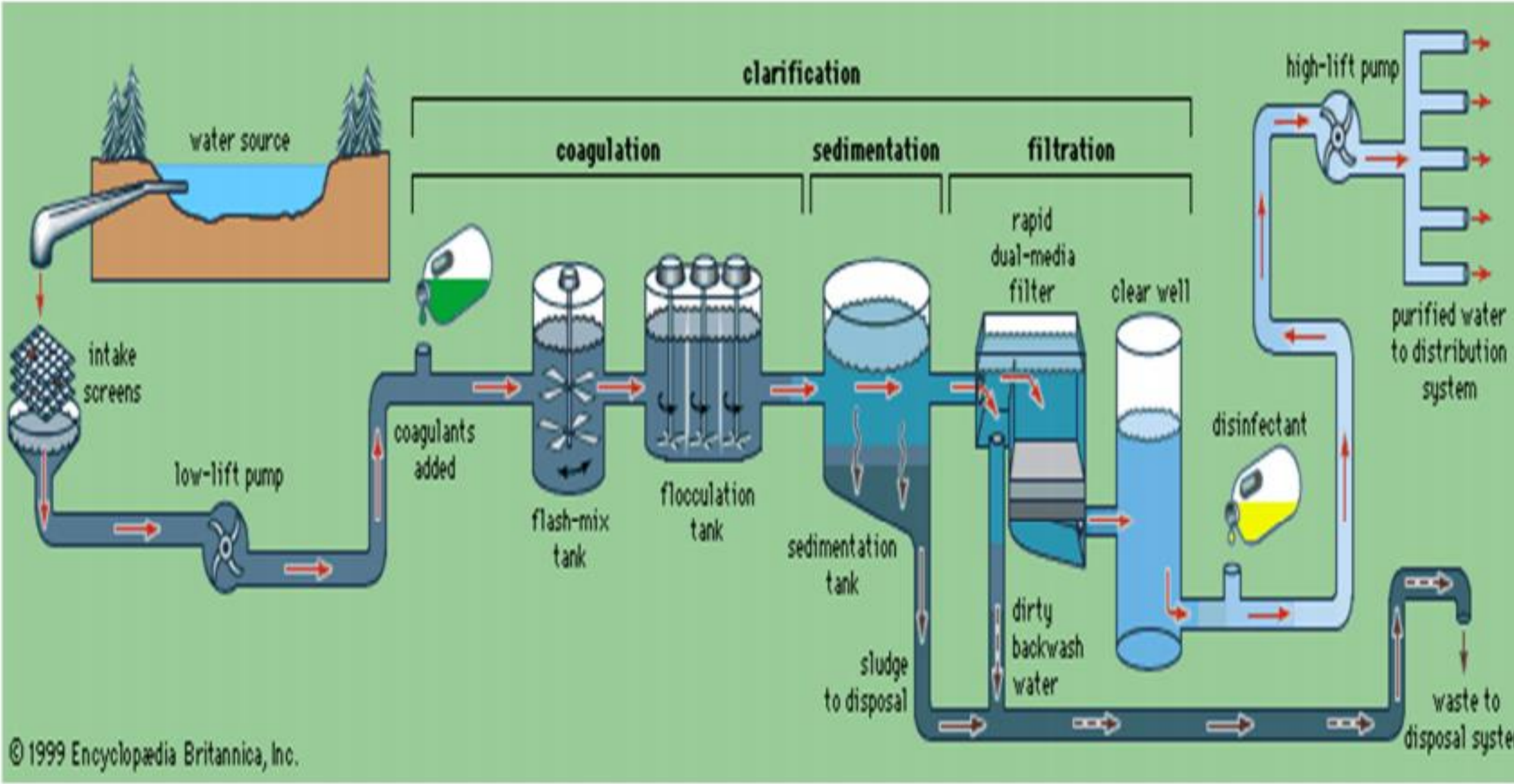
Water Supply and Waste Water Engineering

Unit – Water Treatment Plant


clarification
coagulation
sedimentation
filtration
water source
intake screens
low-lift pump
coagulants added
flash-mix tank
flocculation tank
sedimentation tank
rapid dual-media filter
clear well
high-lift pump
purified water to distribution system
disinfectant
dirty backwash water
sludge to disposal
waste to disposal syste
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Water Source

1. Surface sources, such as
   i. Ponds and lakes;
   ii. Streams and rivers etc
2. Sub-surface sources or underground sources, such as
   1. Springs;
   2. Infiltration wells etc

Water Quality

water is analysed by testing their physical, chemical and bacteriological characteristics.

