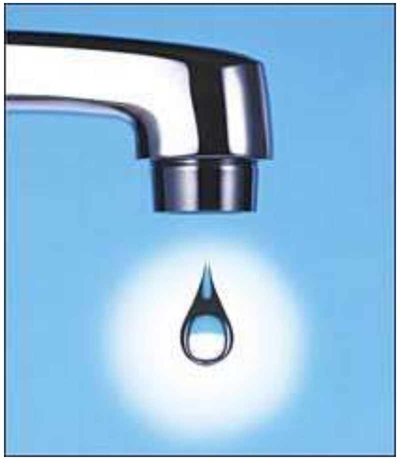
Water Production

Contents

Importance and Necessity Of Water Supply Schemes

I. For drinking and cooking
II. For bathing and washing
III. For watering of lawns garden
IV. For fire fighting
V. For recreation in swimming pool
VI. For heating and air-conditioning systems
VII. Etc.



Objectives of Water treatment

I. To remove the dissolve gases, murkiness , colours .
II. To remove the unpleasant , objectionable tastes.
III. To kill all the pathogenic germs.
IV. To make water fit for domestic use as cooking, washing, various industrial purposes.
V. To eliminate the tuberculating, corrosive properties of water which affects the pipes.

Importance and Realiability of Water Works

- must remove all the impurities and bacteria or the nature organism causing disease.
- reliability in the supply of required quantity of water every time.
- the water source should be permanent surface water or groundwater source.

Duty of Water Works Engineers

- Planning, designing, construction, maintenance and operation.
- Operate the water work without fail & supply the safe water to public in the required pressure.
- Protect source of water & treated water.
- Do the laboratory test.
- Able to alter the purification method.
- Aware of the latest techniques and method of purification and distribution.

Characteristic of raw water

I. Physical Characteristic

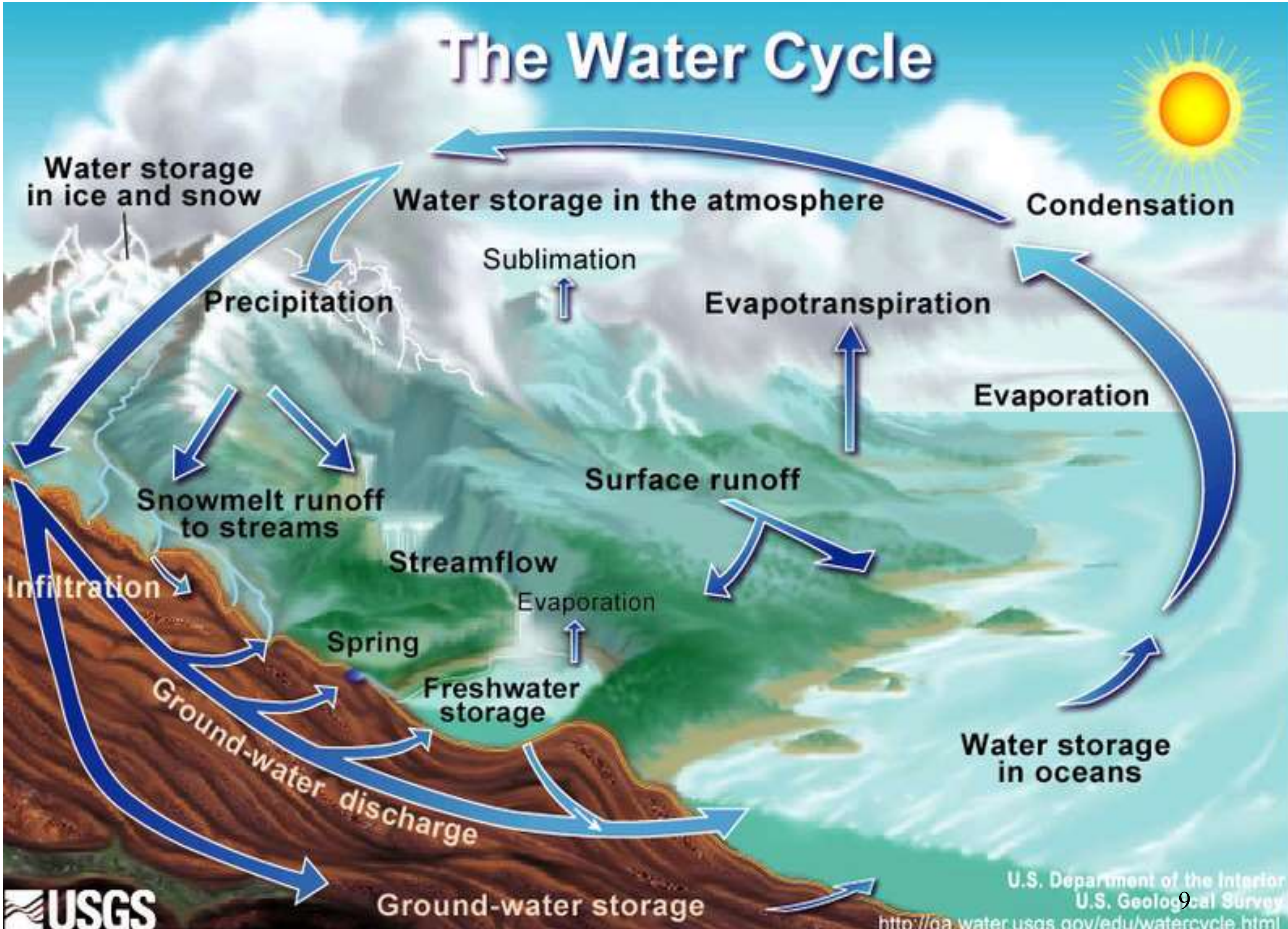
II. Chemical Characteristic

III. Microbiological Characteristic

IV. Heavy metal and Pesticides

Water Demand

- Population.
- Population growth.(data back for 10yrs.to forecast the next 10 to20 yrs.)
- Design period.(10 or 15 yrs plus 3)
- Water consumption.(approx.200 litres/capita/day.)
- % of population served.
- Average water consumption.
- Maximum day demand.(1.5 times of the average is acceptable.)
- Water loss.
- Maximum hourly demand.
- Raw water demand(about 1.1 times of average)
- Capacity of raw water intake(1.1 times of max.day demand)


The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Snowmelt runoff to streams
Surface runoff
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
USGS
Ground-water storage
U.S. Department of the Interior
U.S. Geological Survey
http://ga.water.usgs.gov/edu/watercycle.html

Sources of water

I. Surface sources

- Ponds and lakes reservoirs;
- Streams and rivers;
- Sea, Oceans.

II. Sub-surface sources or underground sources

- Springs;
- Infiltration wells ; and
- Wells and Tube-wells.

Site for Intake

should be:

I. Available the best quality of water and sufficient .
II. Not heavy current of water.
III. Near the treatment plant.
IV. Enough quantity if required in the future.
V. As far as possible the point of sewage disposal..
VI. Not locate in navigation channels.

Primary treatment

Advantage:

- Lightens the load on the subsequent process.
- Process -can be controlled in a better way.
- Chemical coagulation cost can be reduced.
- No chemical is lost from the plain setting.
- Less quantity of chemicals are required.

Pre-Sedimentation

Grit Chamber

Water Treatment Process for Groundwater

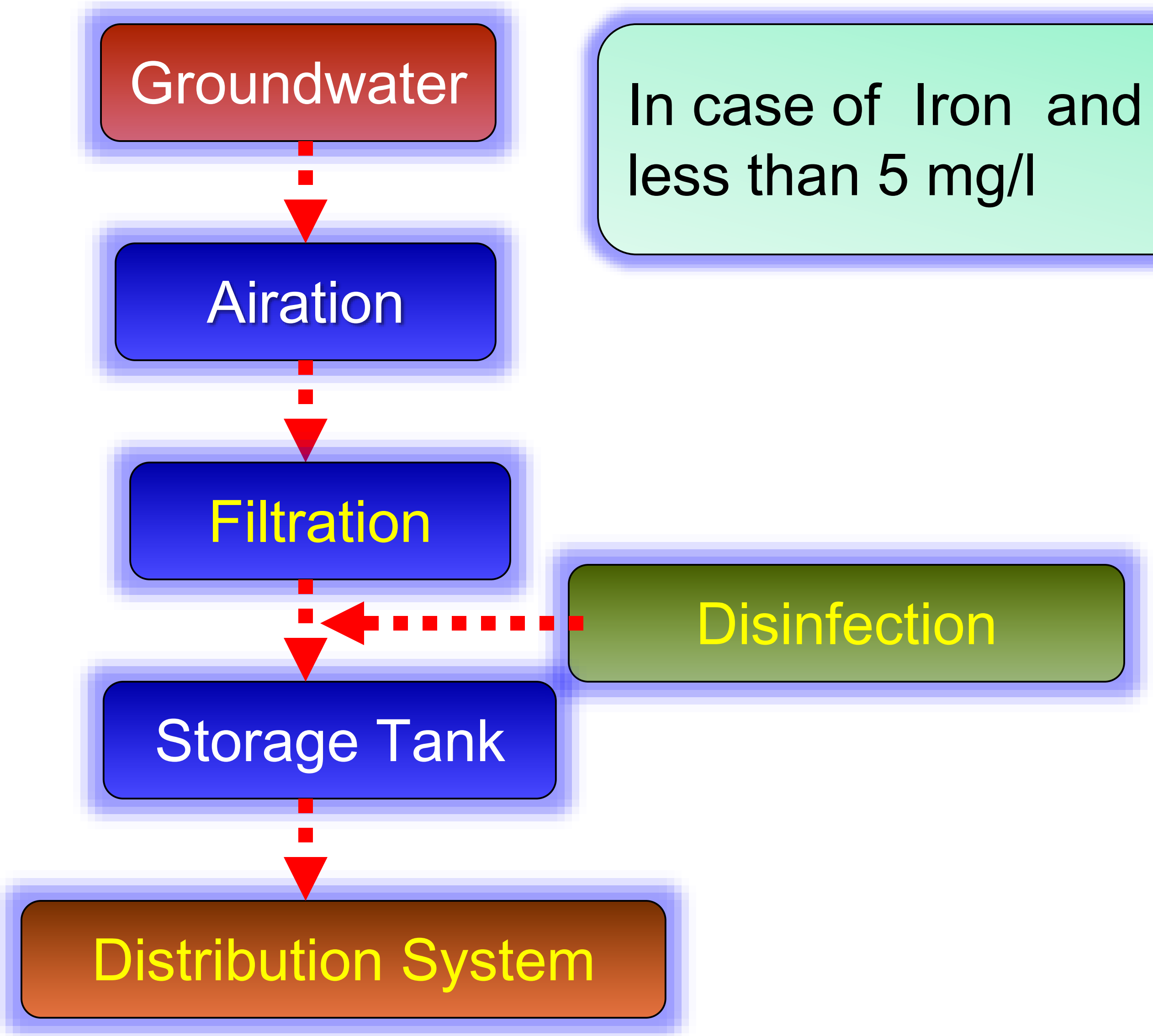
Characteristic of Ground Water

I. Chemical Characteristic

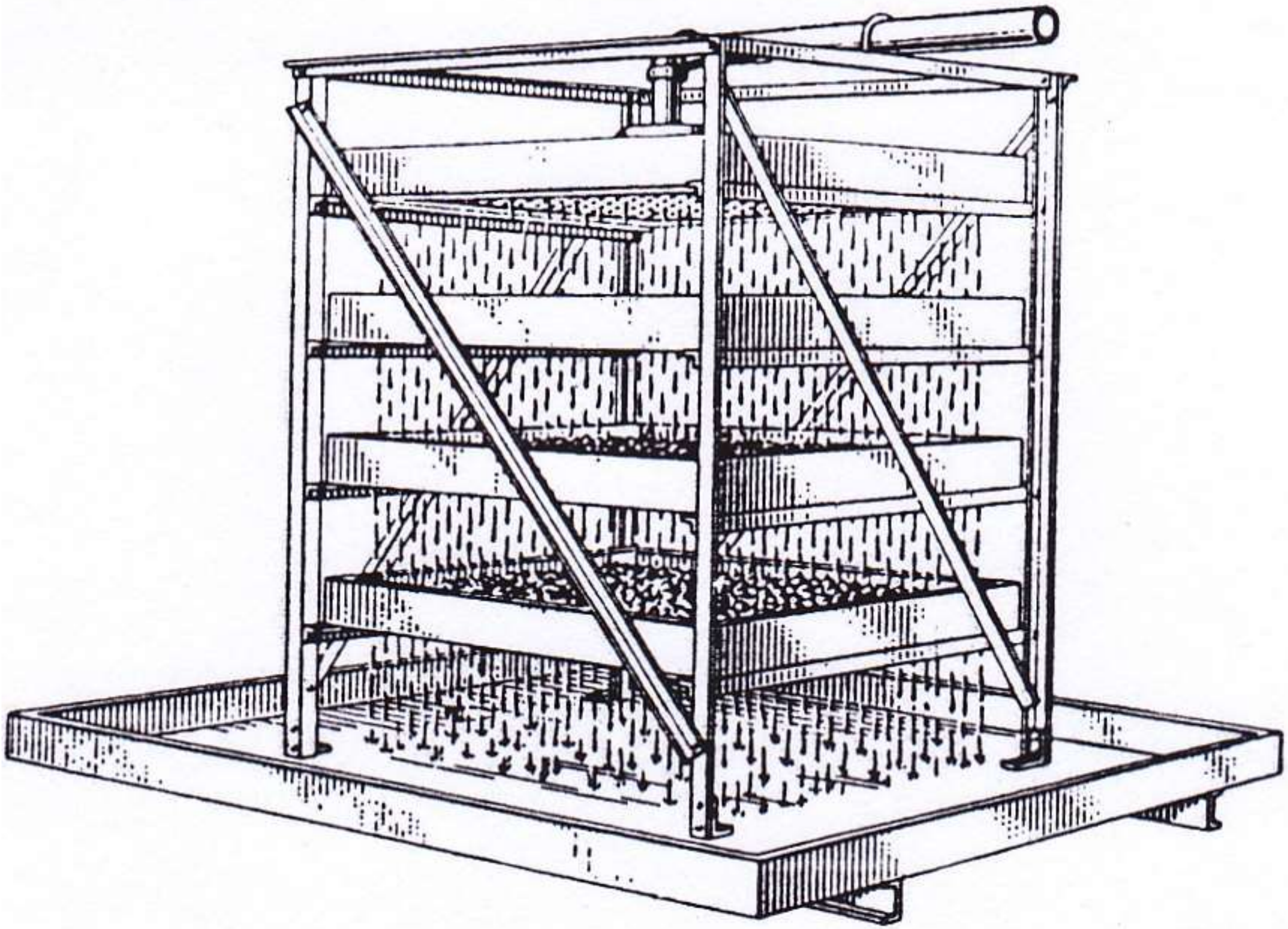
II. Physical Characteristic

III. Microbiological Characteristic

Water Treatment Process for Groundwater

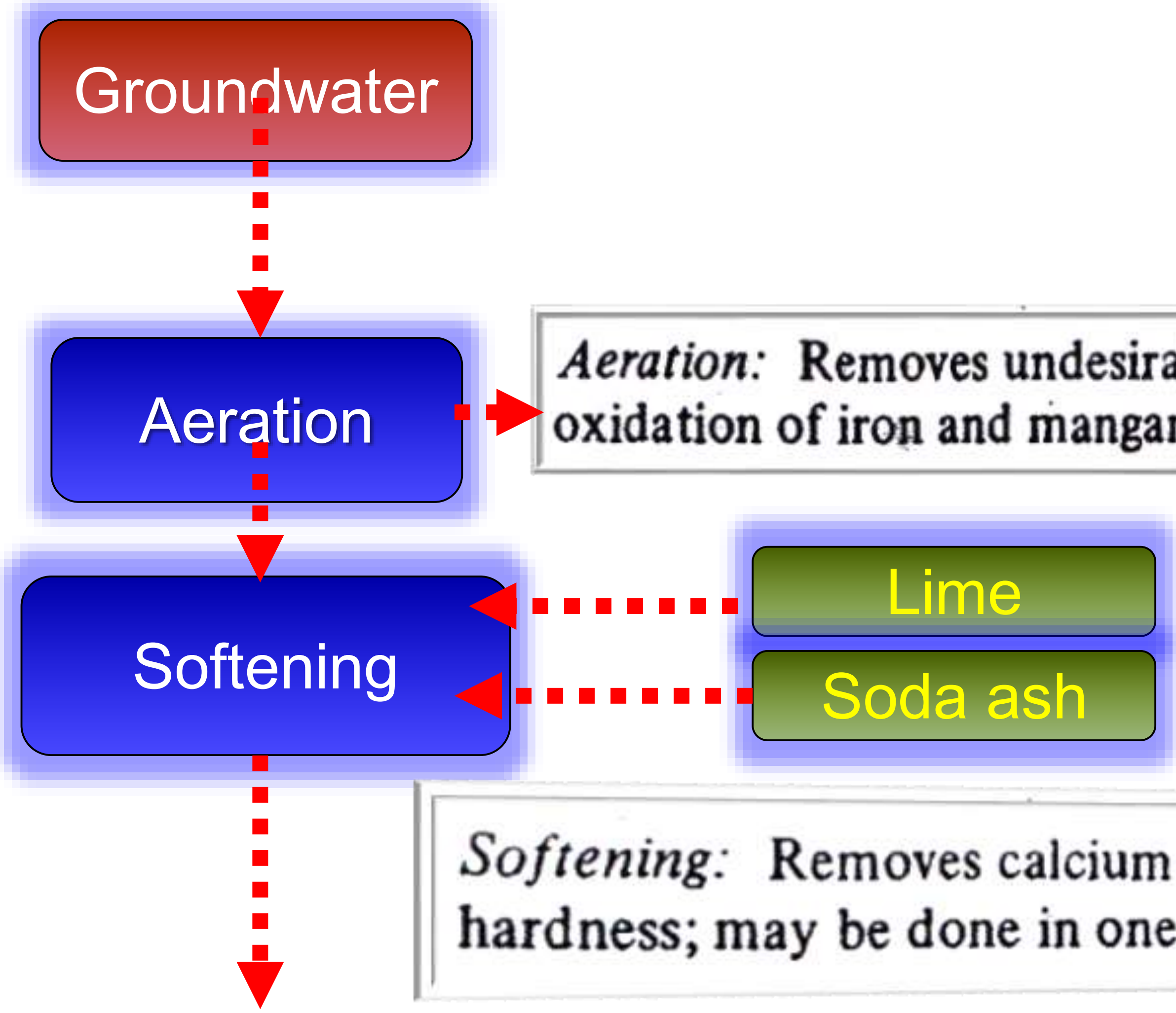


In case of Iron and Manganese less than 5 mg/l



Aerator

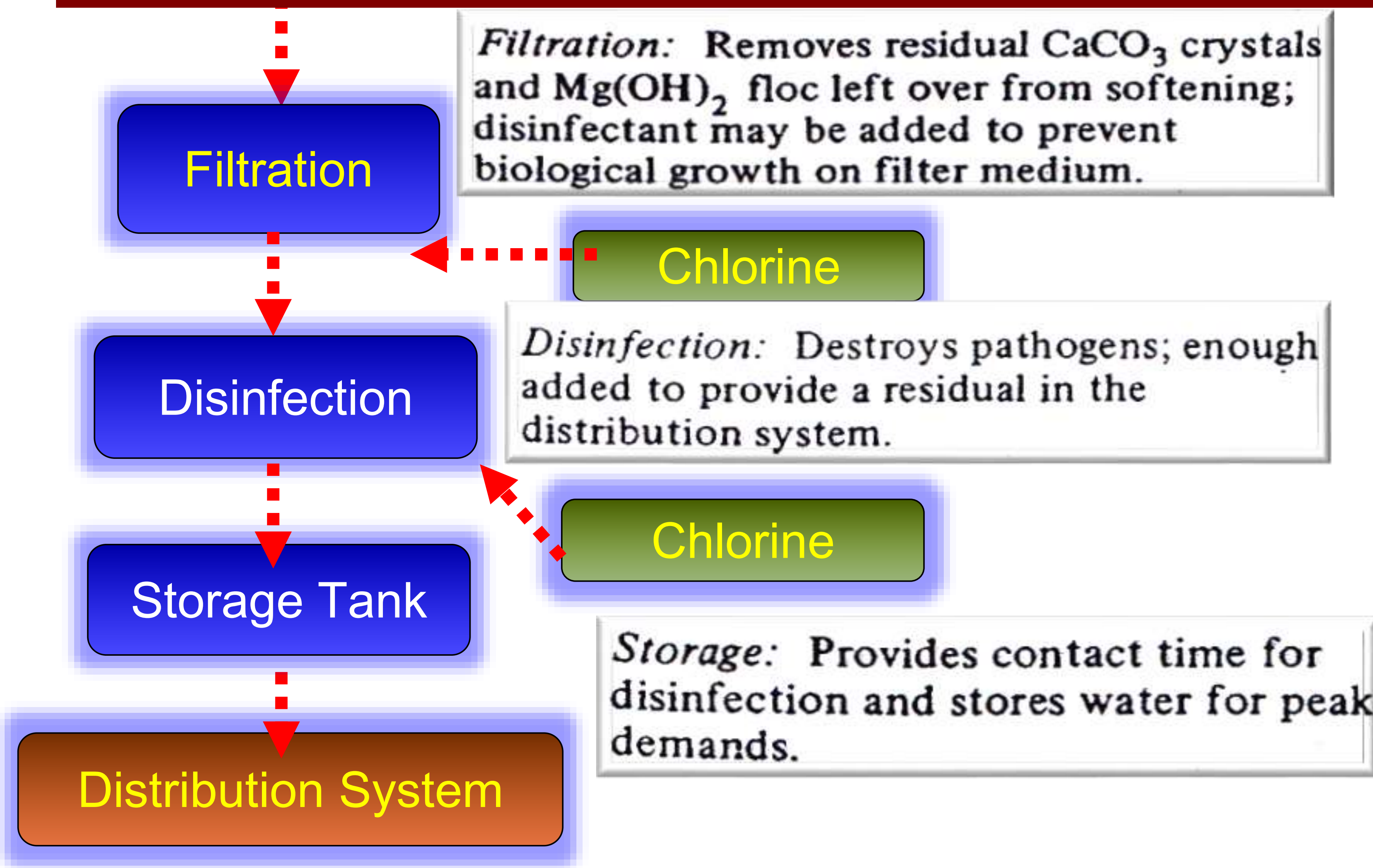
Water Treatment Process for *hard groundwater*



Aeration: Removes undesirable gases and/or oxidation of iron and manganese.

Softening: Removes calcium and/or magnesium hardness; may be done in one or two stages.

Water Treatment Process for *hard groundwater*



Water Treatment Process for Surface water

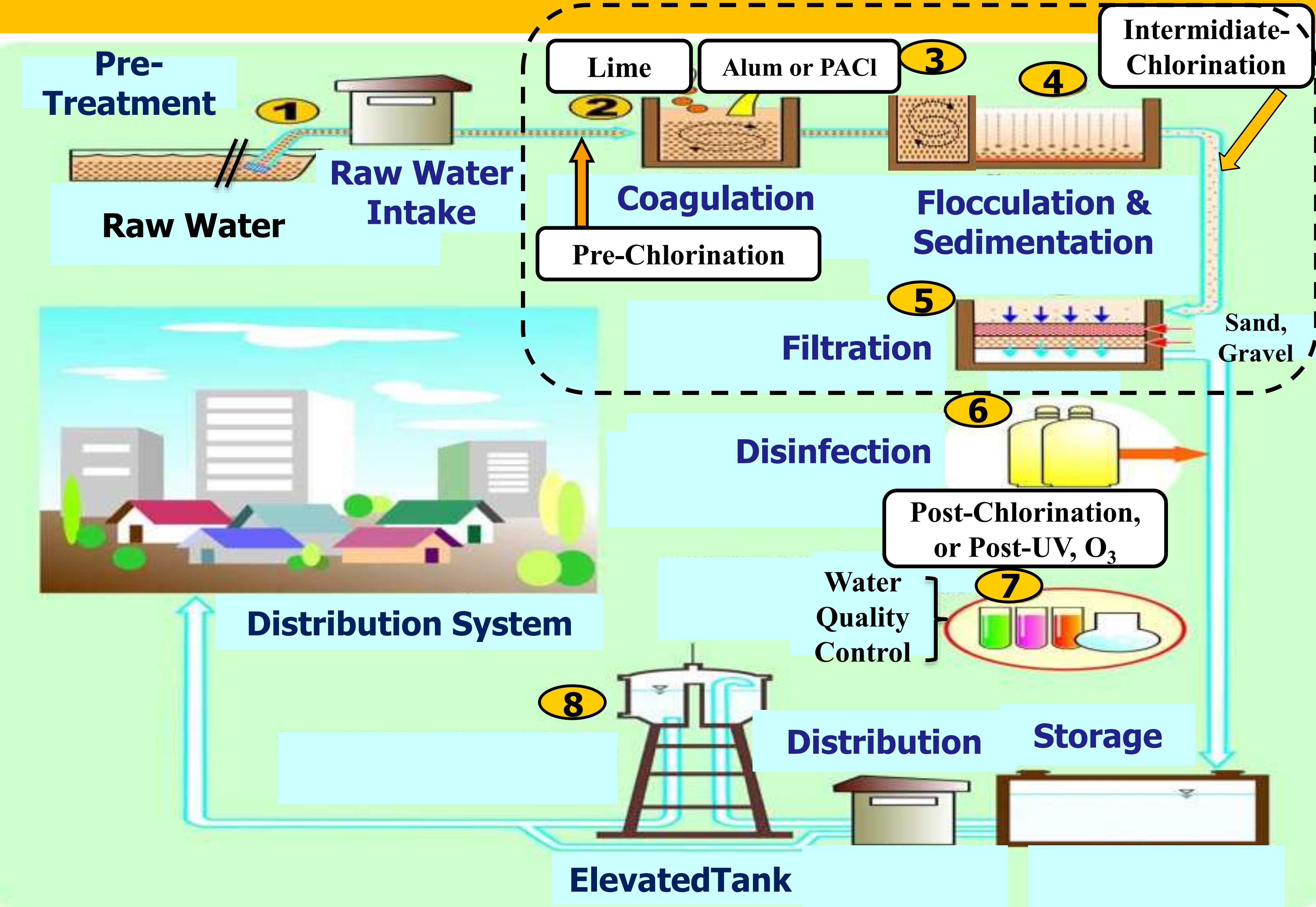
Characteristic of Surface water

I. Chemical Characteristic

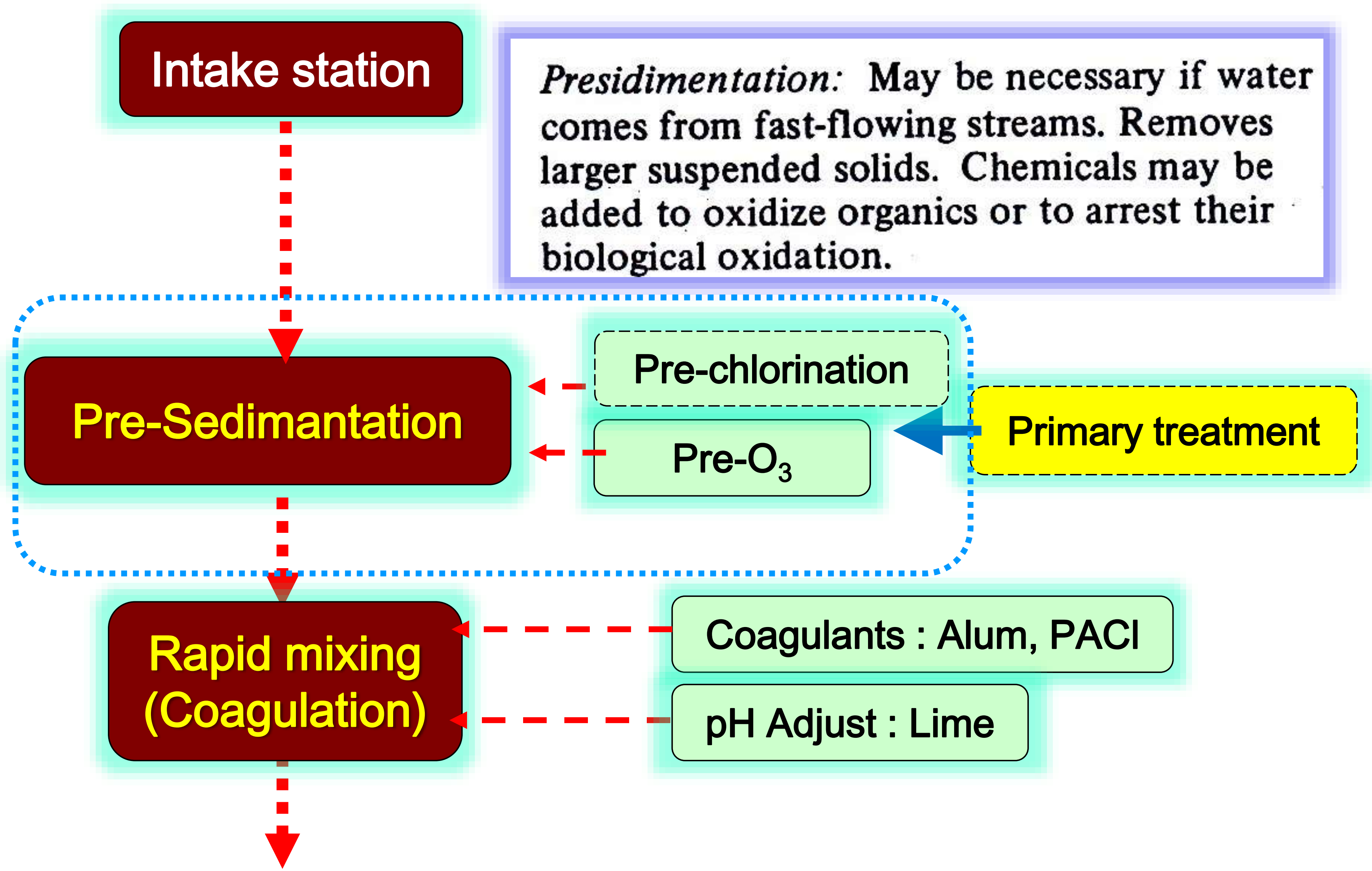
II. Physical Characteristic

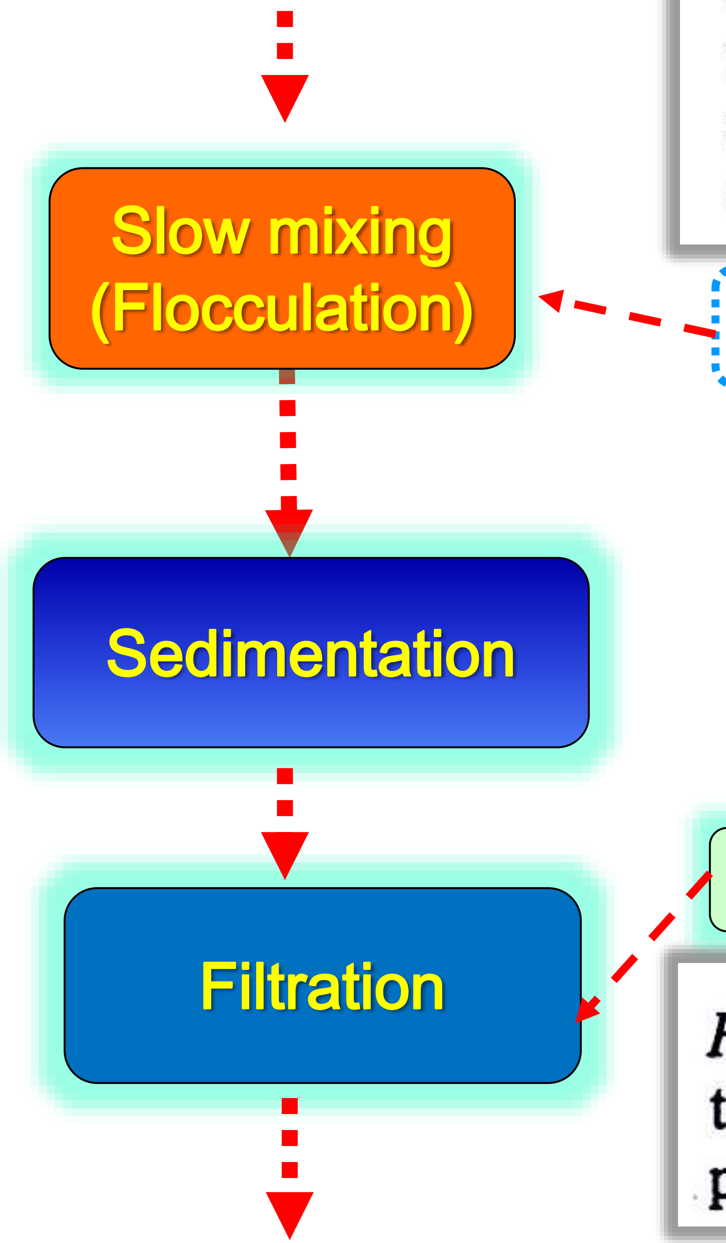
III. Microbiological Characteristic

Conventional Treatment Process



Water Treatment Process for Surface Water





Mixing, flocculation, settling: Removes turbidity by coagulating colloids and settling them out; may also remove color caused by large organic molecules.

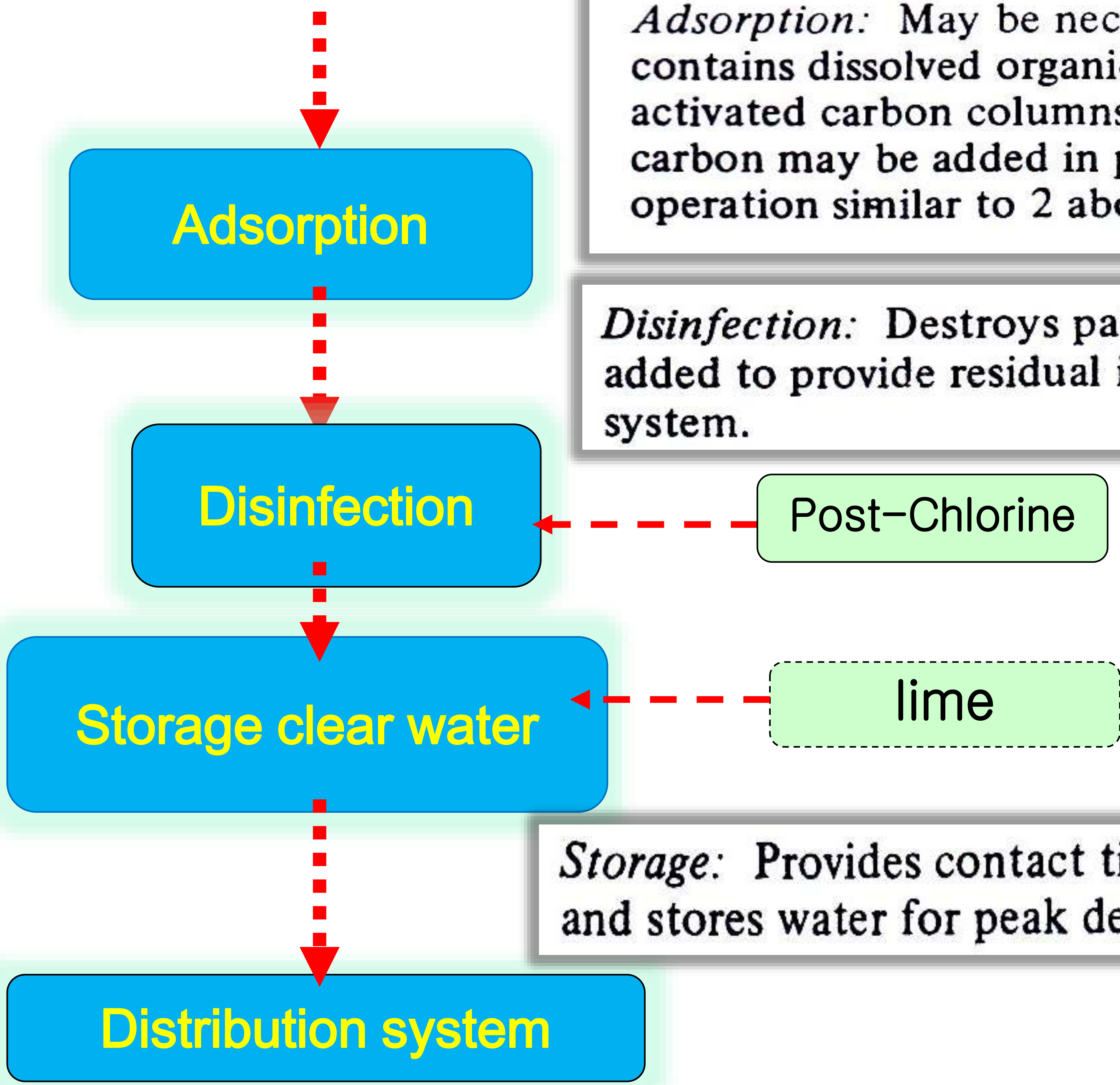
Coagulant Aids : Polymer

Intermidiate-Chlorine

Filtration: Polishes to remove remaining turbidity; disinfectant may be added to prevent biological growth on filter medium.

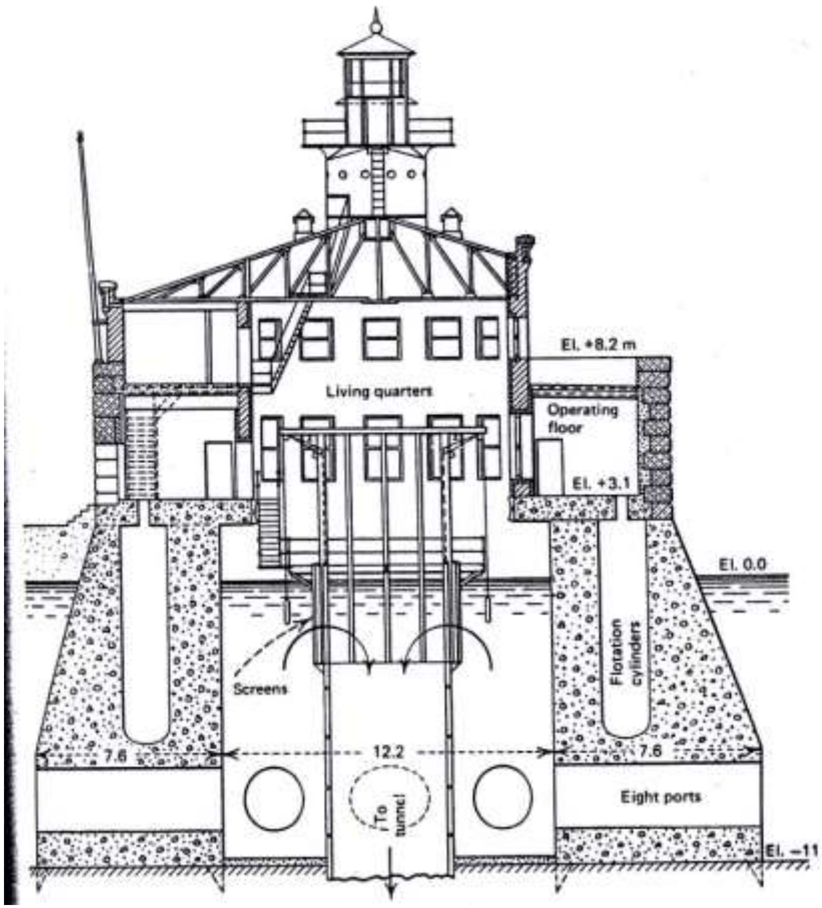
Adsorption: May be necessary if water contains dissolved organics; may consist of activated carbon columns or activated carbon may be added in powdered form in operation similar to 2 above.

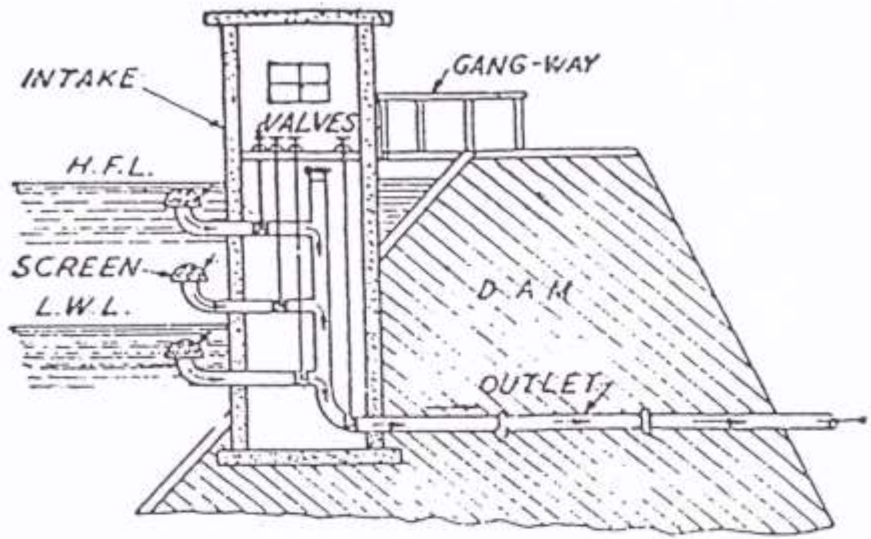
Disinfection: Destroys pathogens; enough added to provide residual in the distribution system.

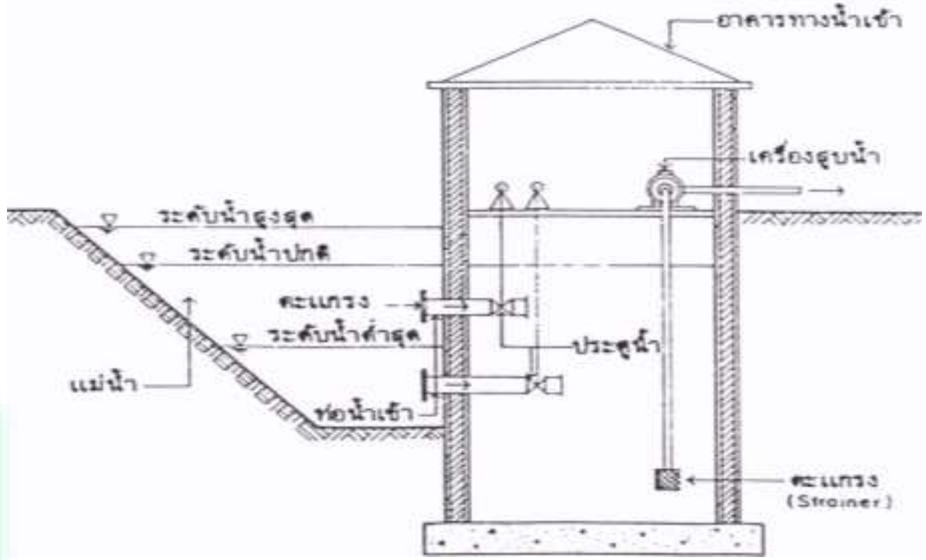


Storage: Provides contact time for disinfection and stores water for peak demand.

Intake Station and Primary Treatment

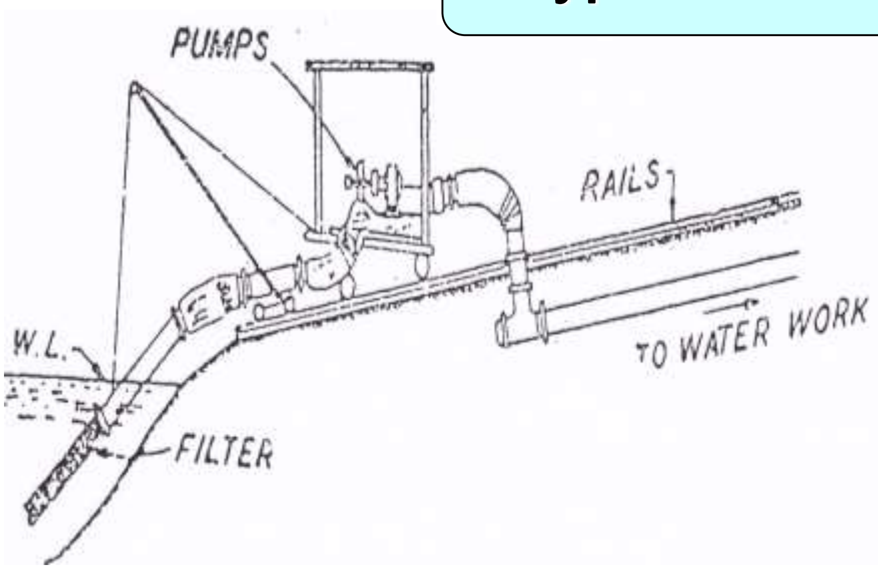


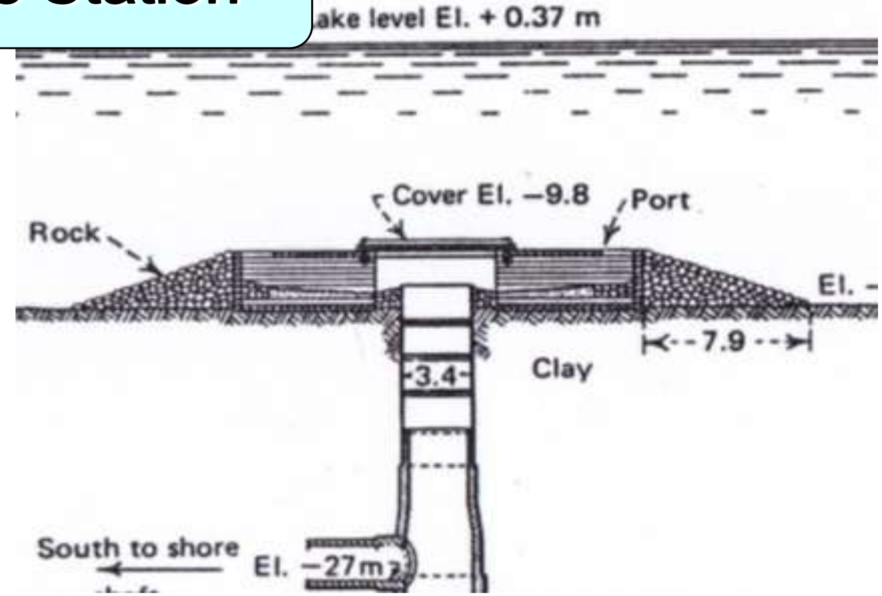


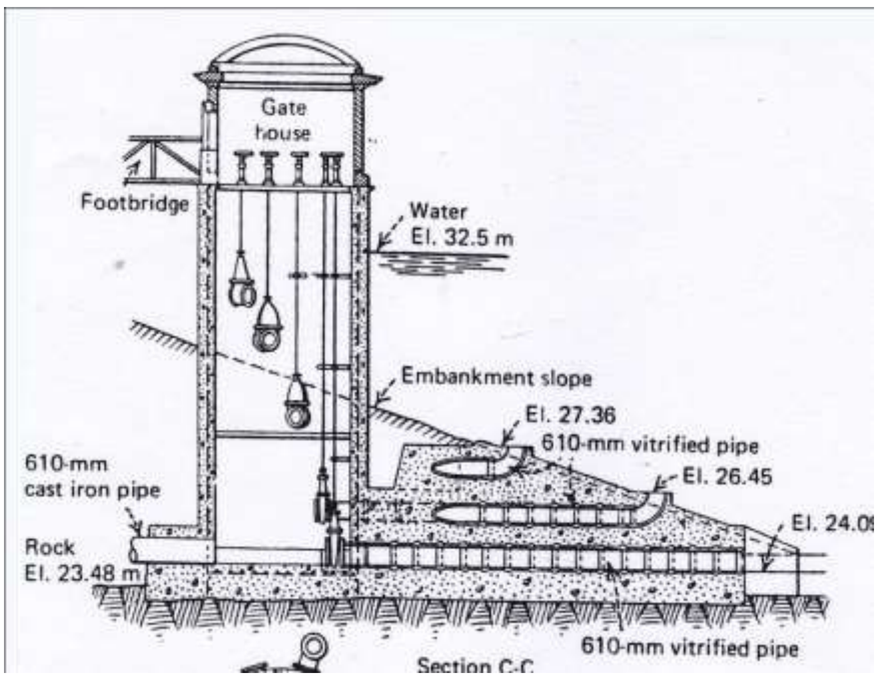


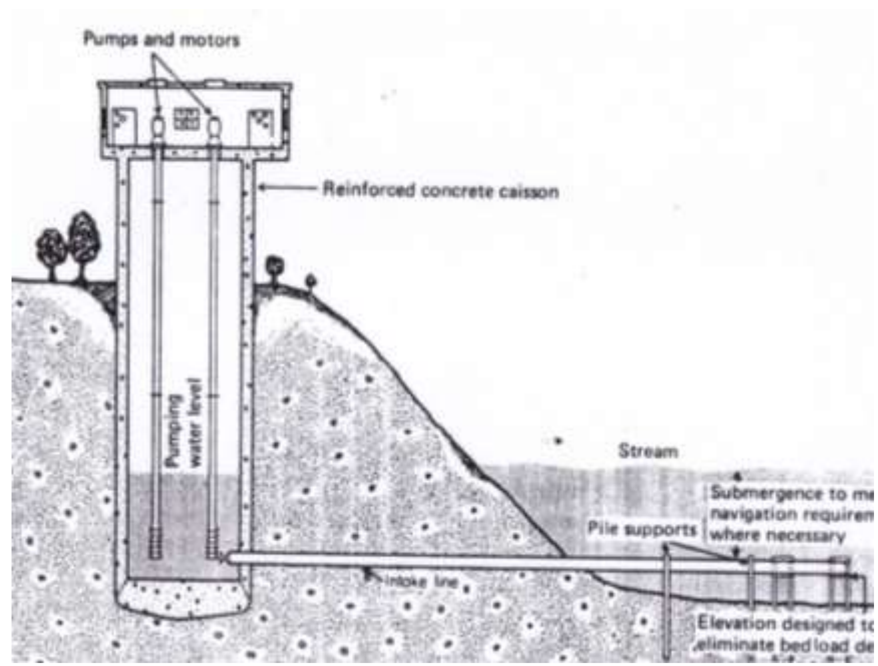
Typical of Intake Station

Typical of Intake Station









PWA Intake Station

PWA Intake Station

Intake Pumping Station

Above Ground

Dry Well

Pontoon

Turbine

ABOVE GROUND
Intake Pumping Station

Dry Well

Intake Pumping Station

Pontoon

Intake Pumping Station

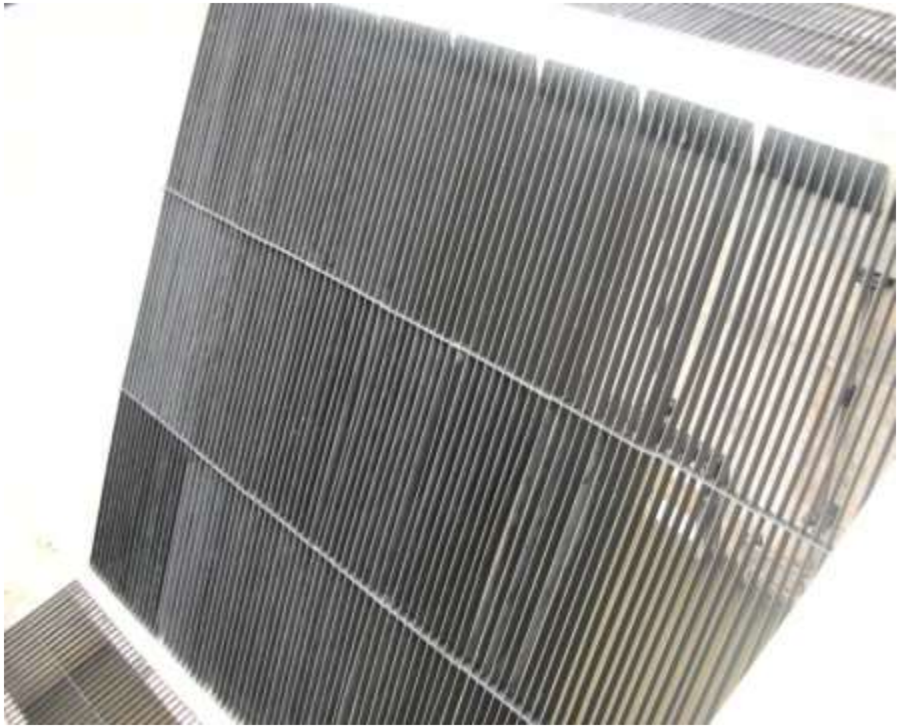



Turbine

Intake Pumping Station

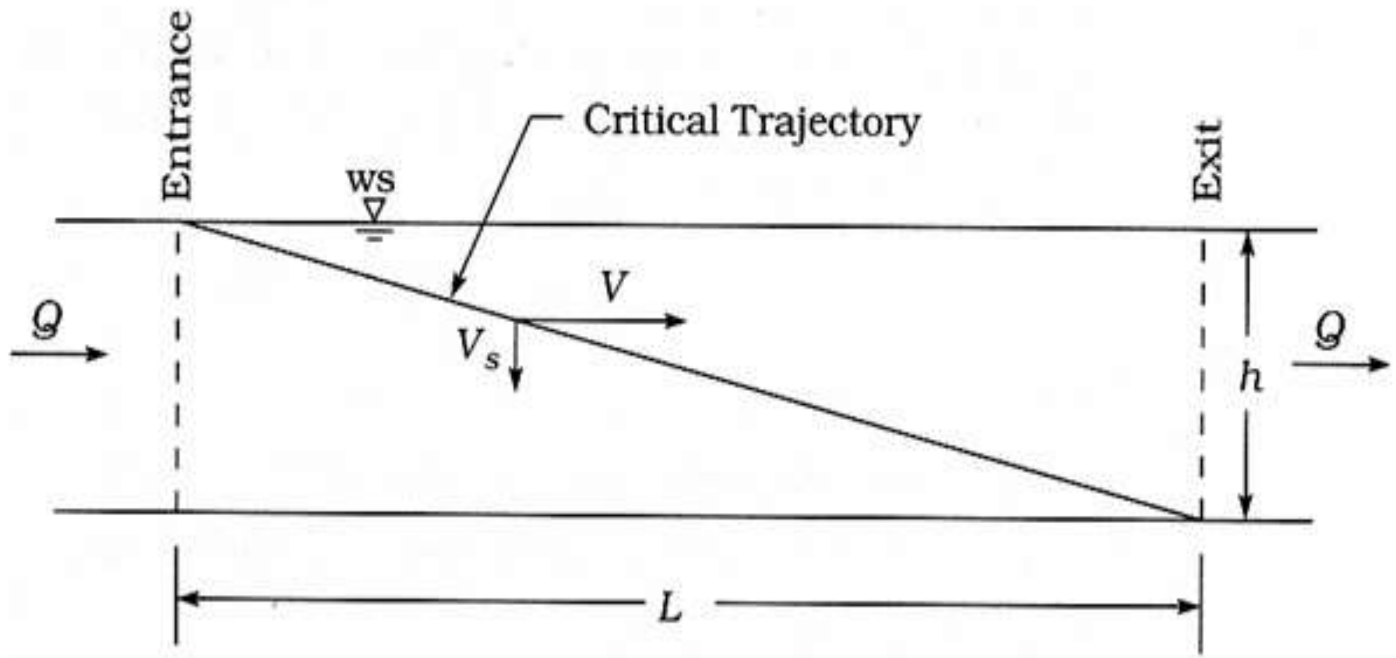
PWA Intake Station with problems of Water quality and Water quantity

Screen Chamber



Screen

Sedimentation



Critical Trajectory of the Design Particle
In a horizontal-velocity Grit Removal Chamber

The sedimentation of discrete particle may be described by Newton's law and Stroke'Law.

Newton's law

$$\nu = \left[\frac{4g(\rho_s - \rho)d}{3C_d \rho} \right]^{1/2}$$

$$= \frac{g}{18\mu}(\rho_s - \rho)d^2$$

ν = terminal setting velocity

ρ_s = mass density of particle

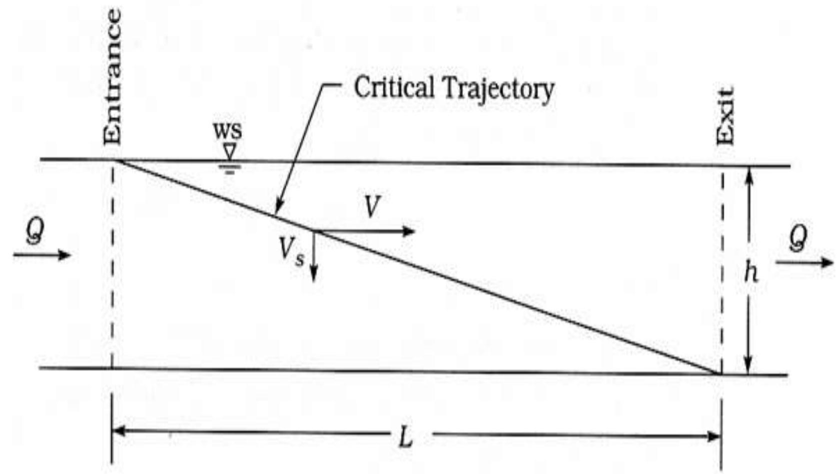
ρ = mass density of fluid

d = diameter of particle

g = gravitational constant

C_d = dimension drag coefficient

$$= \frac{24}{N_R} = \frac{24\mu}{\nu d \rho}$$



Stroke'Law

$$v_s = \frac{Vh}{L} = \frac{h}{L} X \frac{Q}{wh} = \frac{Q}{wL}$$

V_s = surface over flow rate

V = velocity of water

h = depth of chamber

L = length of chamber

W = with of chamber

Q = flow rate

Table Settling velocities of various size particles

Particle diameter (mm.)	Size typical of	Settling velocity
10	Pebble	0.73 m/s
1	Coarse sand	0.23 m/s
0.1	Fine sand	1.0×10^{-2} m/s(0.6 m/min)
0.01	Silt	1.0×10^{-4} m/s(8.6 m/d)
0.0001	Large colloid	1.0×10^{-8} m/s(0.3 m/year)
0.000001	Small colloid	1.0×10^{-13} m/s (3 m/million year)

Mixing and coagulation

Rapid mixing or flat mixing

Rapid mixing can be done by one of the following devices.