1) Physical Characteristics:

- ***Colour***
- ***Taste and odour***
- ***Temprature***

2) Chemical Characteristics:

- pH
- Acidity
- Alkalinity
- Hardness
- Cjlorides
- Sulphates
- Iron
- Solids
- nitrates

Water Quality

Bacteriological Characteristics:

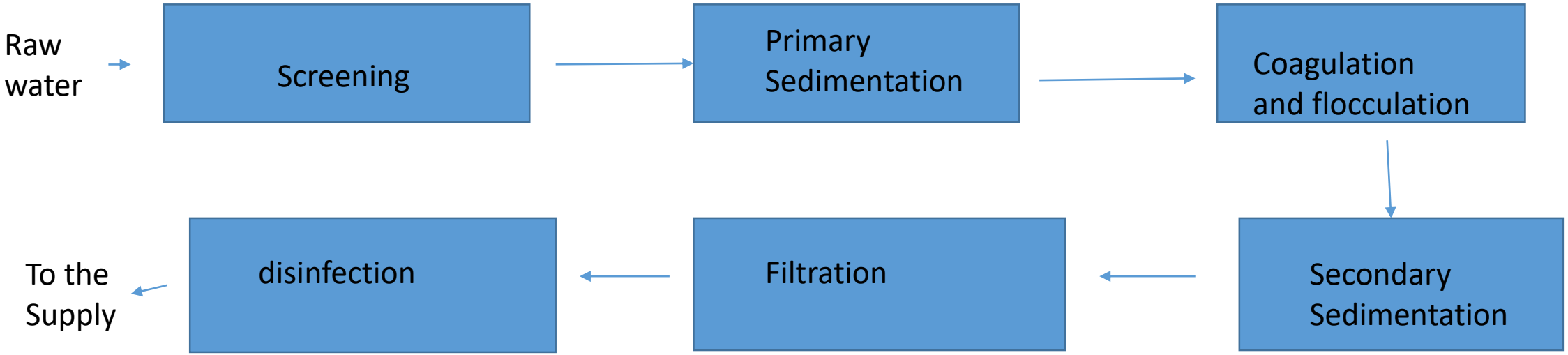
Water polluted by sewage contain one or more species of disease producing pathogenic bacteria. Coliform group serves as indicator of contamination of water with sewage and presence of pathogens.

The methods to estimate the bacterial quality of water are:

1. Standard plate count test
2. Most probable number
3. Membrane filter technique

Water treatment plant

- The available waters must be treated and purified before they can be supplied to the public for their domestic, industrial or any other uses.
- The layout of a water treatment plant is as follows



Indian standard for Drinking Water

Parameter	Desirable-Tolerable	*If no alternative source available, limit extended upto*
Physical		
Turbidity (NTU unit)	< 10	25
Colour (Hazen scale)	< 10	50
Taste and Odour	Un-objectionable	Un-objectionable
Chemical		
pH	7.0-8.5	6.5-9.2
Total Dissolved Solids mg/l	500-1500	3000
Total Hardness mg/l (as $CaCO_3$)	200-300	600
Chlorides mg/l (as Cl)	200-250	1000
Sulphates mg/l (as SO_4)	150-200	400
Fluorides mg/l (as F)	0.6-1.2	1.5
Nitrates mg/l (as NO_3)	45	45
Calcium mg/l (as Ca)	75	200
Iron mg/l (as Fe)	0.1-0.3	1.0

Functions of units in treatment plant

Unit treatment	Function (removal)
Aeration, chemicals use	Colour, Odour, Taste
Screening	Floating matter
Chemical methods	Iron, Manganese, etc.
Softening	Hardness
Sedimentation	Suspended matter
Coagulation	Suspended matter, a part of colloidal matter and bacteria
Filtration	Remaining colloidal dissolved matter, bacteria
Disinfection	Pathogenic bacteria, Organic matter and Reducing substances

Aeration

Aeration removes odour and tastes due to volatile gases like hydrogen sulphide and due to algae and related organisms.

Aeration also oxidise iron and manganese, increases dissolved oxygen content in water, removes CO2 and reduces corrosion and removes methane and other flammable gases.

Principle of treatment underlines on the fact that volatile gases in water escape into atmosphere from the air-water interface and atmospheric oxygen takes their place in water, provided the water body can expose itself over a vast surface to the atmosphere. This process continues until an equilibrium is reached depending on the partial pressure of each specific gas in the atmosphere.

Primary Sedimentation or settling

Purpose of Settling

- To remove coarse dispersed phase.
- To remove coagulated and flocculated impurities.
- To remove precipitated impurities after chemical treatment.
- To settle the sludge (biomass) after activated sludge process / tricking filters.

Primary Sedimentation or settling

Principle of Settling

- Suspended solids present in water having specific gravity greater than that of water tend to settle down by gravity as soon as the turbulence is retarded by offering storage.

Coagulation and Flocculation

- The colloidal particles are too small in size due to which they are difficult to remove from the process of plain sedimentation and filtration along. The process adopted to remove colloidal particles is coagulation and flocculation.
- In this process the colloidal particle aggregated in size by different means

Flocculation

- Flocculation is stimulation by mechanical means to agglomerate destabilised particles into compact, fast settleable particles (or flocs). Flocculation or gentle agitation results from velocity differences or gradients in the coagulated water, which causes the fine moving, destabilized particles to come into contact and become large, readily settleable flocs. It is a common practice to provide an initial rapid (or) flash mix for the dispersal of the coagulant or other chemicals into the water.

Topics to be discuss in next lec

- Coagulants
- Filtration
- Disinfactants
- Working of units as a single plant.

Thank You