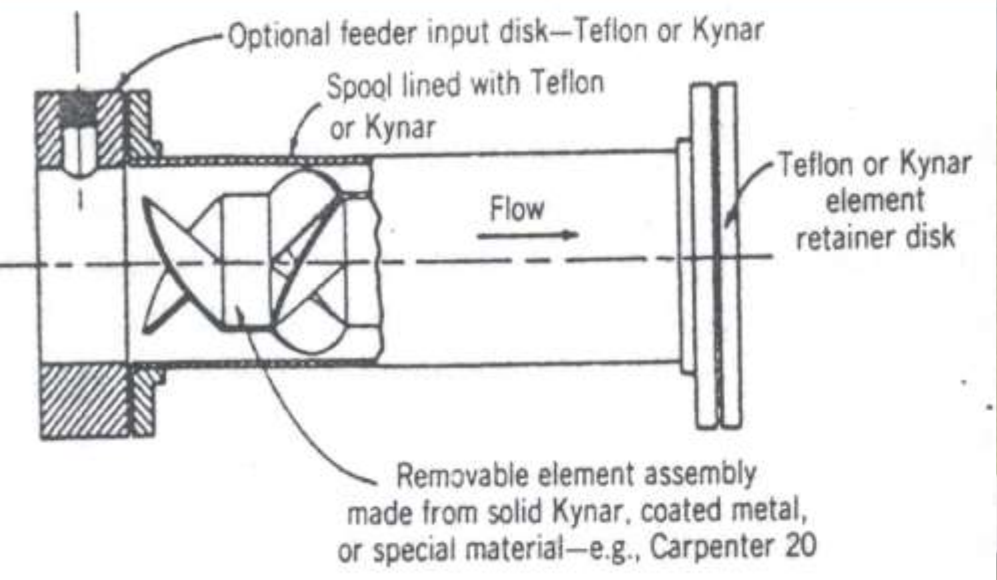
Hydraulic

- Hydraulic Jump
- Static Mixer.

Mechanical

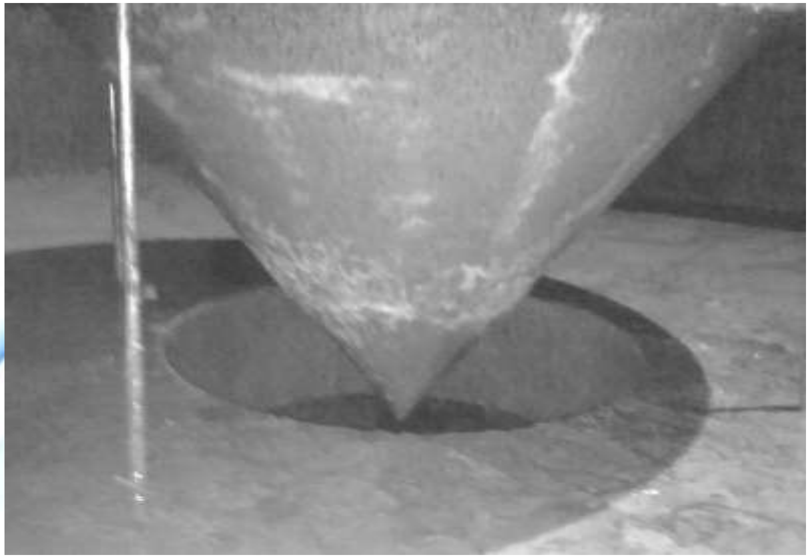
- Propeller
- Pneumatic
- In-line Blender
- Diffusers and Injection Device

Static Mixer



Static Mixer

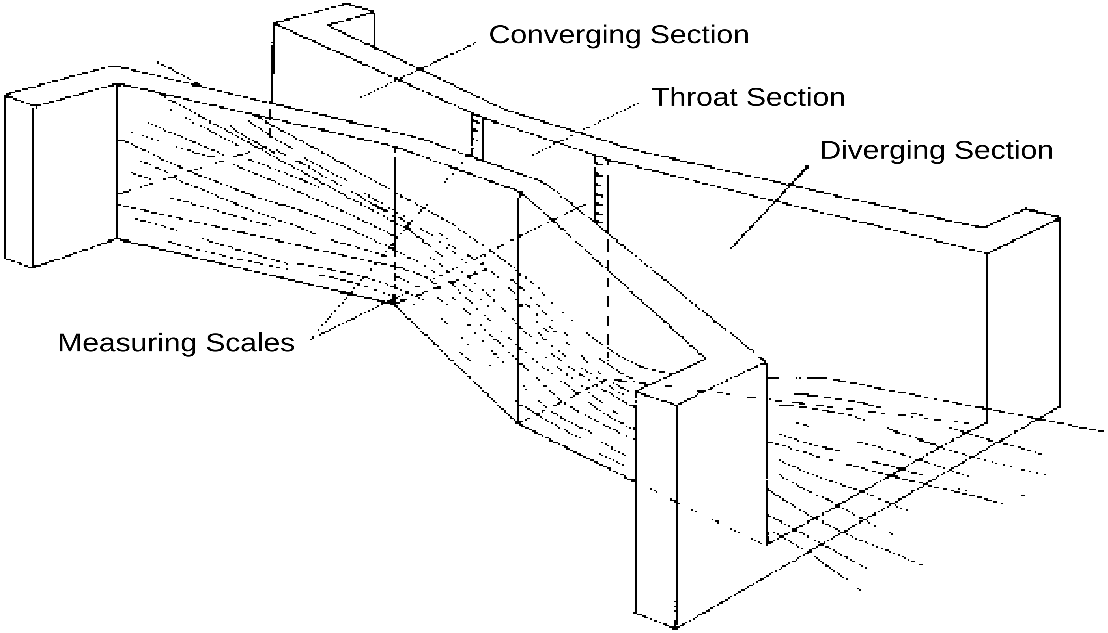
Mixer Cone



Hydraulic Jump

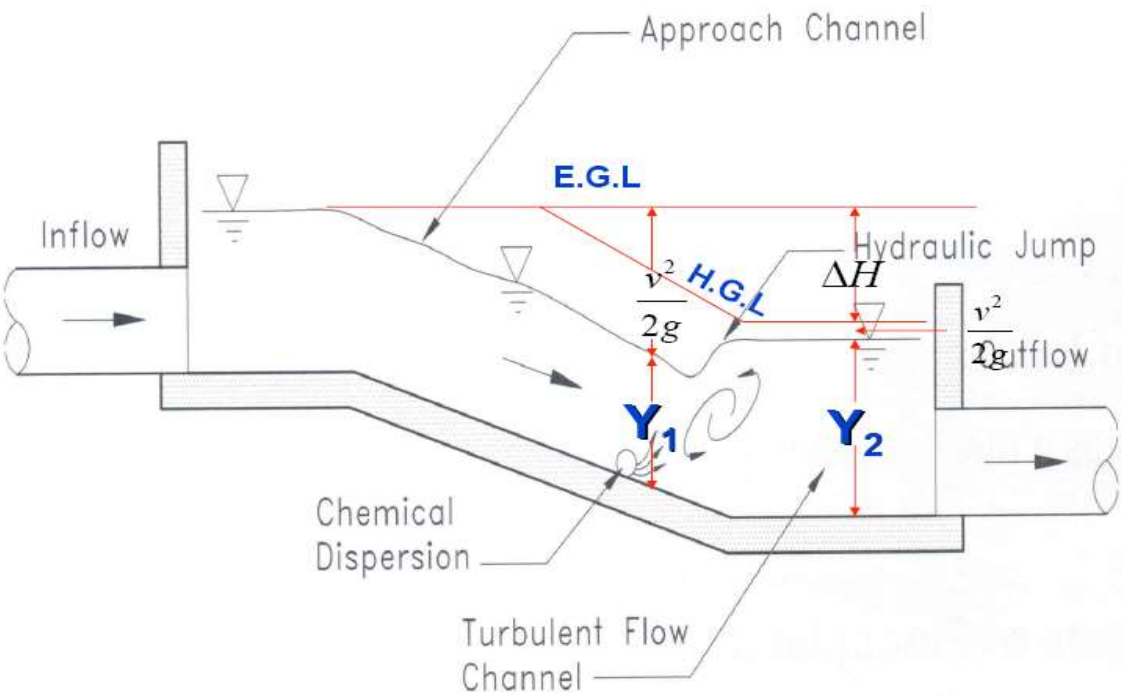
Coagulant Feed Pipe

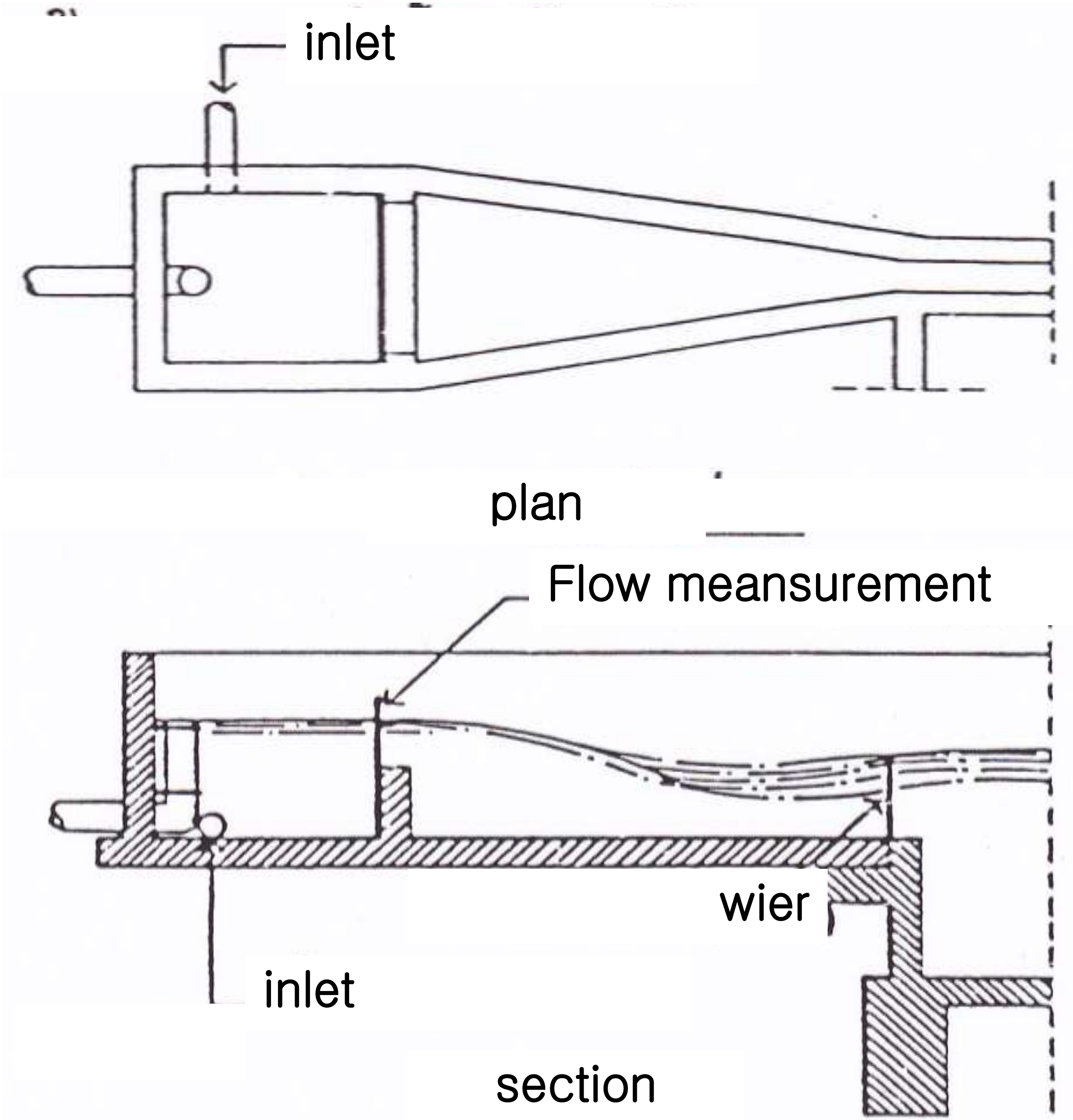
Hydraulic jump with Turbulent Flow



Parshall Flume

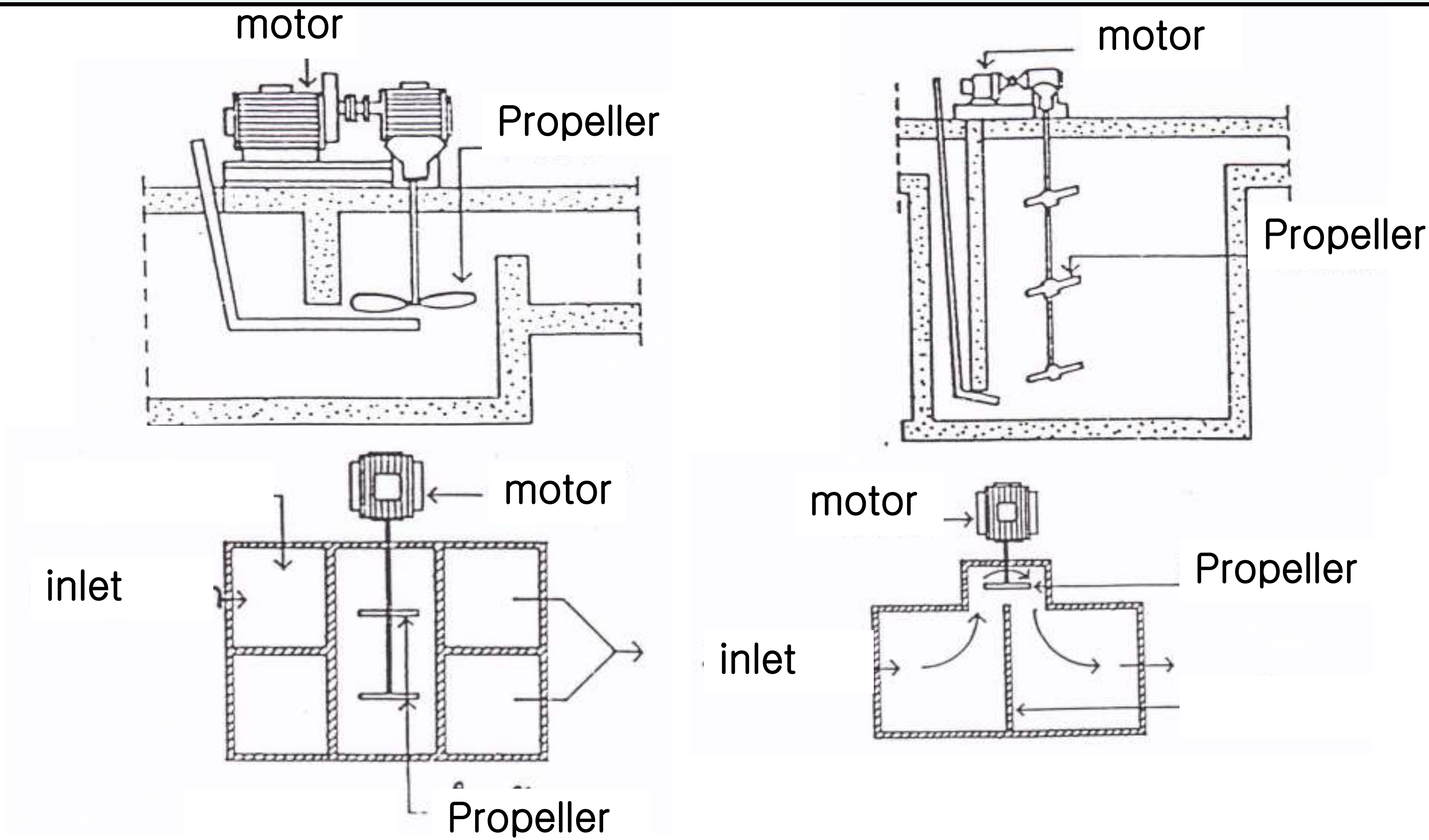
Hydraulic Jump



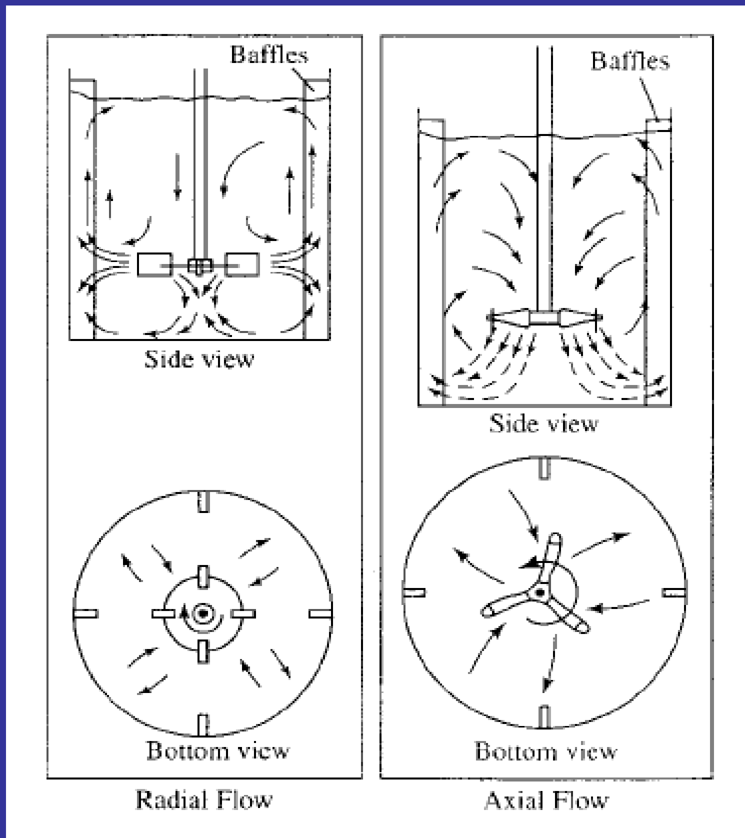


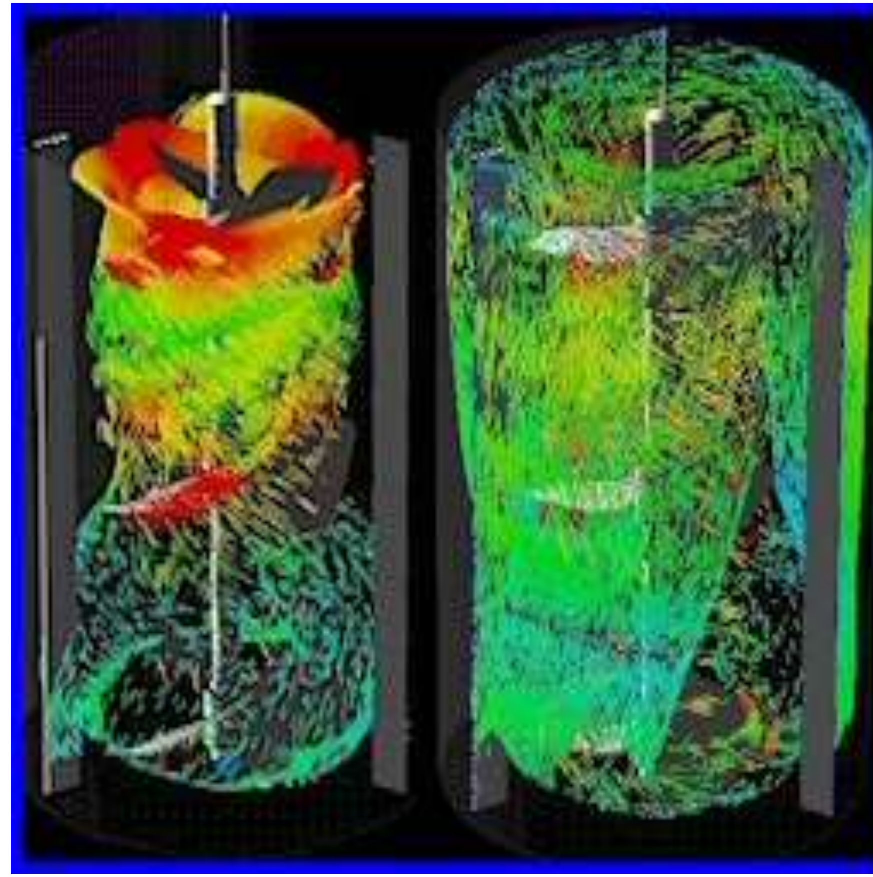
Parshall Flume

Mechanical Mixing

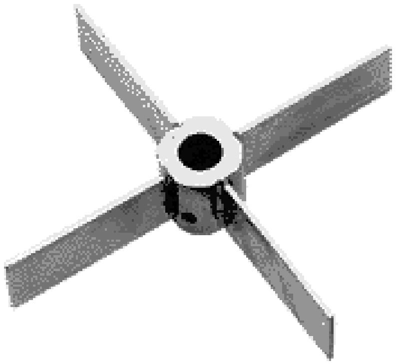


Typical of Propeller





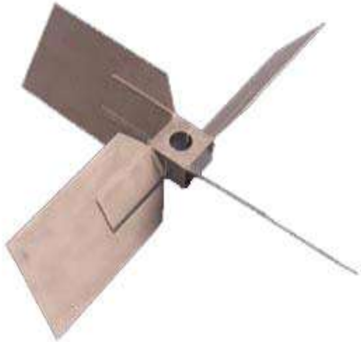
Typical of Propeller



Straight-blade

Flat-blade disk impeller

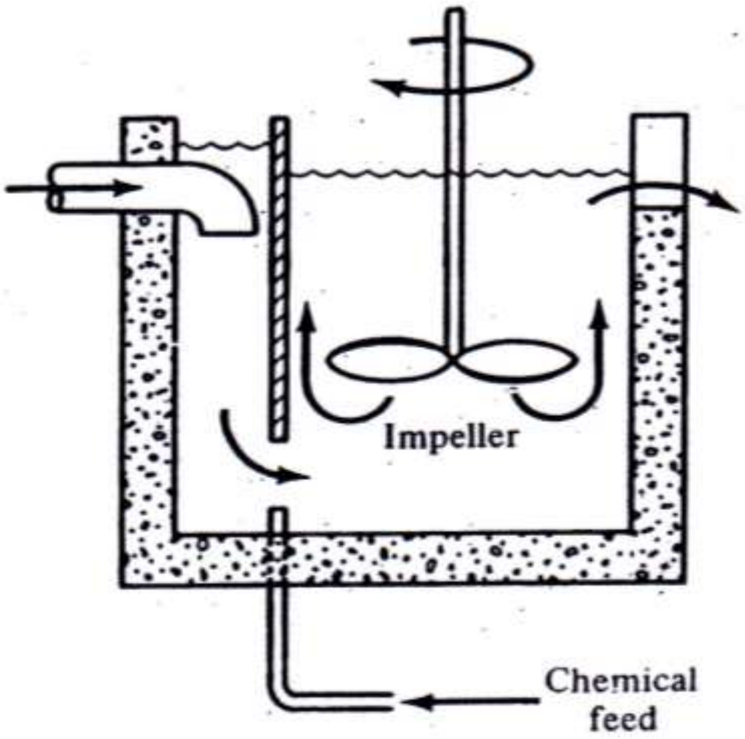
Pitched-blade axial-flow impeller



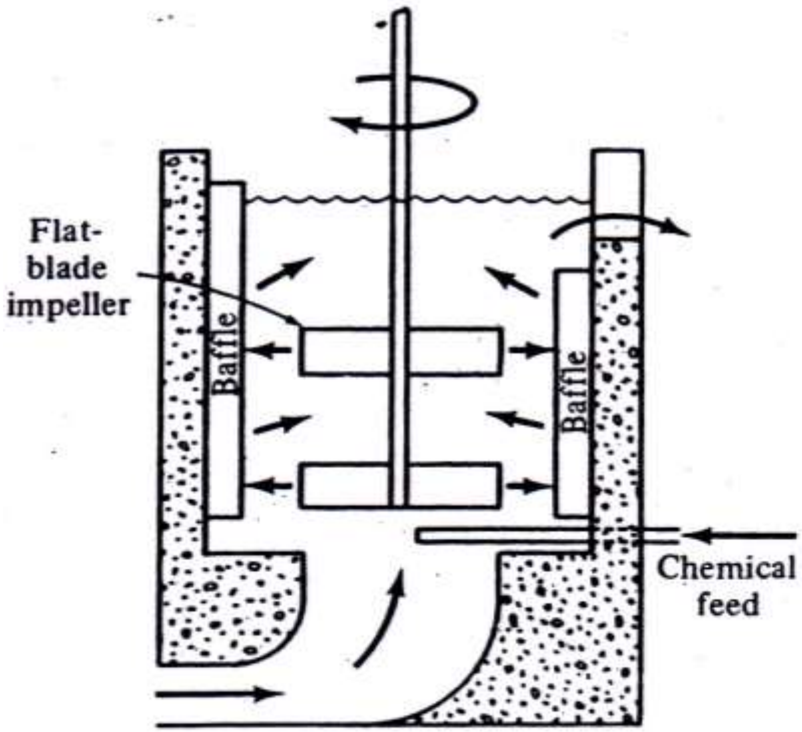
Pitched-blade axial-flow impeller

Marine-type pitched-blade axial-flow impeller

Typical of Propeller



Back-mix impeller



Flat-blade impeller

Typical of Rapid Mixing

Chemical Coagulants

- Aluminum sulphate : Alum ;
  $Al_2(SO_4)_3.18H_2O$
- Poly aluminum Chloride (PACl)
- Ferric Chloride ($FeCl_3.6H_2O$)
- Sodium Aluminate ($Na_2Al_2NO_4$)

Aluminum sulphate :Alum ; $Al_2(SO_4)_3.18H_2O$

Coagulant Storing

And Feeding Devices


เครื่องจ่ายสารส้ม
FA-1
FA-1

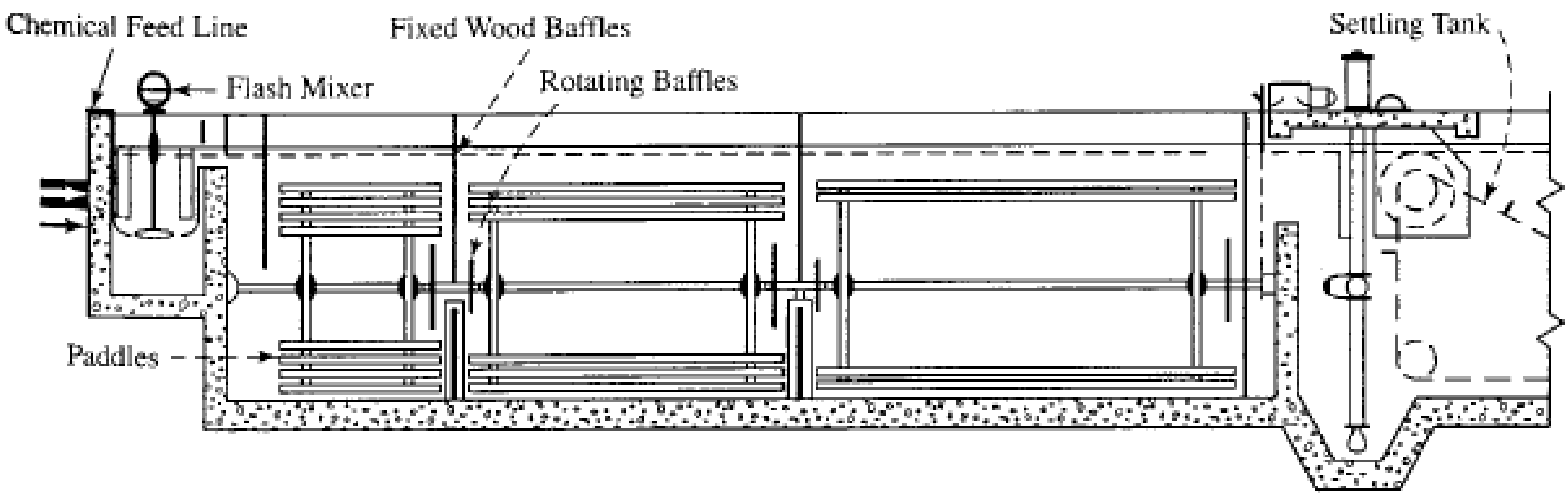
Chemical House and Chemical Storage tank

Slow Mixing or Flocculation

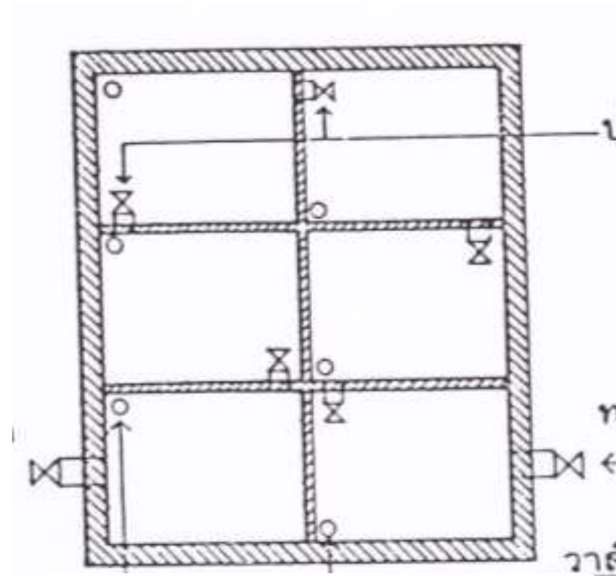
Slow Mixing can be done by one of the following devices.

I. Mechanical
   - Propeller type
   - Paddle type

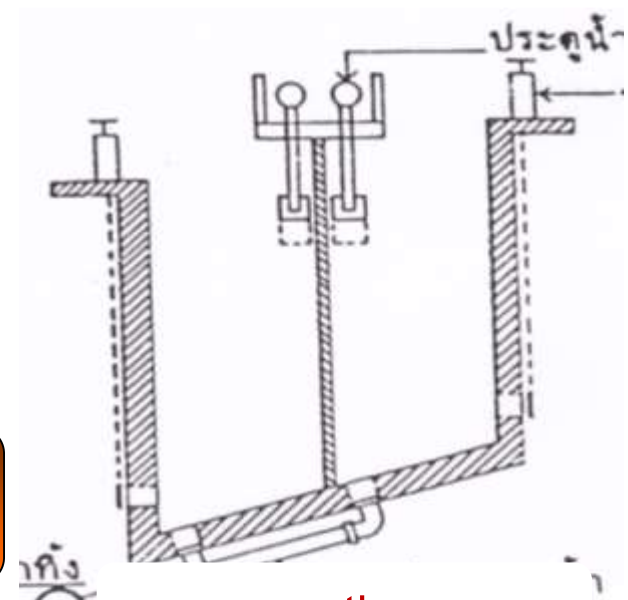
II. Hydraulic
   - Baffle type



Hydraulic Slow Mixing ; Paddle type



Plan



section

Hydraulic Slow Mixing ; Baffle type

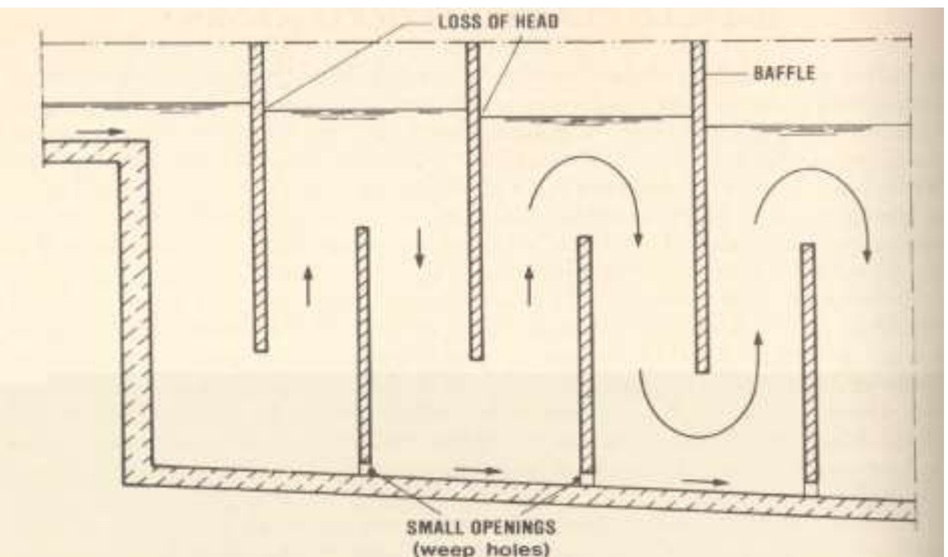
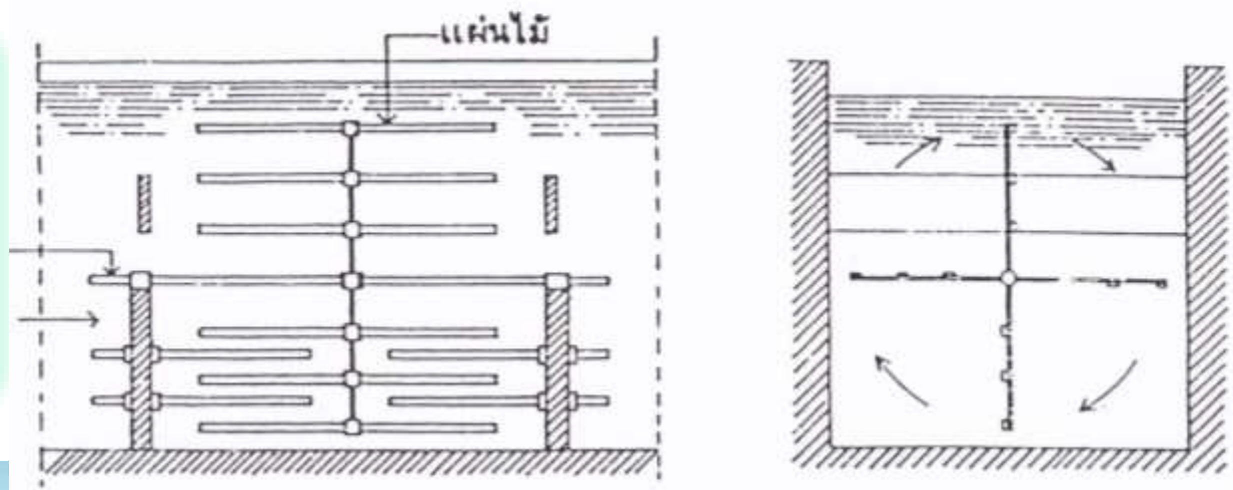
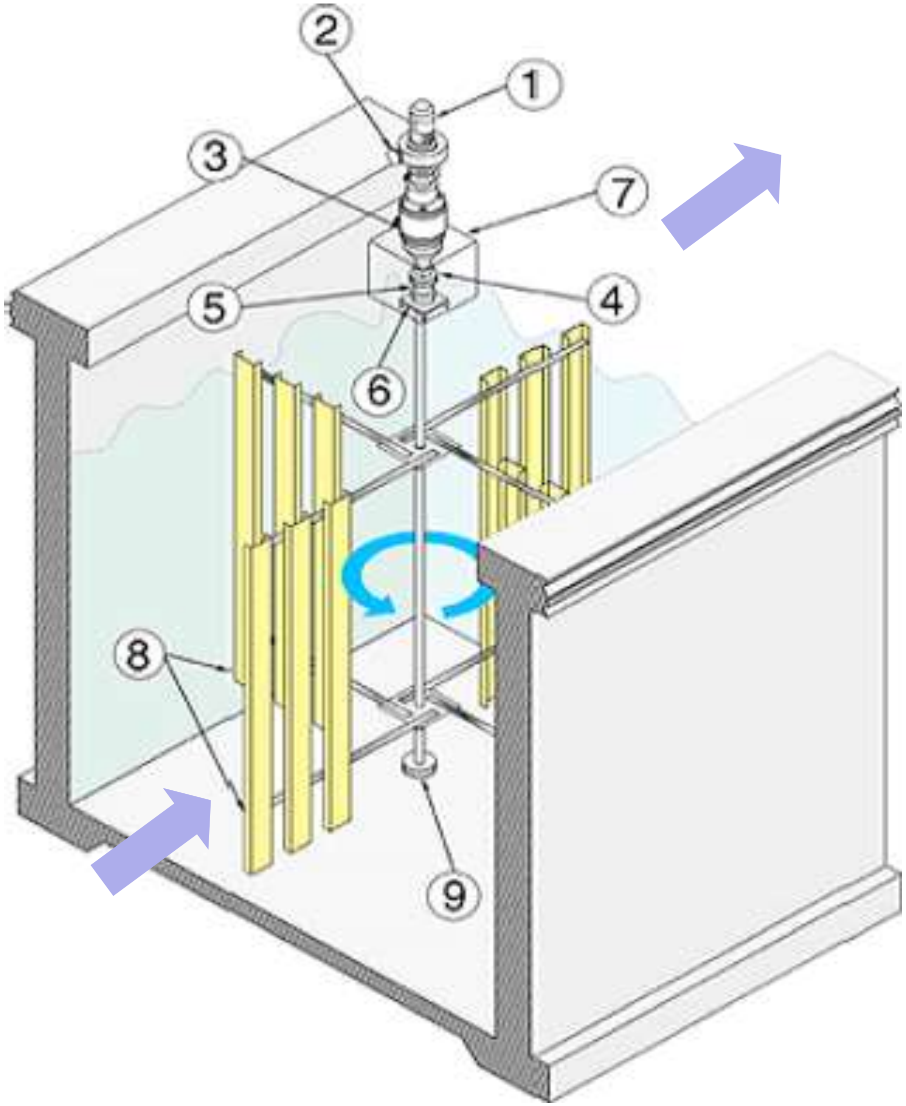


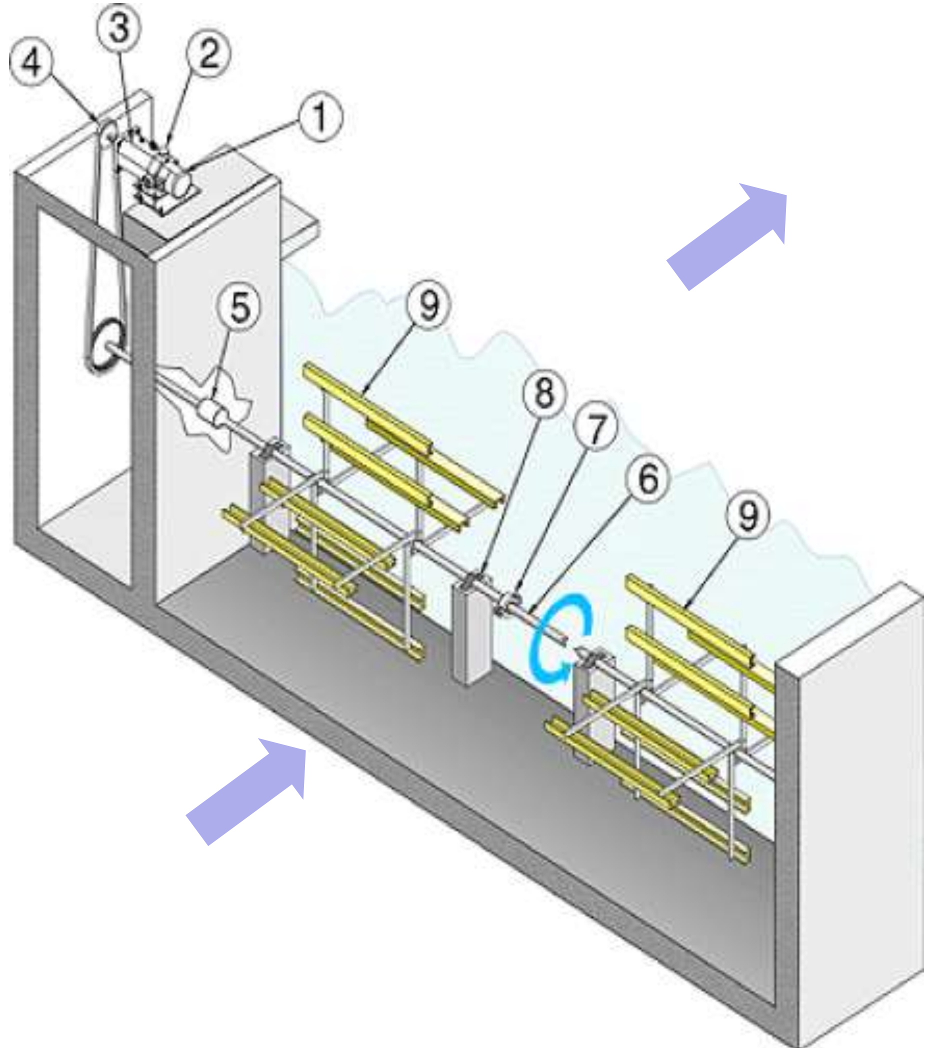
Figure 6.3. Vertical-flow baffled channel flocculator (cross-section). *Source:* IRC, 1981b.

Mechanical Slow Mixing ; Paddle type



Vertical Paddle Flocculator

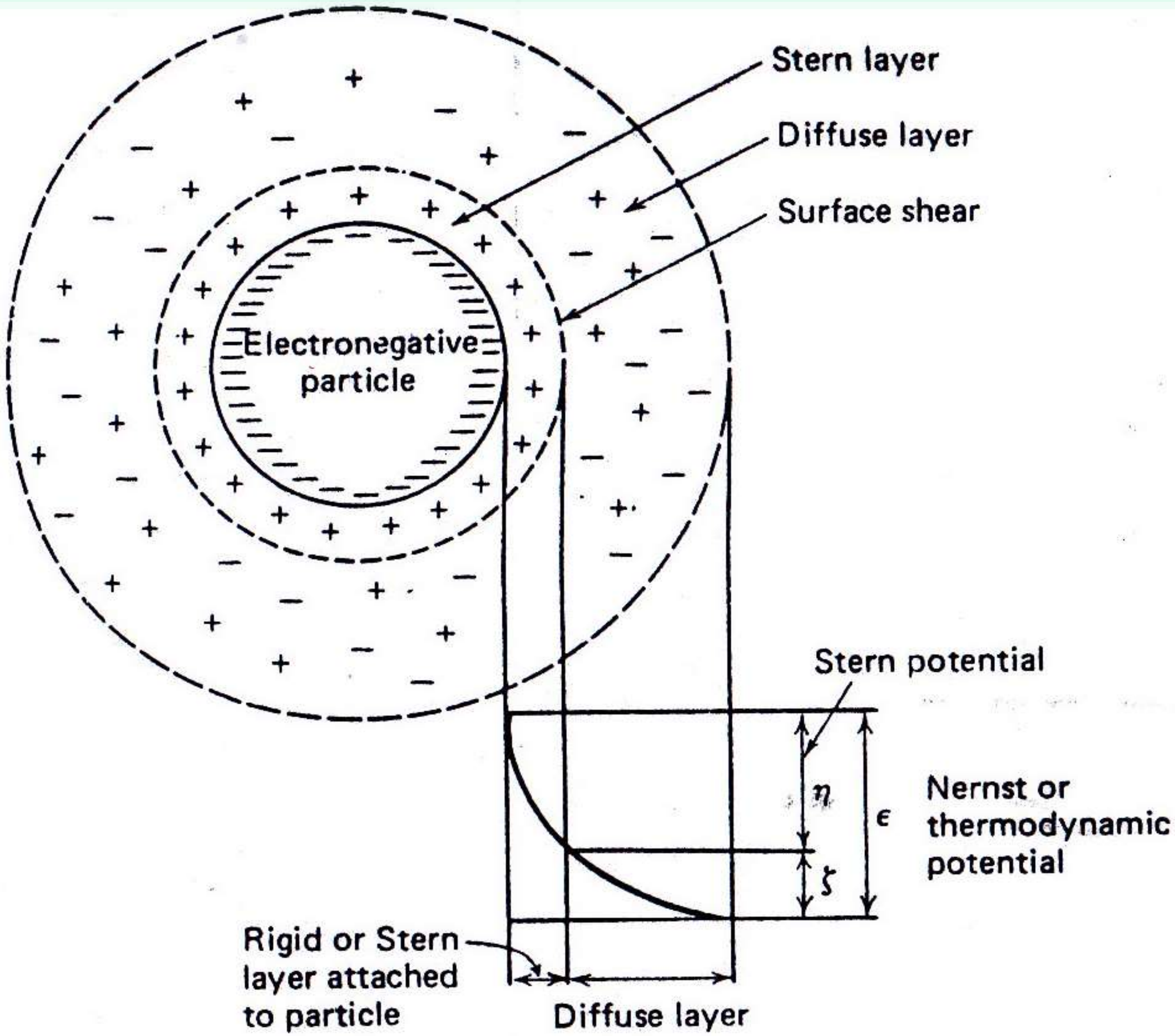


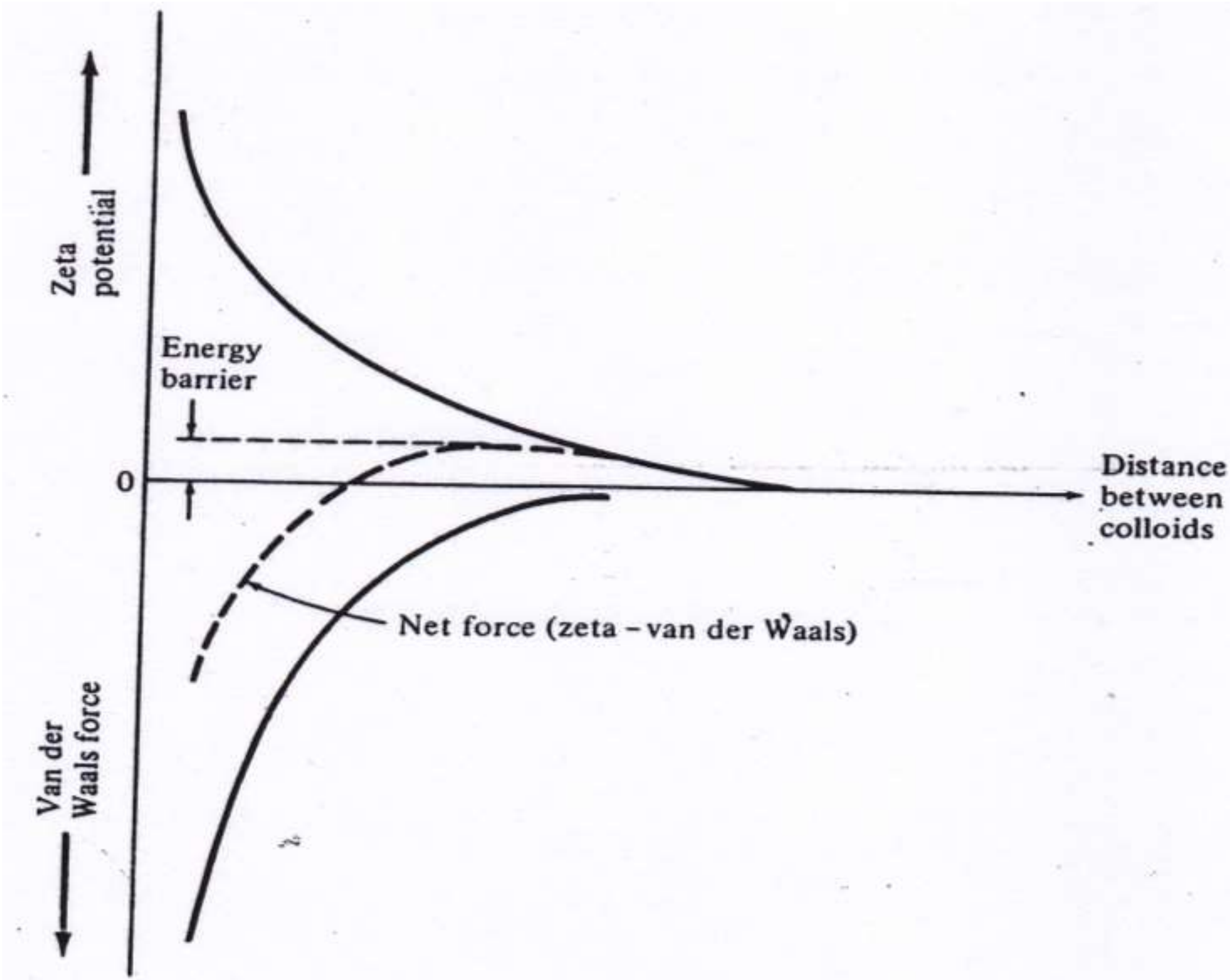


Horizontal Paddle Flocculator

Mechanical Mixers (Propeller)

Colloid & Coagulation



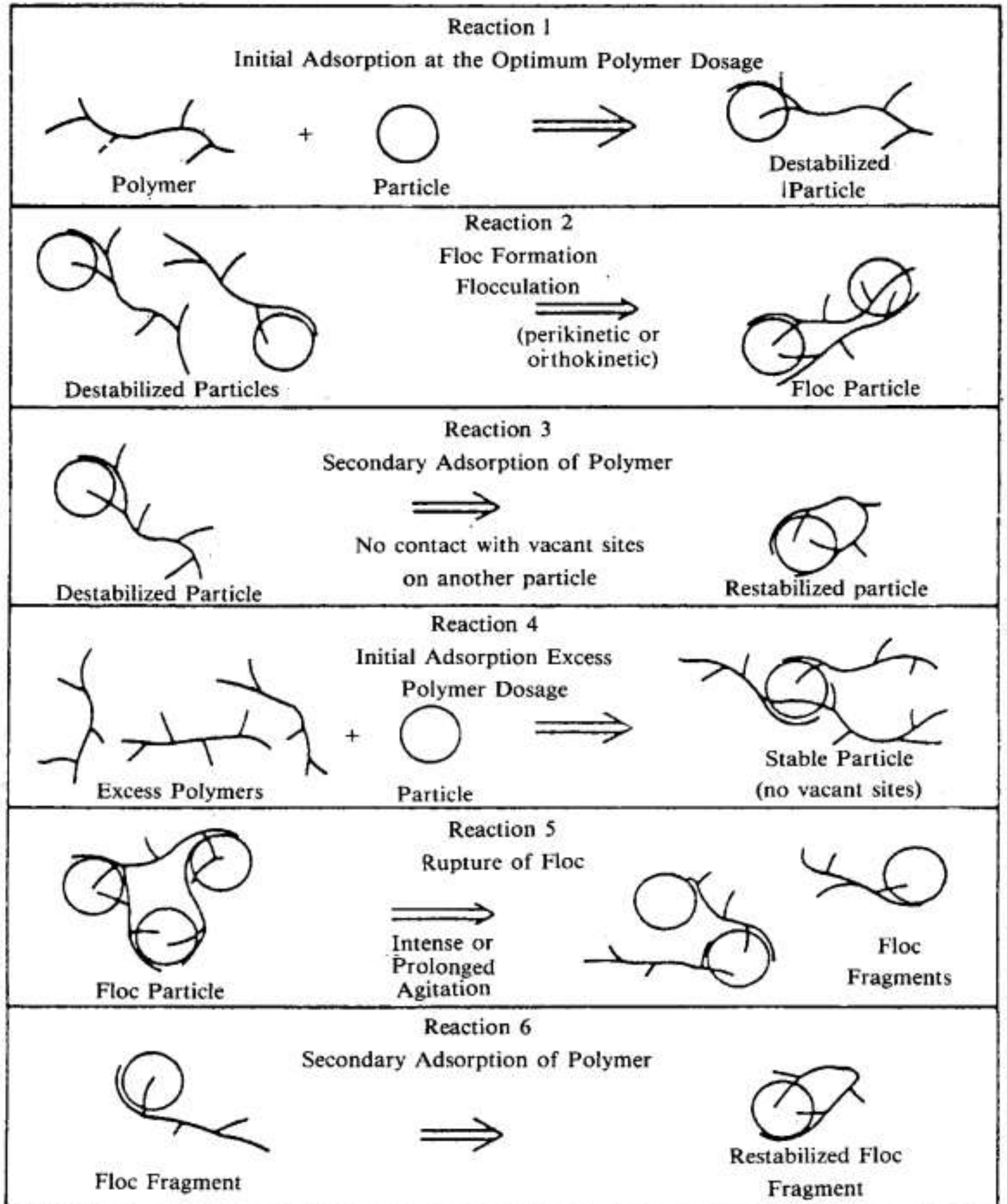


Force fields between colloids of like charge

Coagulant Aid

Coagulant aid, do not aid, but rather In the subsequent flocculation of the destabilized particles. Agents include oxidizers such as chlorine and weighting agents such as clay (ex. Bentonite clay) and activated silica

POLYALUMINIUM CHLORIDE (PACl)



Reaction from Polymer Dosage

The coagulation process

The coagulation process removes the suspended impurities of water and considerably reduce the load on filtration process .

Flocculation process

-Flocculation are slow stirring mechanisms or hydraulic, which from floc.
- fully disperse in the whole water.
- mixing by mixing devices.
- rapid mixing or flat mixing
- slow mixing.

Sedimentation

Sedimentation tanks

-Rectangular or square tank.

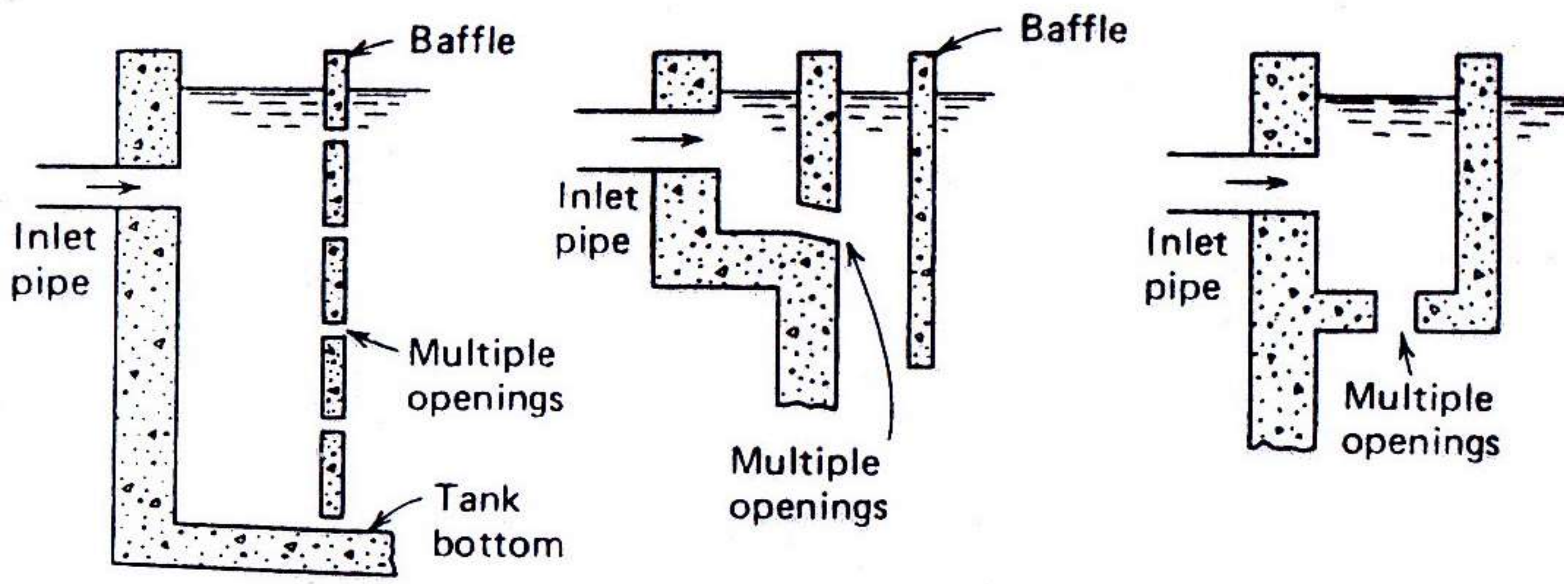
-Circular tank.

- Hopper bottom tank.

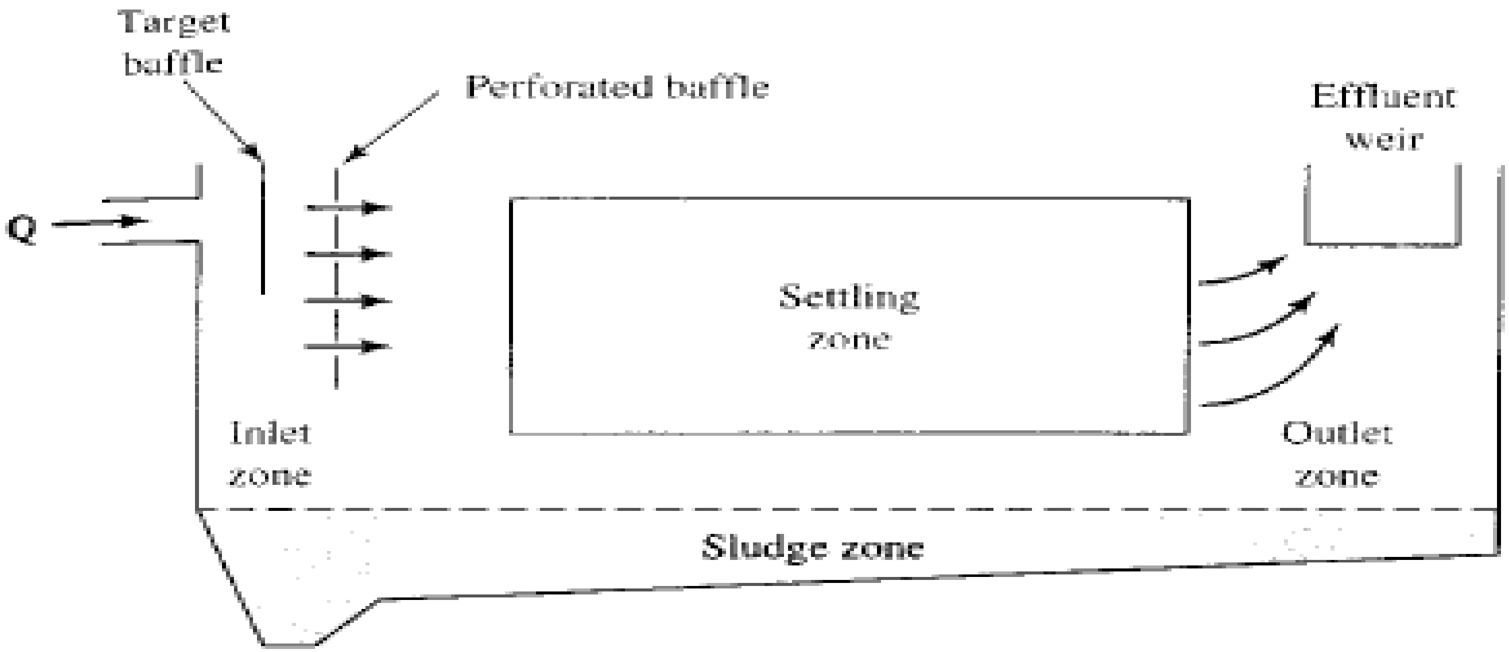
Dividing zone of Sedimentation tanks

I. Inlet Zone
II. Settling Zone
III. Sludge Zone
IV. Outlet Zone

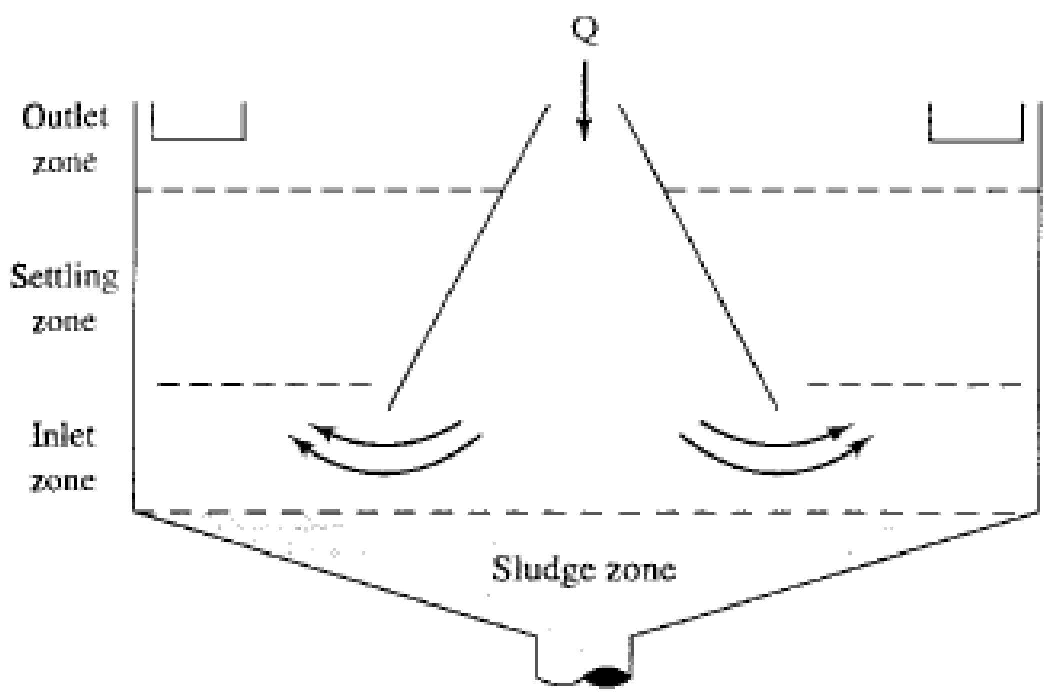
Sedimentation



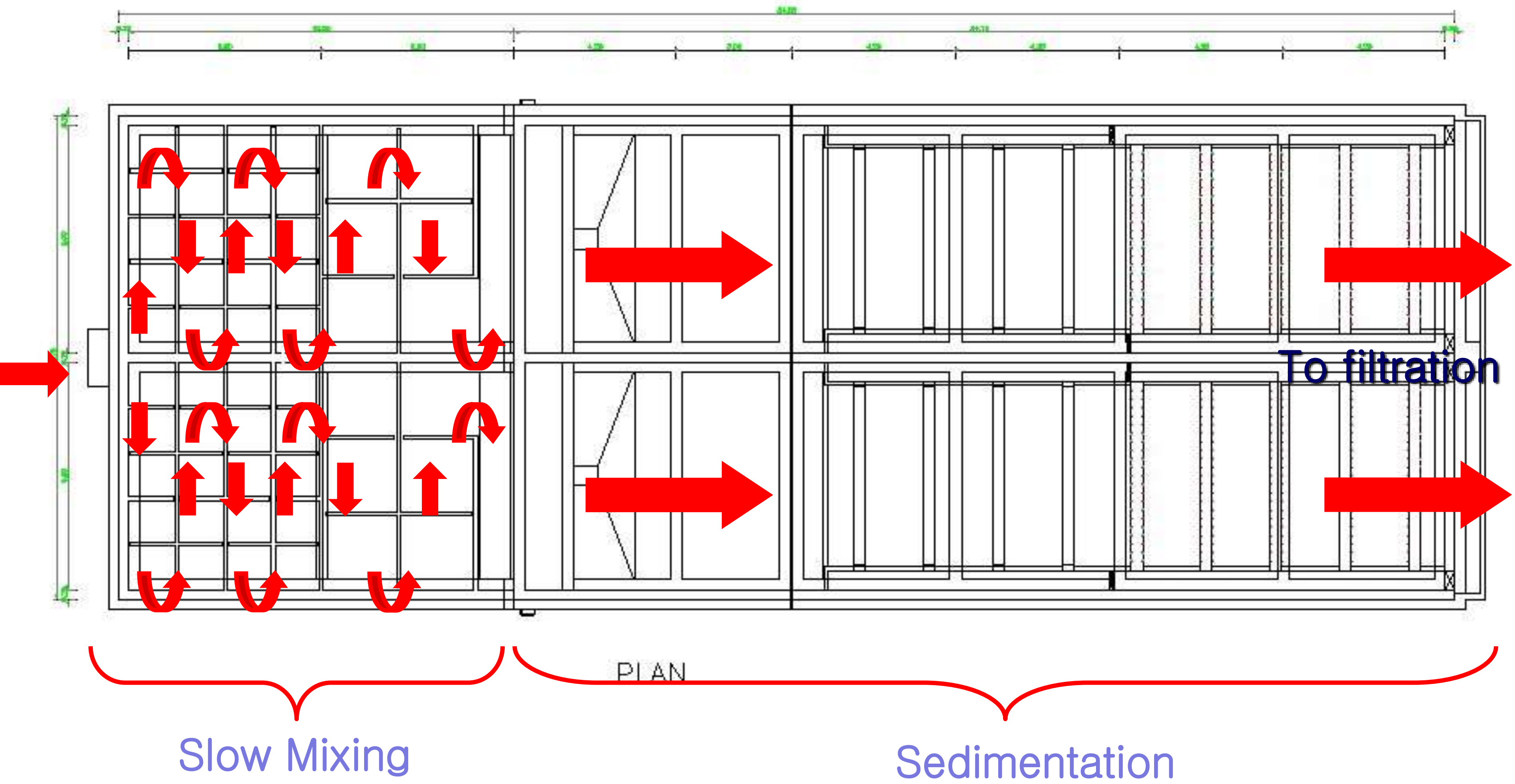
Typical of Inlet Zone



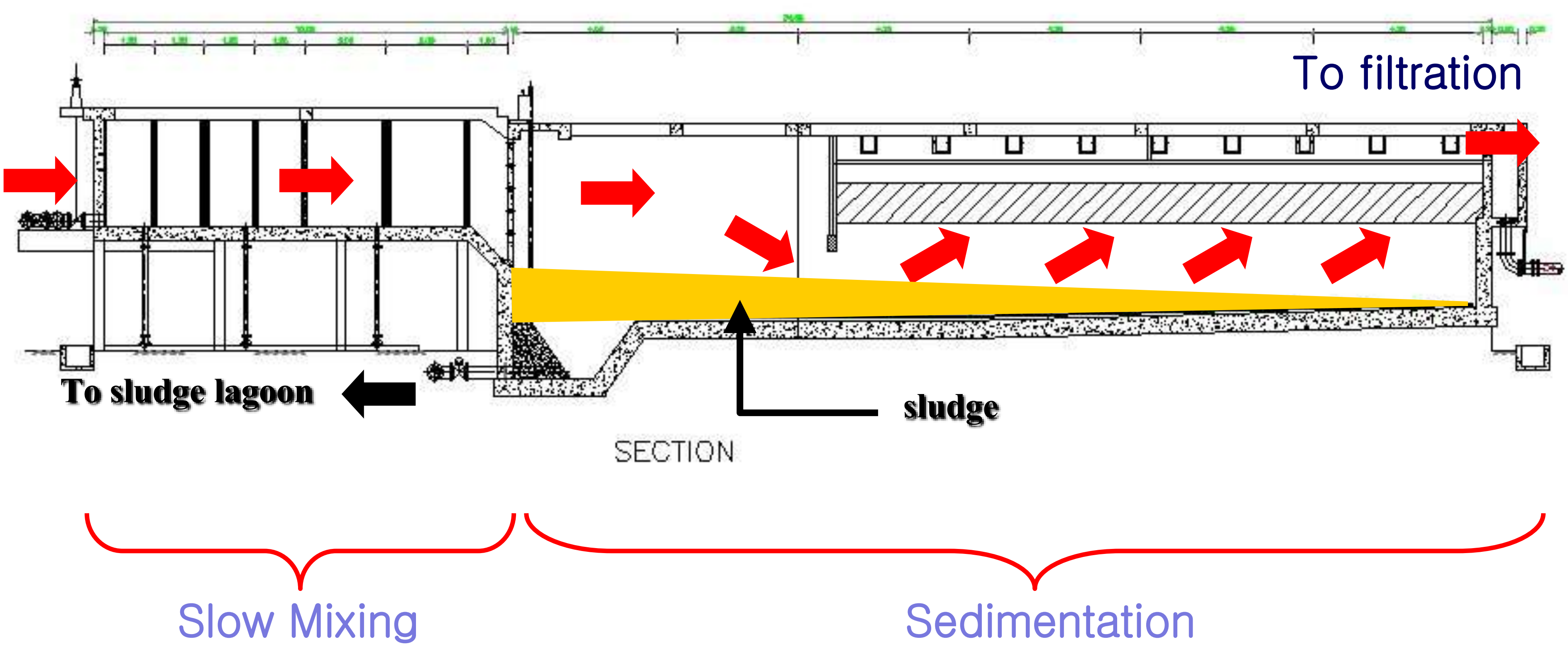
Typical of Sedimentation tanks

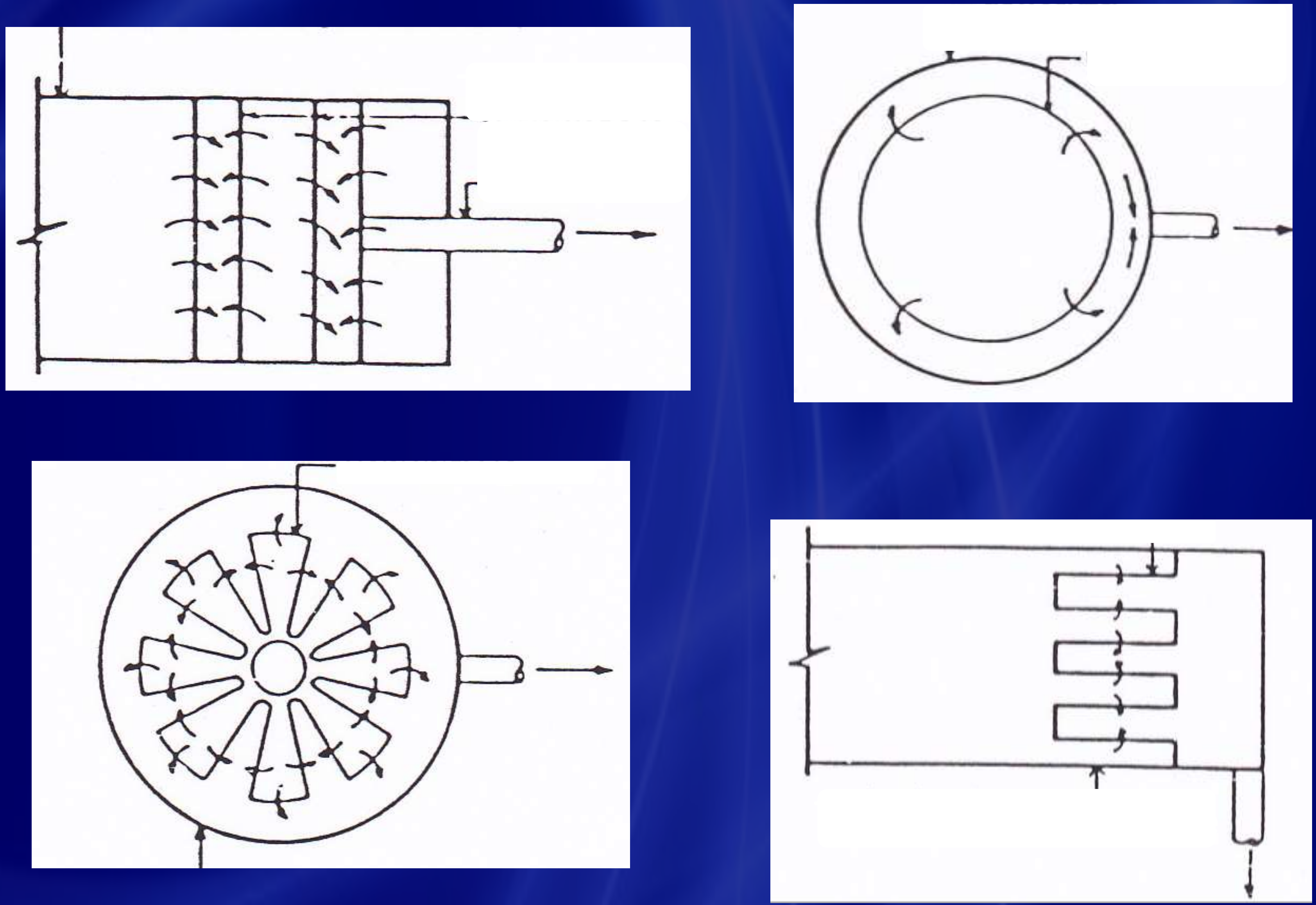


COAGULATION&FLOCULATION

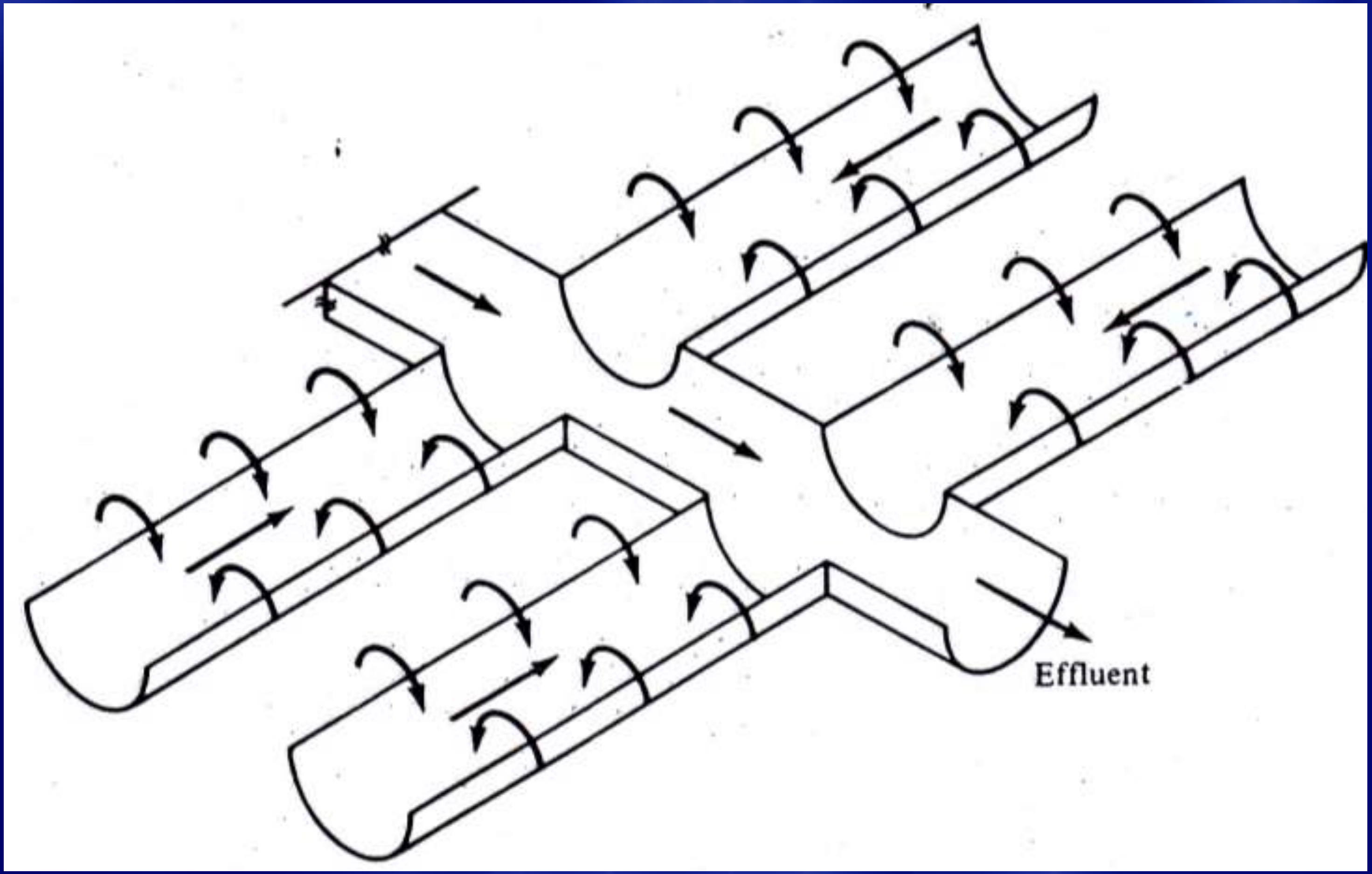


COAGULATION&FLOCULATION





Typical of Outlet Zone

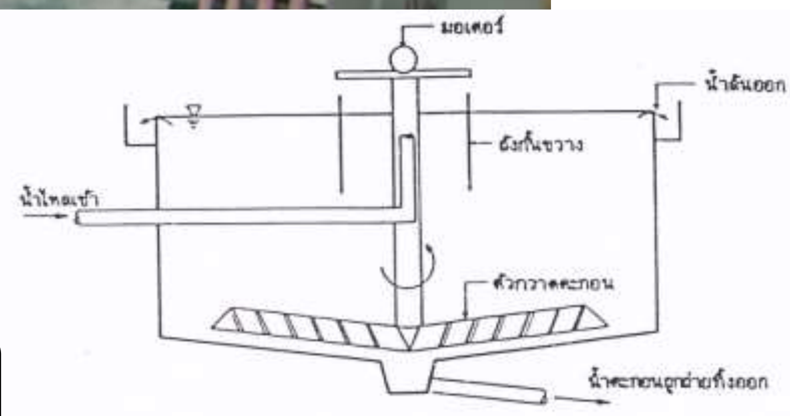


Typical of Outlet Zone
Inboard weir arrangement to in crease weir length)

Rectangular Sedimentation Tank



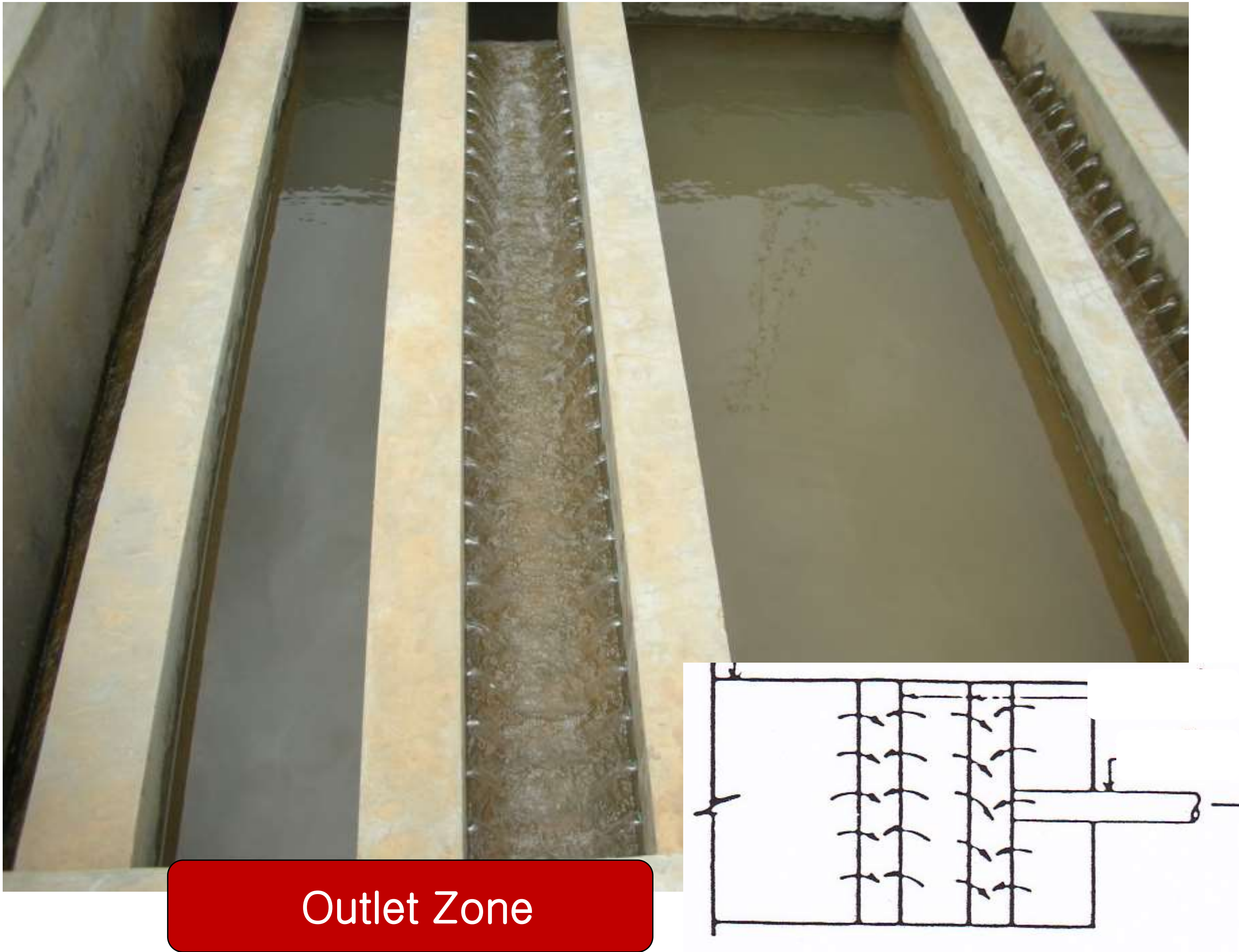

Sedimentation tanks



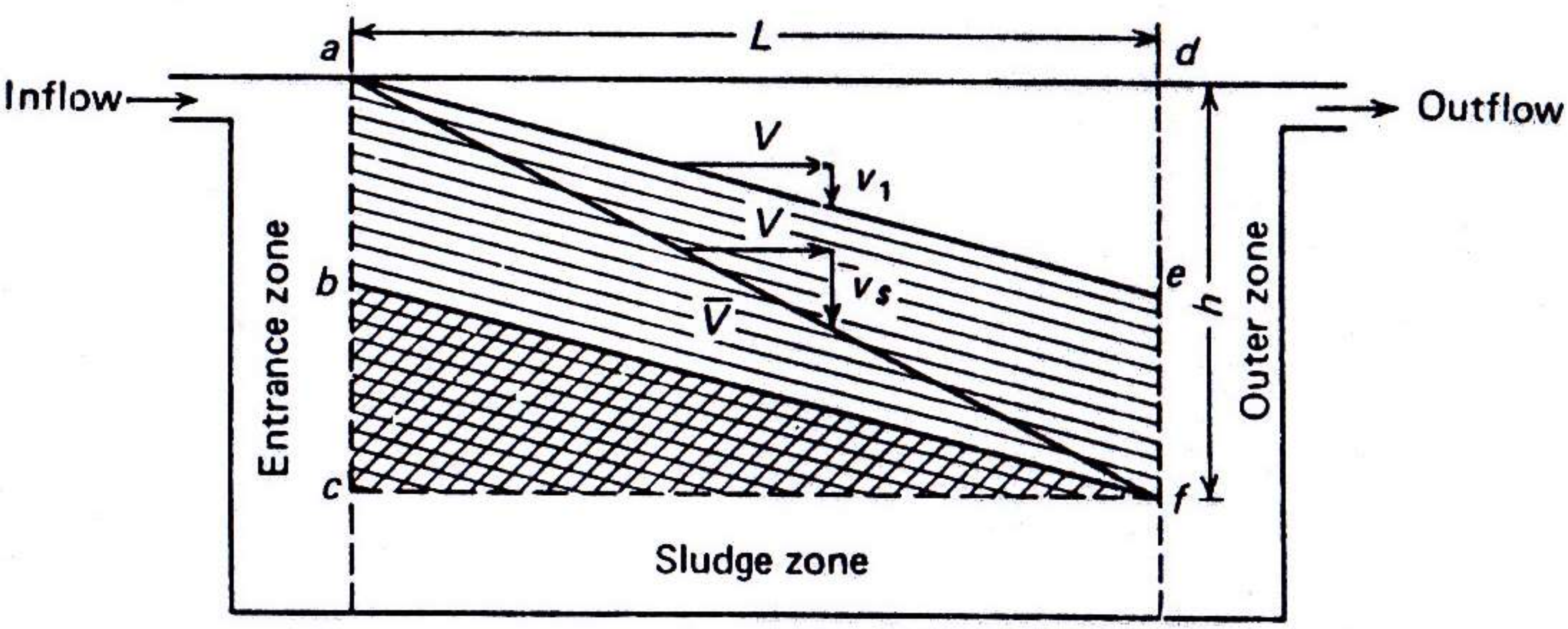
ถังตกตะกอนทรงกลม

Sedimentation tanks

Sedimentation tanks

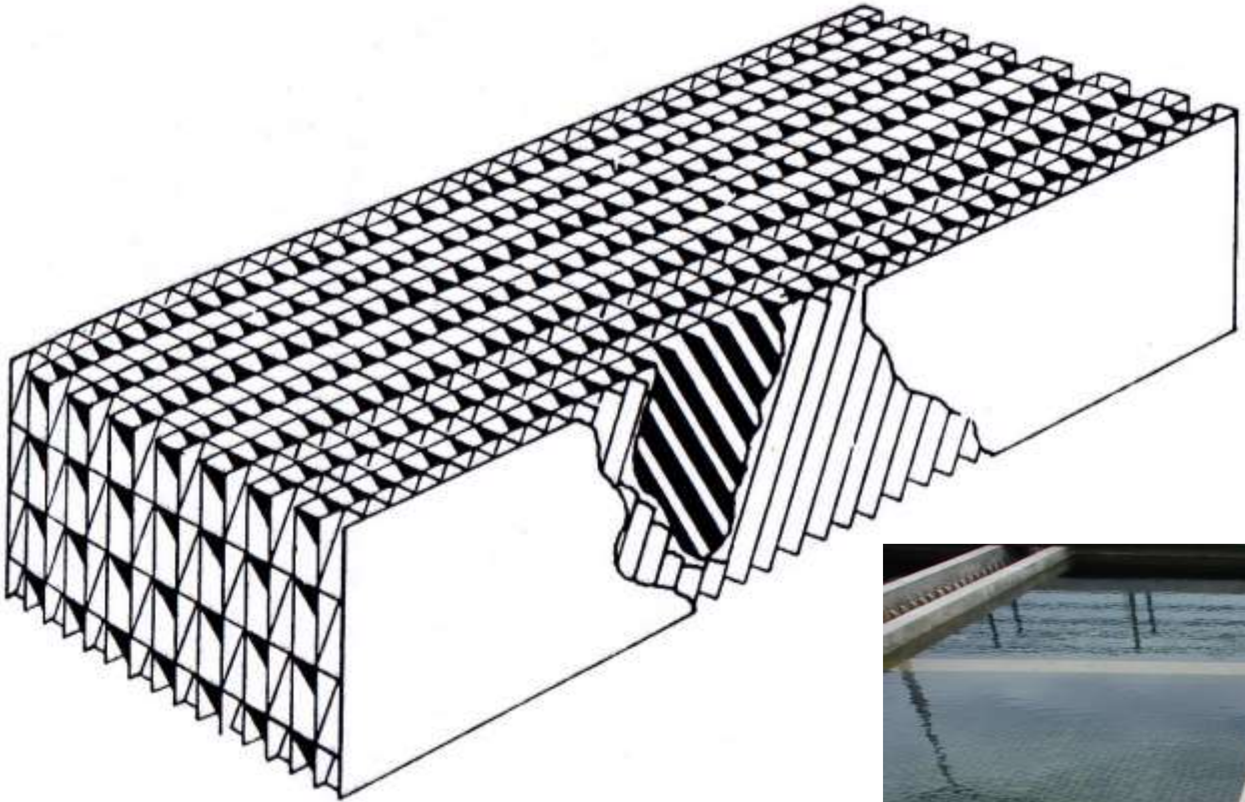


Outlet Zone

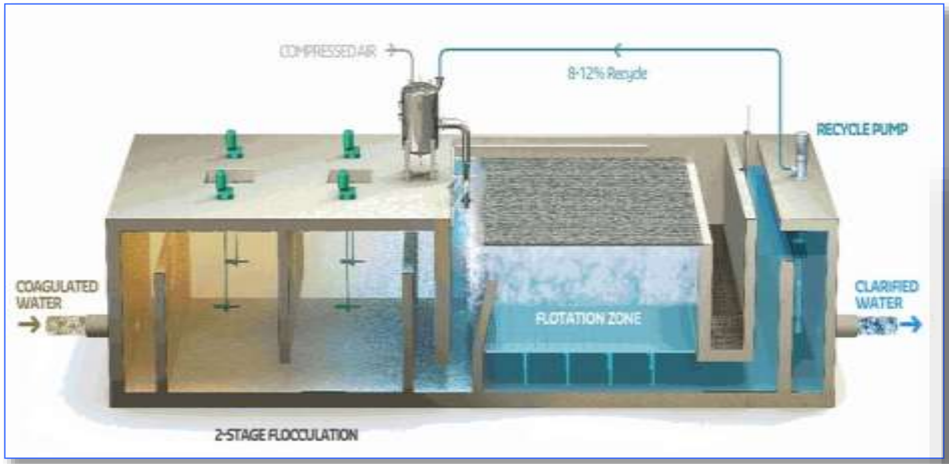


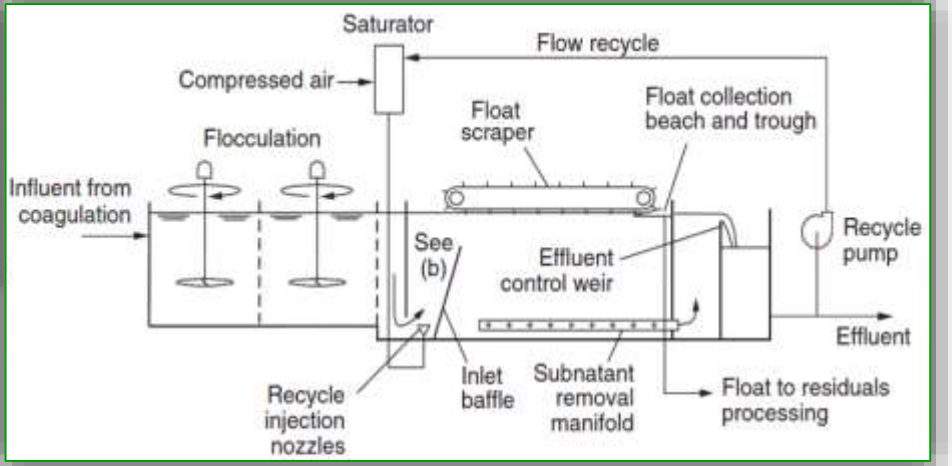
Ideal Setting Basin

Tube Settler



Dissolved Air Floatation (DAF)





- DAF is a water treatment process that clarifies waters by the removal of suspended matter such as oil or solids.
- The removal is achieved by dissolving air in the water under pressure and then releasing the air at atmospheric pressure in a flotation tank or basin.
- The released air forms tiny bubbles which adhere to the suspended matter causing the suspended matter to float to the surface of the water where it may then be removed by a skimming device.

Dissolved Air Floatation (DAF) system

Raw Water

Chlorine

Coagulant

Coagulation (Rapid Mixing)

Flocculation (Slow Mixing)

Dissolved Air Floatation (DAF)

Filtration

Chlorine

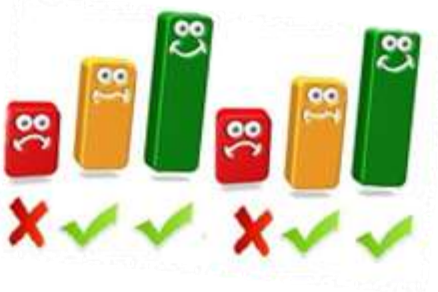
Clear Water Tank

- **The characteristics of the raw water system for DAF system:**
  - ✓ DAF system are supplies with low turbidity which are suitable with algae in water.
  - ✓ The color in water that are made from organic material.
  - ✓ Water containing are iron (Fe) and manganese (Mn).
  - ✓ Water turbidity do not exceeding 100 NTU

Advantages and Disadvantages…!!!

Advantages	Disadvantages
• High loading rate: Typically 10–20 m/h. New process variants have operated successfully up to 40–45 m/h. • Very thick float (sludge) product: Typically 2–3% total solids float can be achieved using hydraulic or mechanical skimming devices. Float can be dewatered without intermediate thickening. • Often, no polymer is required, as DAF does not require a large, dense floc. Coagulant dosages may also be reduced in some circumstances. • Shorter flocculation times, as compared to gravity separation, are possible, because a smaller floc particle size is required. • Rapid startup, typically $<$30–60 min to reach steady state, depending on size. • Excellent algae removal efficiencies. • Excellent *Giardia* and *Cryptosporidium* removal efficiencies (~2–2.5 log), depending on temperature. • Smaller footprint required as compared to conventional flocculation and gravity sedimentation	• Requires a cover or housing to protect the float layer from wind and precipitation. • Mechanically more complex than conventional gravity clarifiers. • More power intensive as compared to conventional flocculation and sedimentation (2.5–3 to 0.75–1 kWh/10^3 $m^3 \cdot d$). • Generally not well suited for clarification of high-turbidity silt-laden waters. • Because DAF is more mechanically intensive, may not be suitable for locations where equipment maintenance is likely to be neglected.

Conventional and DAF



	Conventional	Dissolved Air Floatation
Detention time (min)	10 - 20	10 – 15
Mixing intensity (G) sec-1	50 - 100	
Contact zone loading rate (m/h)	100 - 200	120 – 300
Contact zone detention time (min)	1 – 2.5	1.0 – 2.0
Hydraulic loading	5 - 15	10 - 30
Separation zone loading rate (m/h)	6 - 18	20 - 40
Basin depth (m)	2.0 – 3.5	2.5 – 4.5
Recycle rate (%)	6 – 12	
Saturator gauge pressure (kPa)	400 – 600	
Saturator efficiency (%)	80 – 95 packed	

Filtration Theory

I. Mechanical straining : Unsettled floc from coagulation tank and settle particles form a mat on the top of sand bed which further arrests very fine particles and remove them from the water.

II. Sedimentation : Very small particles of suspended matter, colloidal particles and some bacteria settle in these.

III. Biological Action : Organic impurities form a layer on the top of sand bed which is know as "Schnutzdecke"or "dry skin".

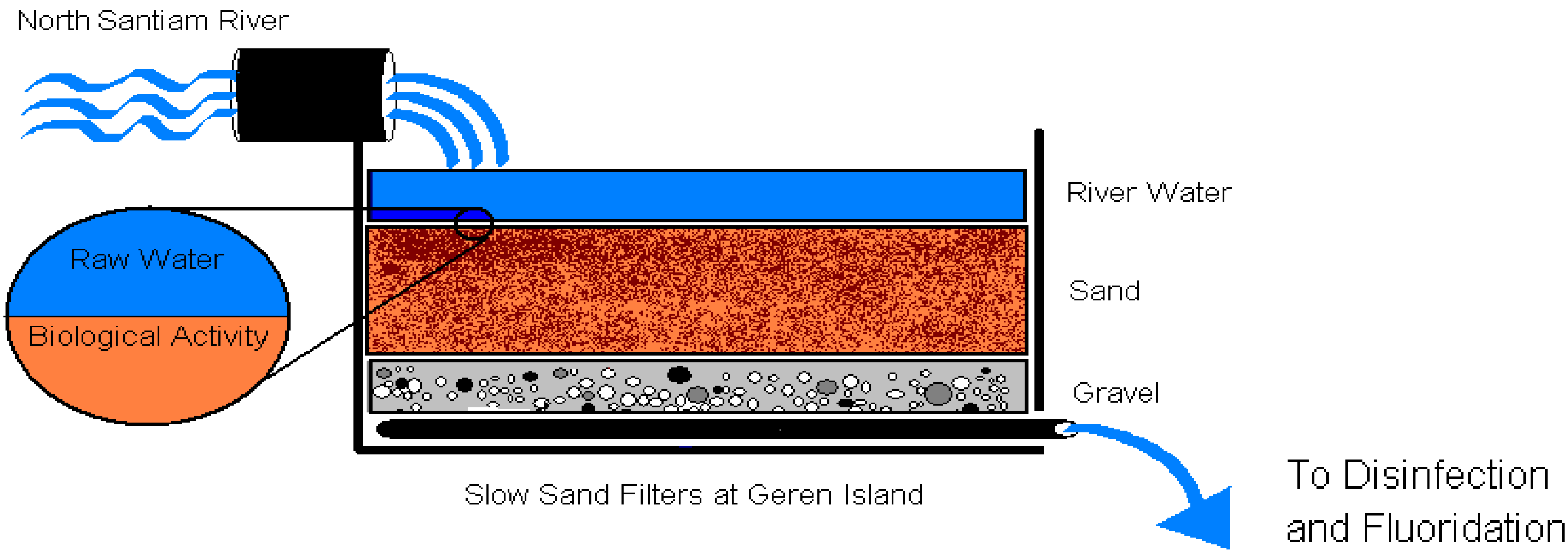
IV. Electrolytic Action : The sand particles ionized matter in the water carry electrical charges of opposite nature.

Classification of Filter

I. Gravity Filter

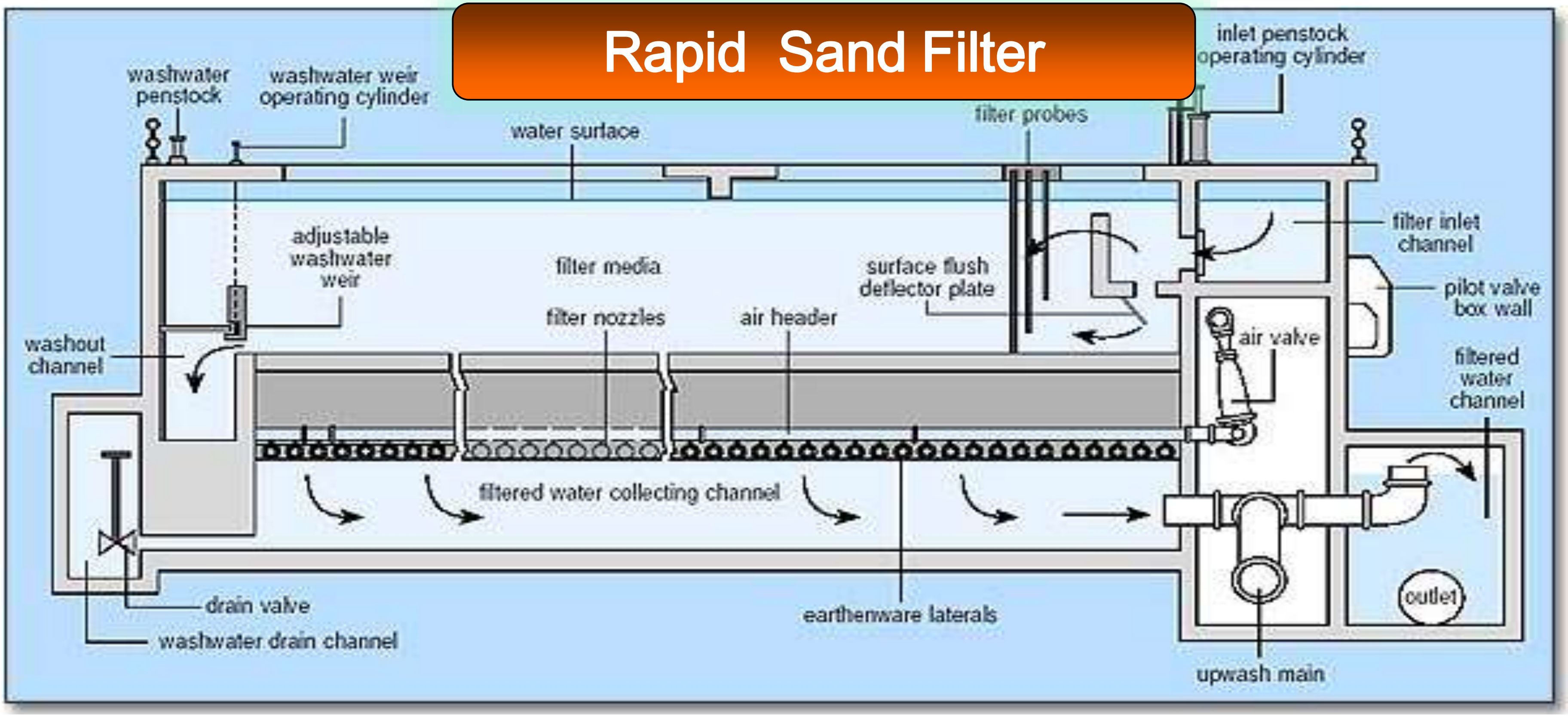
- Slow Sand Filter
- Rapid Sand Filter

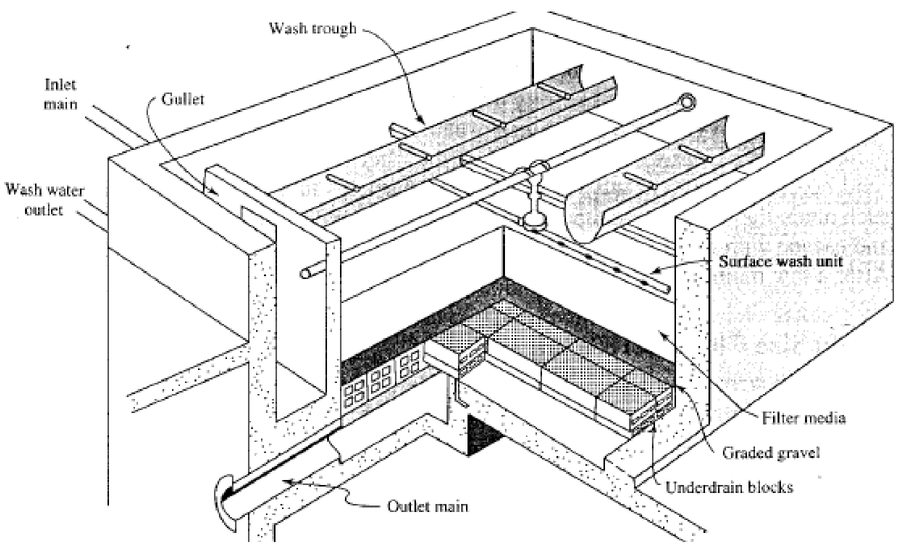
II. Pressure Filter

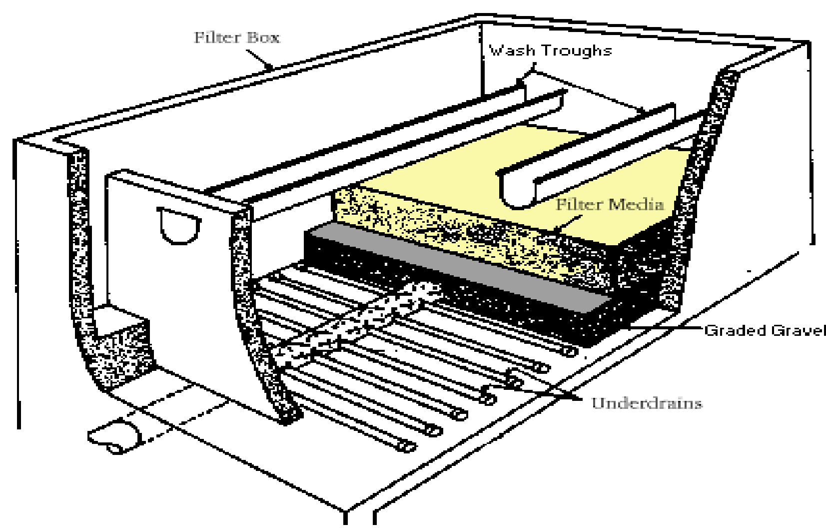


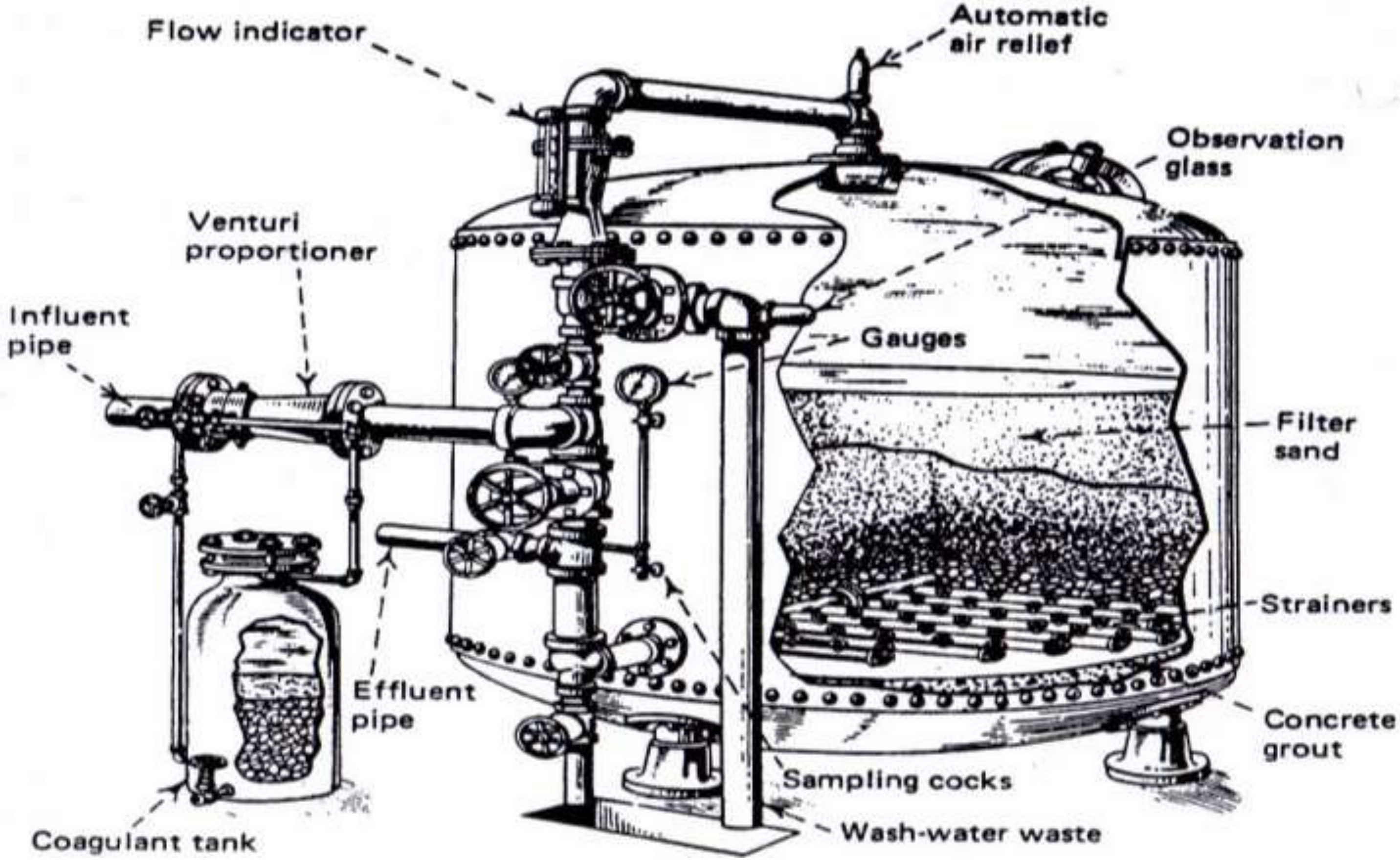
Slow Sand Filter

Rapid Sand Filter





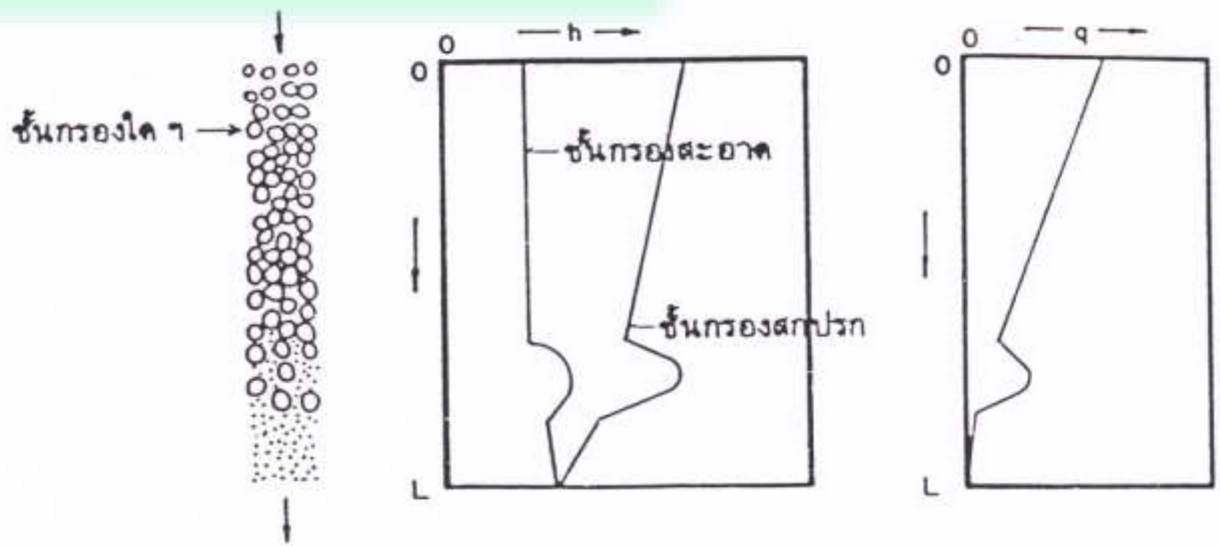




Pressure Filter

Rapid Sand Filter

head loss




08/07/2010 16:46

Filter media

Filter Media :

I. Sand
II. Coal or Anthracite
III. Activated Carbon ; GAC
IV. Garnet sand and ilmenite

Effective size and *uniformity coefficient*

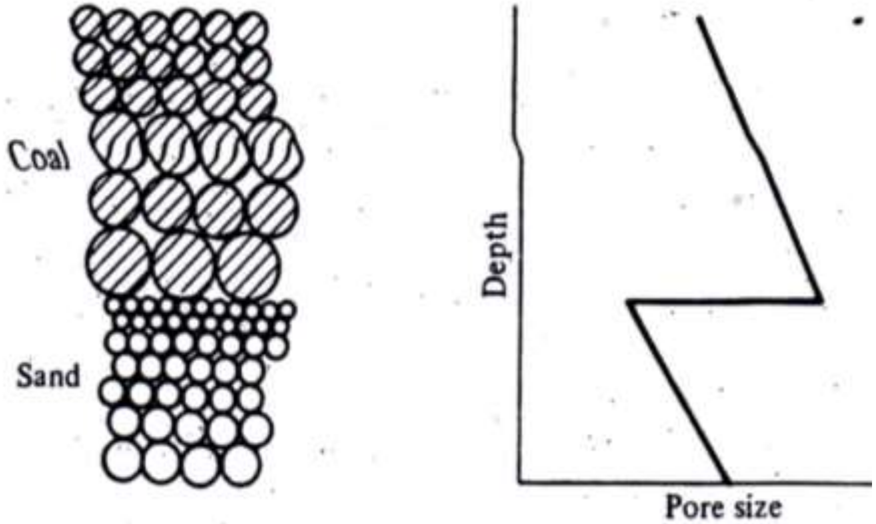
The size and uniformity of filter media are specified by *effective size* and the *uniformity coefficient*.

Coarse material require higher backwash velocity for fluidization but are less likely to form large agglomerates called *mudball* during backwash.

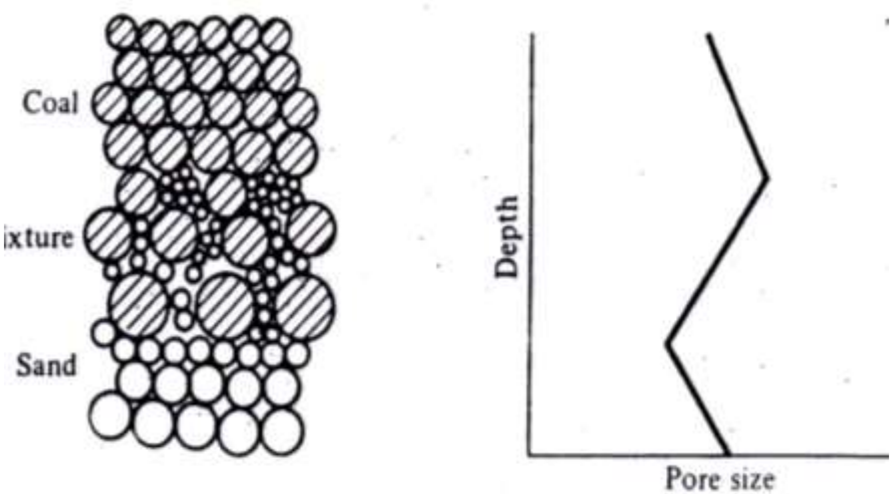
Effective size and *uniformity coefficient*

The size and uniformity of filter media are specified by *effective size* and the *uniformity coefficient*.

Coarse material require higher backwash velocity for fluidization but are less likely to form large agglomerates called *mudball* during backwash.



Sharp gradtion



partial mixing

Mudball

Size gradiation in dualmedia

Depth of media bed

I. Single media : 0.50 to 0.75 meter .

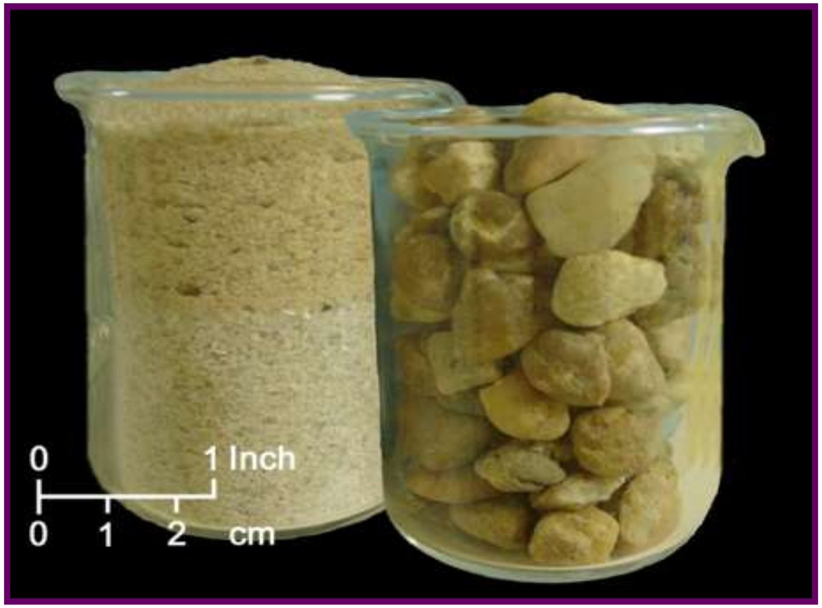
II. Dual media : Sand bed 0.30, anthracite 0.45 meter.

$$\frac{d_1}{d_2} = \left[\frac{\rho_2 - \rho_w}{\rho_1 - \rho_w}\right]^{2/3}$$

d = size of particle , ρ = specific gravity

Gravel for Filter

Gravel supports the sand and allows the filtered water to move freely towards the underdrainage. The gravel is Placed In 5-6 layer having finest size on the top.


0
1 Inch
0
1
2
cm


www.phuketwaterfilter.com


www.phuketwaterfilter.com

Sand&Gravel

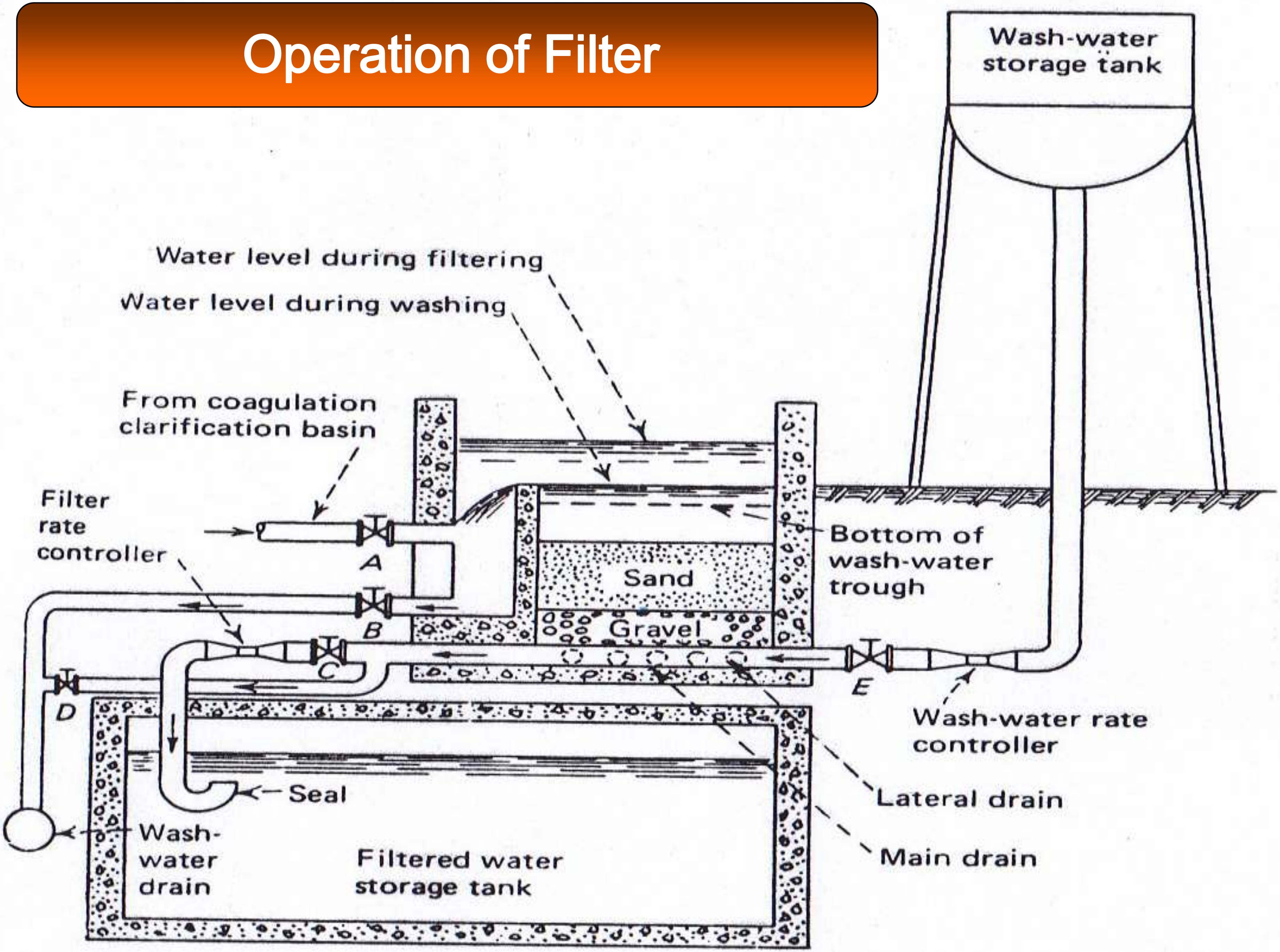
Anthracite

Activated Carbon

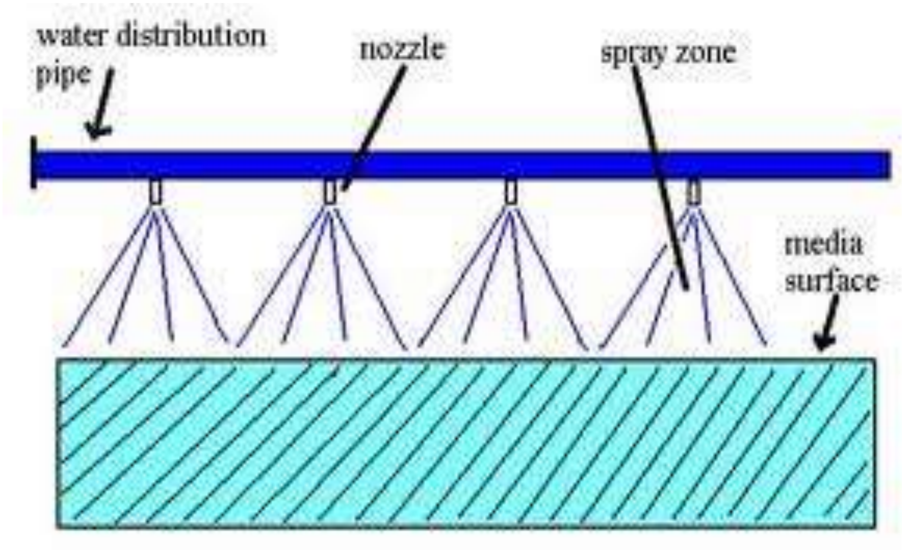
Grading of Gravel

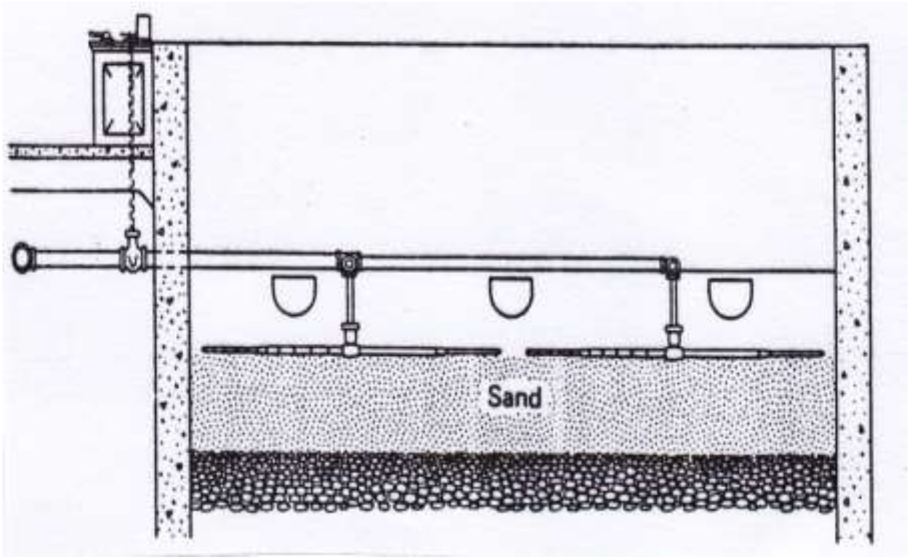
Thickness of layer in cm	Size of gravel in mm
5 - 8	4.7-2.4
5-8	12.7-4.7
7-13	19.0-12.7
7-13	38.0-19.0
13-20	63.0-38.0

Operation of Filter



Surface wash





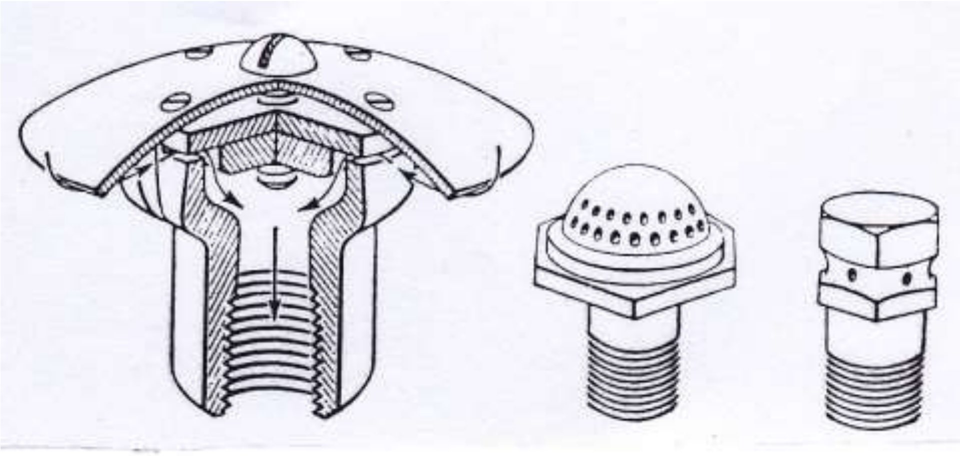
- water at the rate of 270 litres/sq.m/min.
- pressure of 0.7 to 1.1 ksc.
- Through nozzles.
- Nozzles are kept vertical on the surface of sand bed.

Rotating- arm surface wash

Surface wash pipe

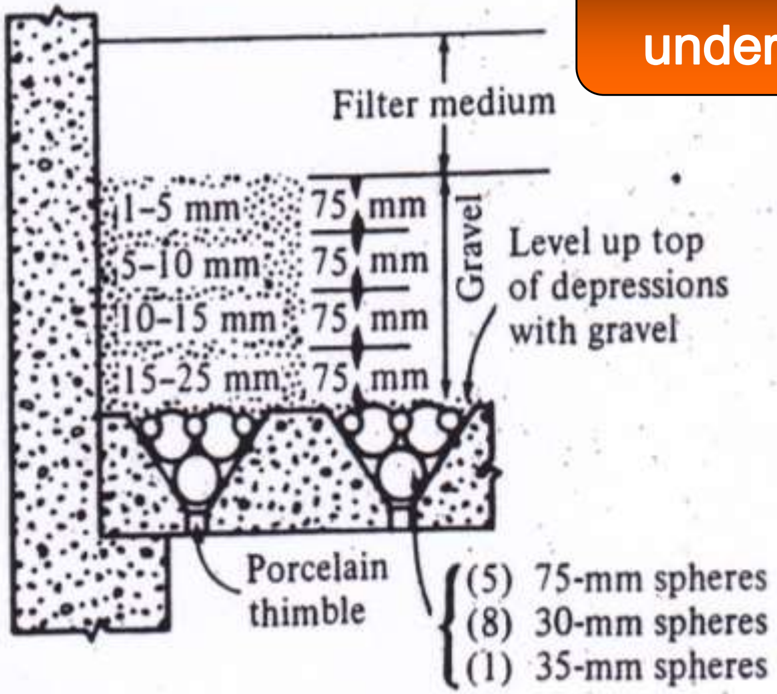
The Underdrainage System

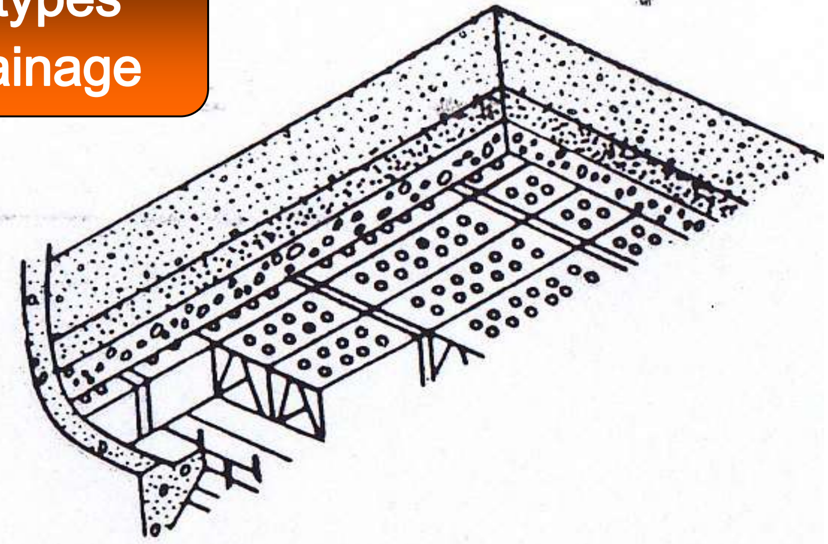
In the bottom of the filter underdainage system is laid to collect the filter water and to distribute wash water uniformly on the filter bed of sand. There are various types under-drainage system for exam. ***the manifold and pipe laterals , vitrified tile blocks, the wheeler filter bottom and the porous plate bottom***.



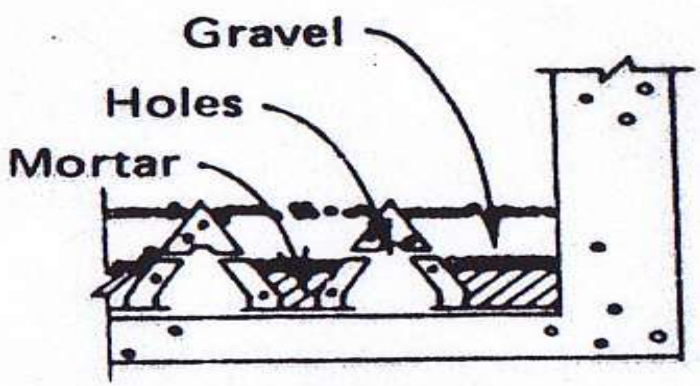
Types of strainers used in underdrainage system

Various types under-drainage

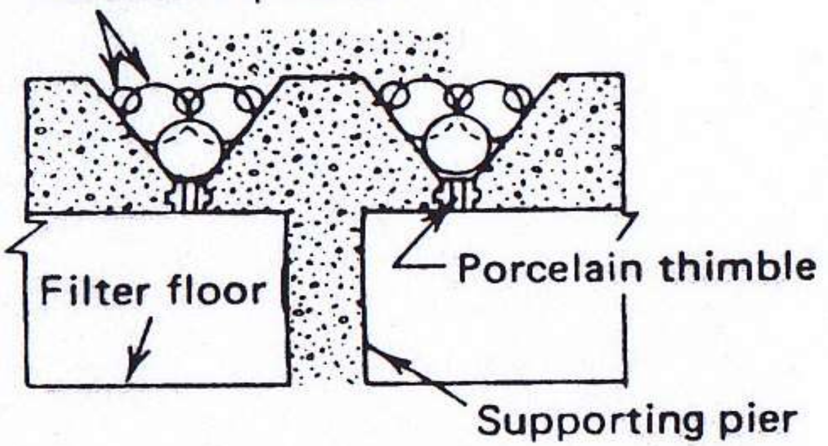




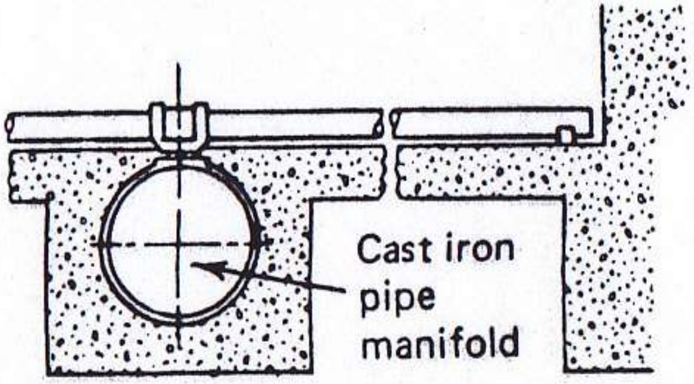
Fiber-glass underdrain



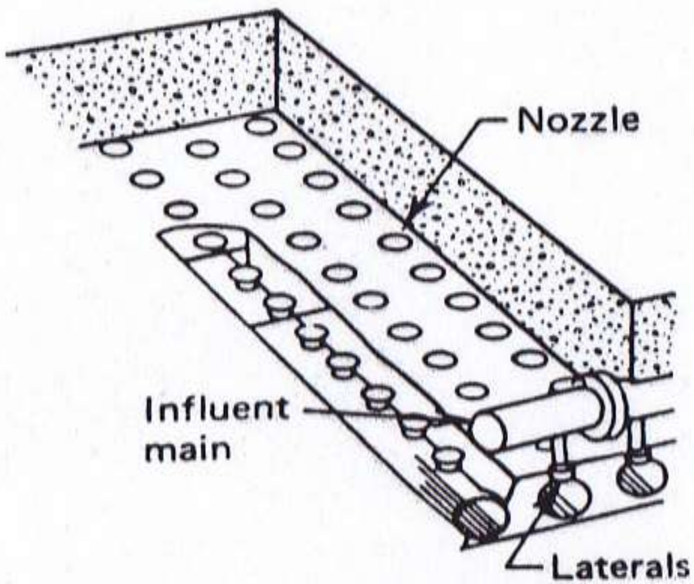
Teepee underdrain



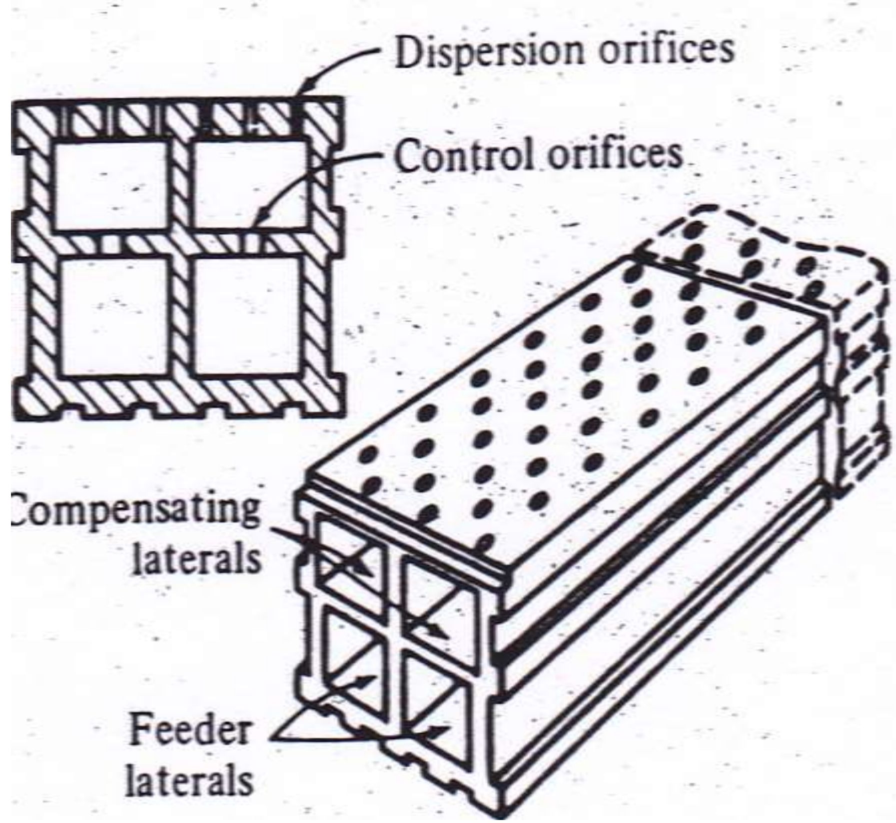
Wheeler underdrain



Pipe underdrain

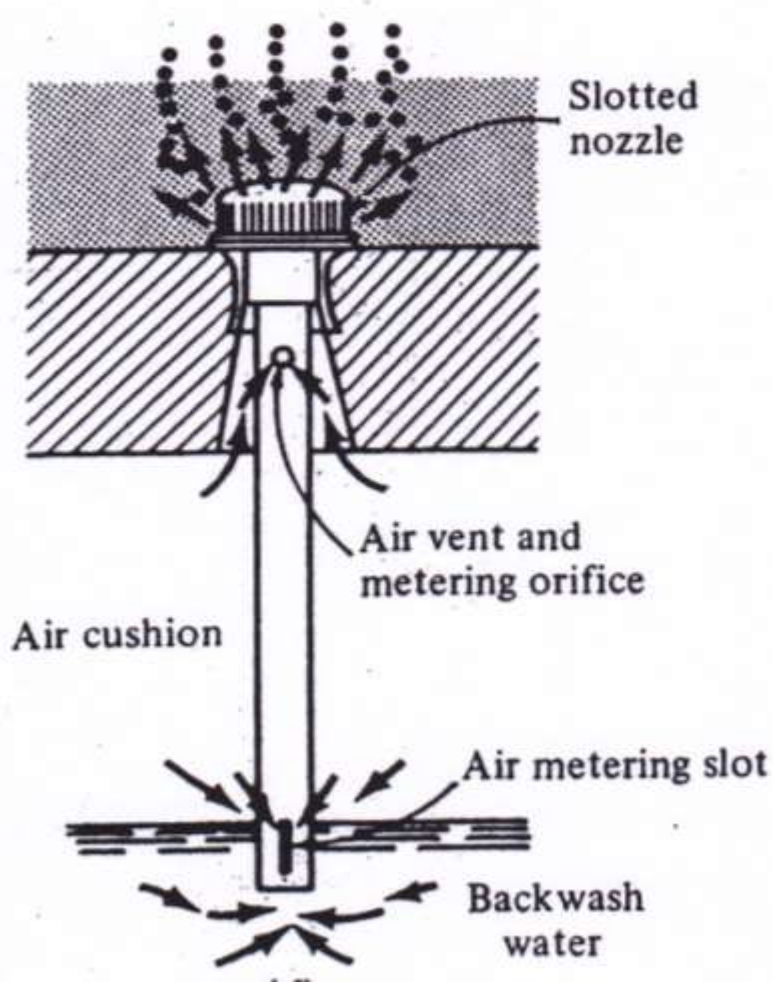


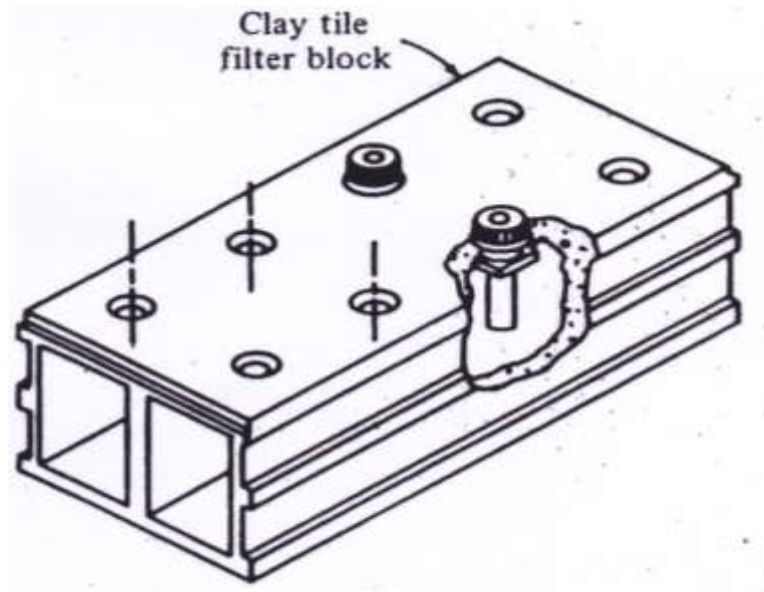
Air/water pipe underdrain

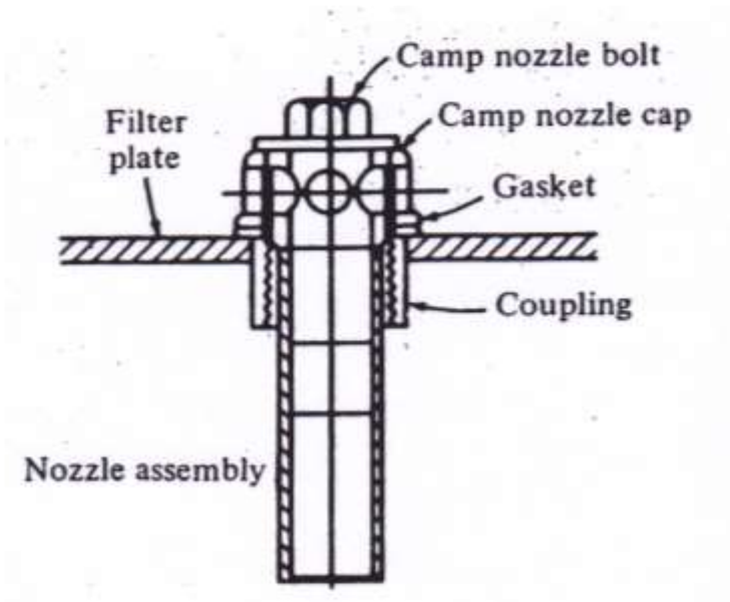


Tile underdrain

Various types
under-drainage







Various types
under-drainage

Advantage of pressure filter

I. Compact unit automatic.
II. For small water works.
III. Flexible.
IV. Small number of fitting.

Disadvantage of pressure filter

I. Overall capacity of the filter is small.
II. Cannot be used for treating large quantity of water.
III. Quality control and inspection is not possible.
IV. The filter media, gravel and repair of under drainage system is difficult.
V. Efficiency is poor.
VI. Require high cost of power.

Disinfection

The chemicals or substances which are use for killing the bacteria are known as *disinfectants*. And the process of killing the bacteria is known as *disinfection of water*. *Chlorine* has been found as the most ideal disinfectant, and is widely used mostly at all the water works.

Requirements of Good Disinfection

I. Destroy all the harmful pathogenic organism.
II. Not take more time.
III. Economical and easily available.
IV. Non toxic .
V. Leave some residual concentration and do not require high skill.

Method of Disinfection

I. Boiling the water.
II. Ultra-violet rays.
III. The use of iodine and Bromine .
IV. The use of ozone(O_3).
V. The use of excess lime.
VI. Using potassium permanganate($KMnO_4$).
VII. Treatment with silver or electro-katadyn process.
VIII. Chlorine(Cl_2) or Chlorinedioxide (ClO_2).

Form of chlorine

I. Liquid chlorine
II. Gaseous chlorine
III. Chlorine dioxide
IV. Chloramines i.e. the mixer of chlorine and ammonia.
V. Bleaching powder

Addition of Chlorine to Water

When chlorine is added in water;

I. Water containing ammonia and organic nitrogen compound, monochloramine(NH_2Cl) dichloramine($NHCl_2$) and tri-chloramine(NCl_3) are released, but their distribution depends on the pH-value of water.
II. Water is free from organic impurities, hypochlorous acid (HOCl), hypochlorite ion (OCl^-) are released and their distribution depends on the pH-value of water.
III. Water contains ,sewage and waste water, when chlorine is added complex organic chloromines are released.

Factors Affecting Bacterial Efficiency of Chlorine

I. Time of contact .
II. The concentration of disinfectant.
III. The number of organism.
IV. Temperature of water .
V. pH value of water.
   - in the form of *hypochlorite*..
VI. The presence of various chemical.

Free Chlorine

When chlorine is dissolved in water, it hydrolysis immediately as;

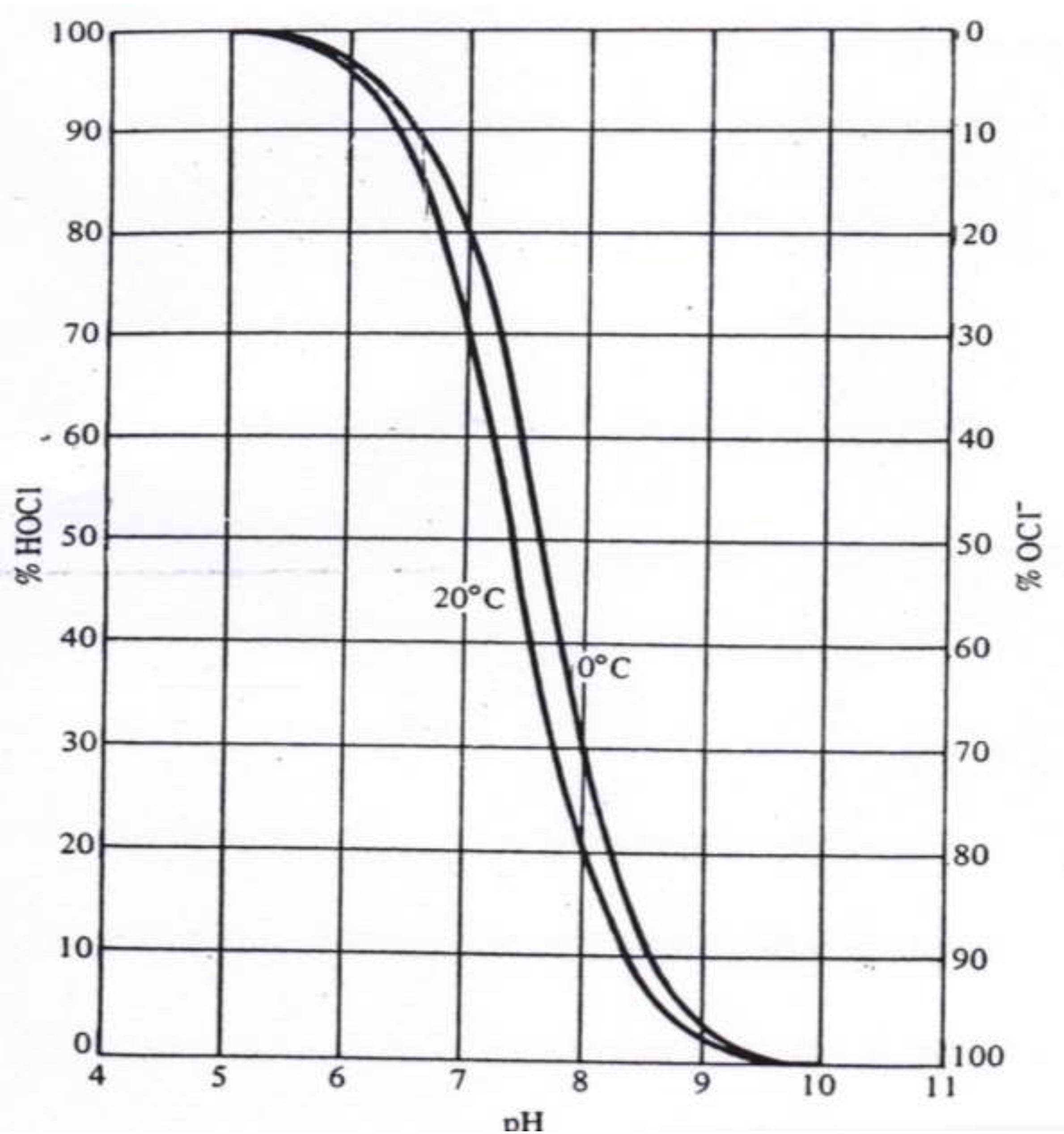
$$C_3l + H_2O \rightleftharpoons HOCl + H^+ + C^+$$

$$HOCl \rightleftharpoons H^+ + OCl^+$$

HOCl and Ocl⁻ are called free available chlorine.

chlorine compounds

Various chlorine compounds which are used as disinfectants are ***hypochlorites*** of calcium ($Ca(OCl)_2$)and sodium (NaOCl), the chloromines, chlorine dioxide and complex chlorine compound. Such as $(CH_2\ CO_2)_2NCl$ etc.



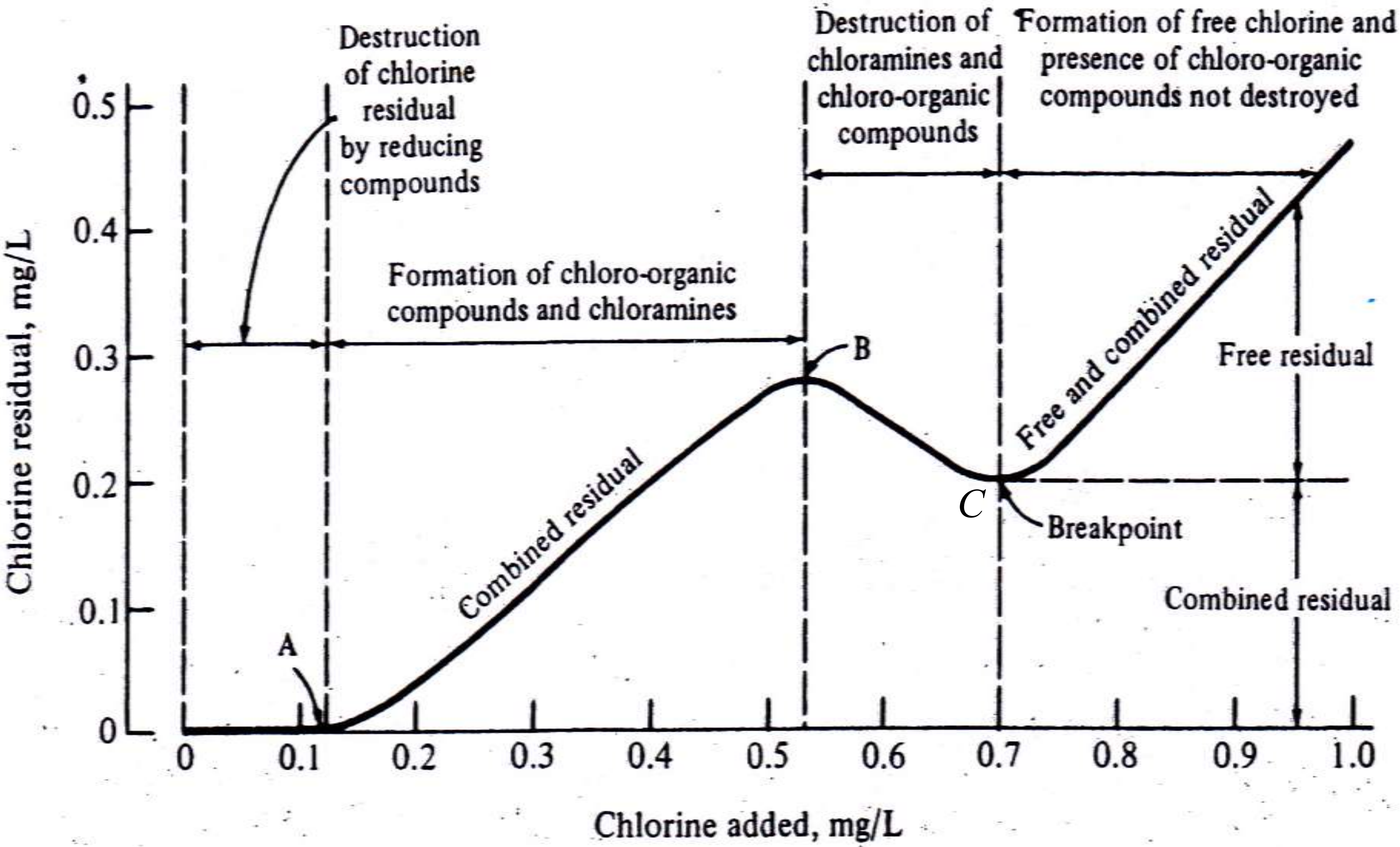
Free Chlorine

Distribution of HOCl and OCl^- as a function of pH

Chlorine Demand

I. Nature and concentration of chlorine consuming substance.
II. Time of contract.
III. pH-value of water.
IV. Temperature of water.
V. Variable conditions in the process of chlorination.
VI. Other factors.

Break Point Chlorination



Break Point Chlorination

On studying the curve residual chlorine in the beginning increases with the apply chlorine dose, but after point *B* it suddenly drops up to point *C* and then increases. It shows formation of chloramines and their oxidation. Point *C* at which residual chlorine again starts increasing is know as *"Break Point Chlorination"*.

Advantages of Break Point Chlorination

I. It completely oxidizes the ammonia and other impurities in water.
II. The colour of water which is due to organic matters is also removed.
III. It completely destroys all the disease bacteria.
IV. It remove taste and odour from the water.
V. It prevent growth of weed in water.

Super- Chlorination

Super- Chlorination is define as the administration of a dose considerably in excess of necessary for adequate bacterial purification of water. Under certain circumstances such as during epidemics. Of water –born diseases, high dose of chlorine is given to the water, generally 2 to 3 ppm. beyond the break point for safety of public. The addition of chlorine in excess is call *Super- Chlorination* .

De-chlorination

The method are:

I. Sulphur dioxide (SO_2)
II. Sodium Bi-Sulphate ($NaSH_3$)2NCl
III. Sodium Thisulphate ($CH_2S_2O_3$)
IV. Activate Carbon
V. Areation
VI. Ammonia.

Plain Chlorination

In some places where good surface water I available, it is used with no other treatment except chlorination. Only chlorination is done and the water is safeguarded against disease. Such type of chlorination is know as *plain chlorination*. The water of lakes and springs is pure and can be used after plain chlorination.

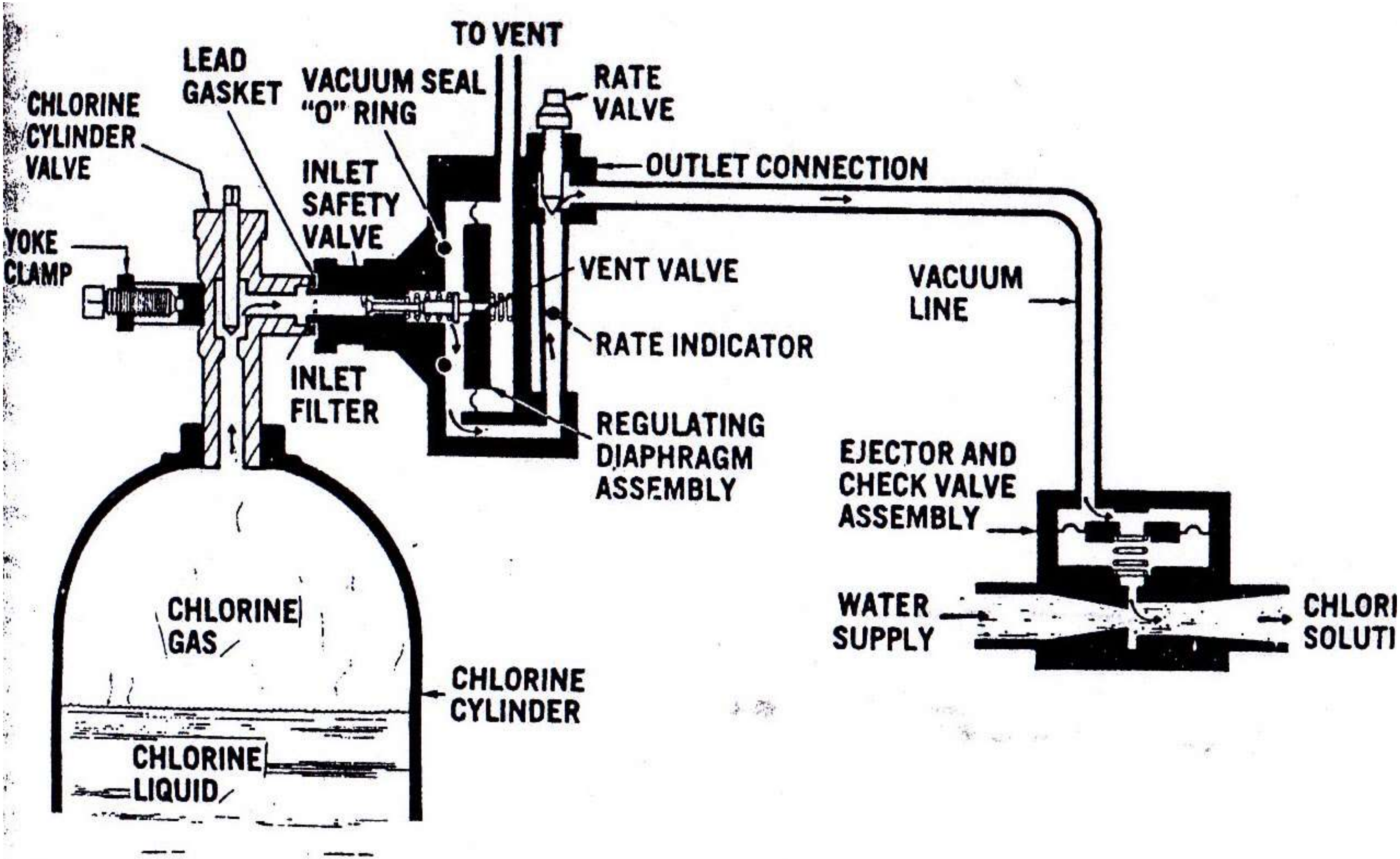
Post- Chlorination

When the chlorine is added in the water after all treatment, it is know as *Post-chlorination* Generally this is done after filtration process. The chlorine may be add in the suction pipe, but it more suitable to add in the clear water well. The minimum contact period should be 30 minutes, before use of water.

Chlorine Residuals Testing Equipment

Chlorine Gas and safety Cylinder


DANGER



Gas Chlorinator

Liquid Chlorine

Management of sludge

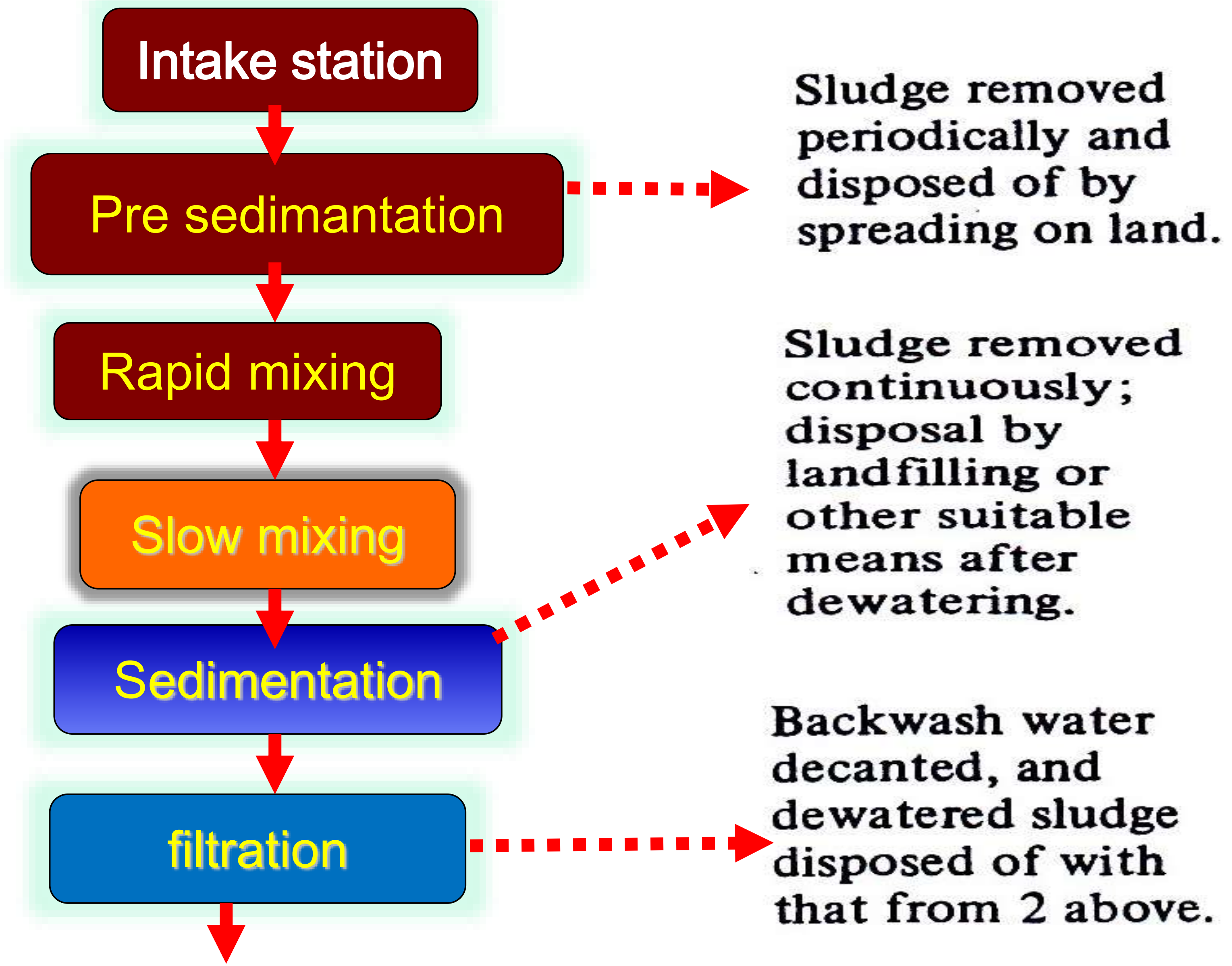
Sludge comes from three sources:

(i) The pre-sedimentation tank which is expected to be desludged once per year post wet season.

(ii) The sedimentation tank is expected to be desludged 3-4 times per year.

(iii) Backwash water from filter backwashing.

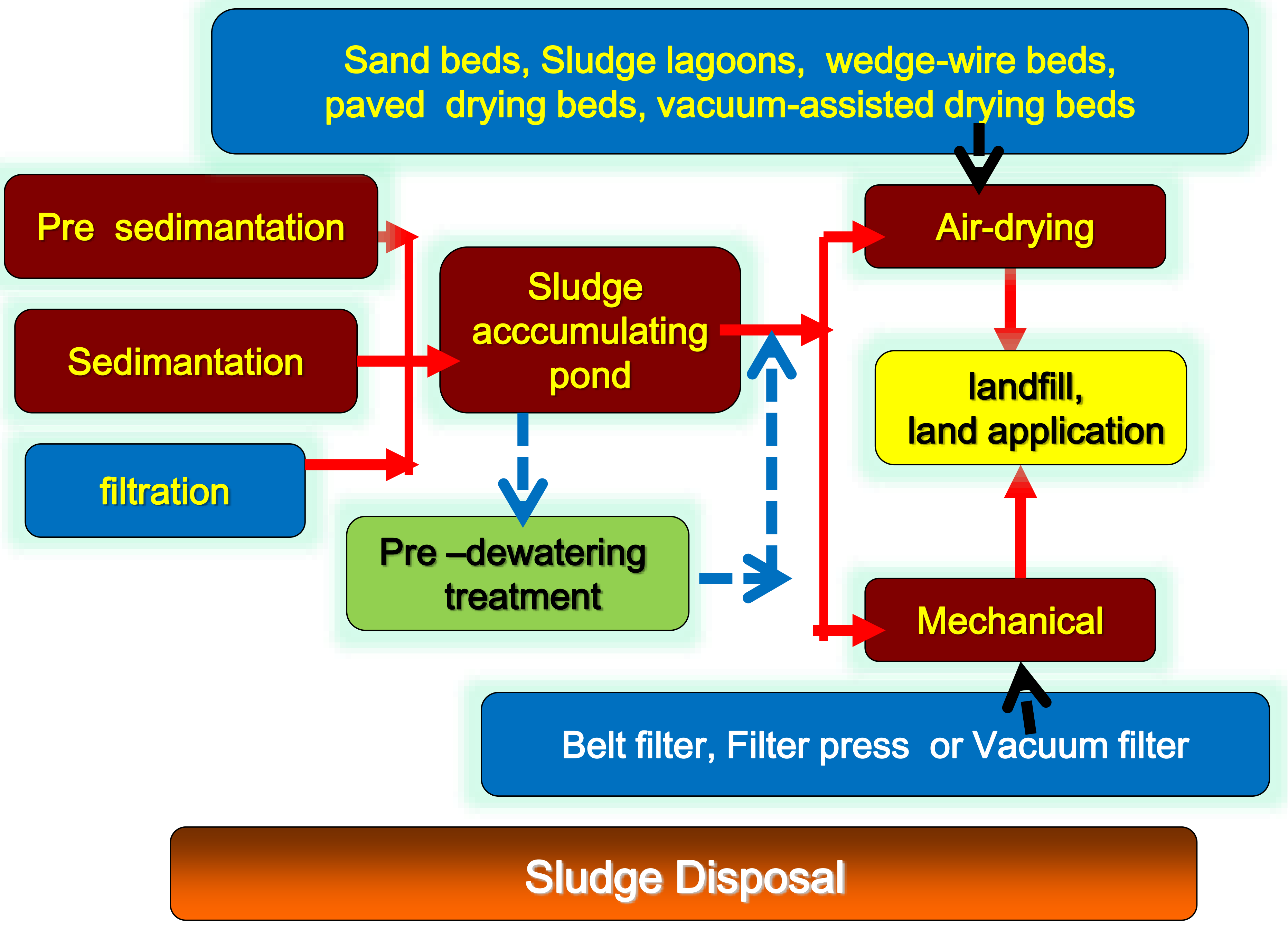
Sources of sludge and Sludge Disposal



Sludge Dewatering

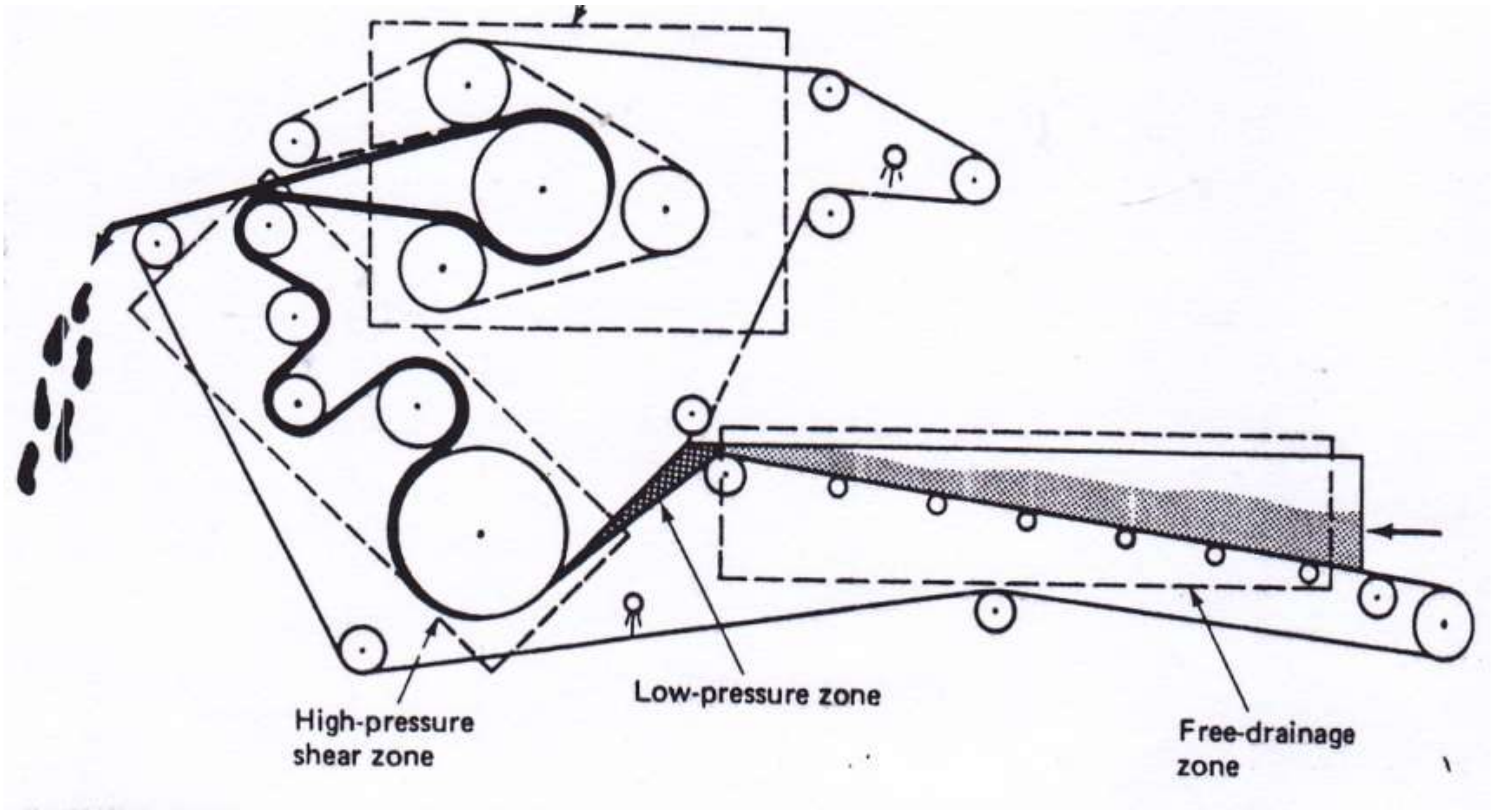
Dewatering processes may be usually divided into air drying and mechanical method, although some air-drying techniques employ mechanical equipment. Air drying includes those methods in which moisture is removed by evaporation and gravity or induced drainage such as sand beds, vacuum- assisted beds, wedge-wire beds, sludge lagoon, and paved beds.

Alum sludge

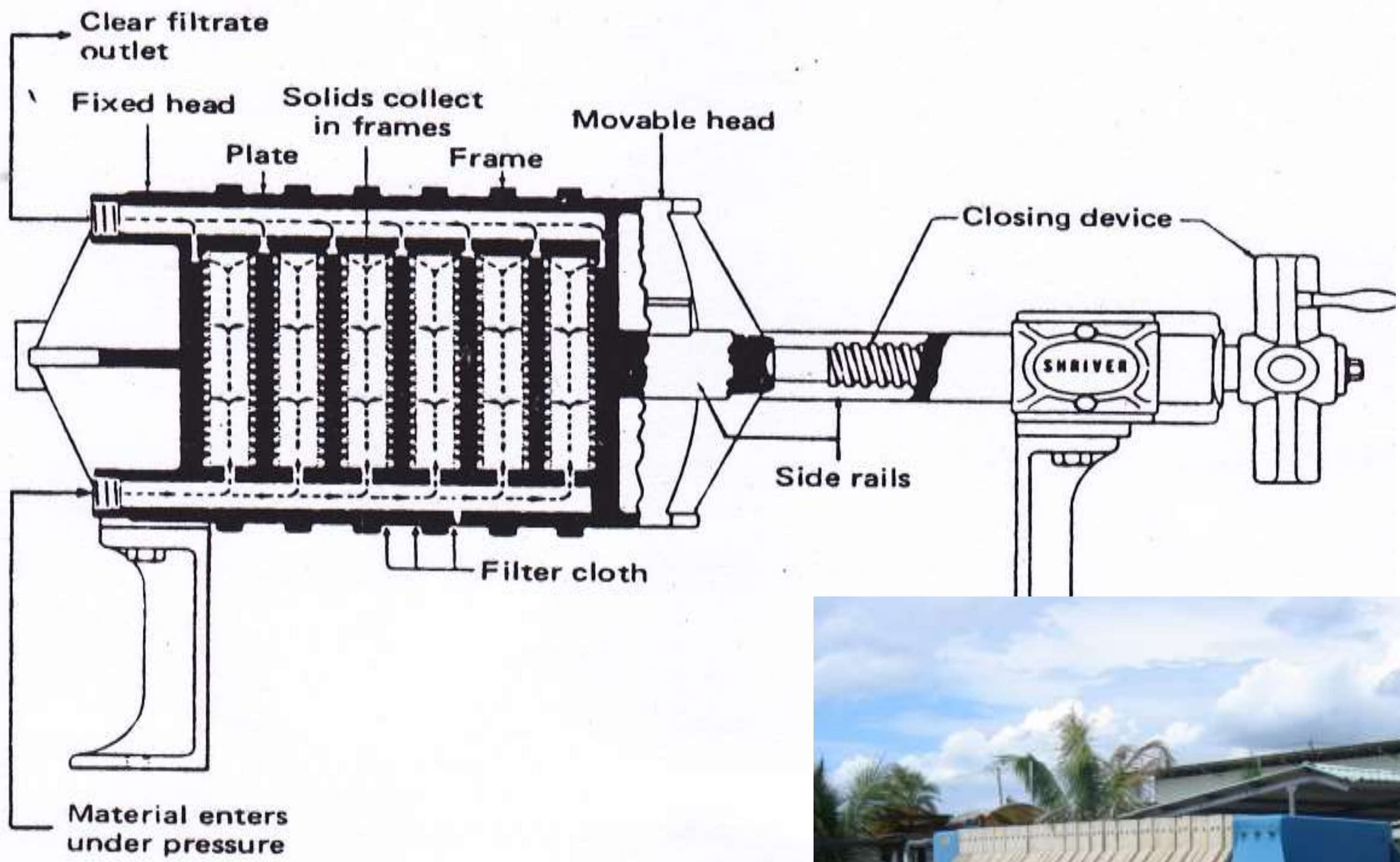


Sand beds, Sludge lagoons, wedge-wire beds, paved drying beds, vacuum-assisted drying beds
Pre sedimantation
Sedimantation
filtration
Sludge acccumulating pond
Air-drying
landfill, land application
Pre –dewatering treatment
Mechanical
Belt filter, Filter press or Vacuum filter
Sludge Disposal

Sludge Dewatering

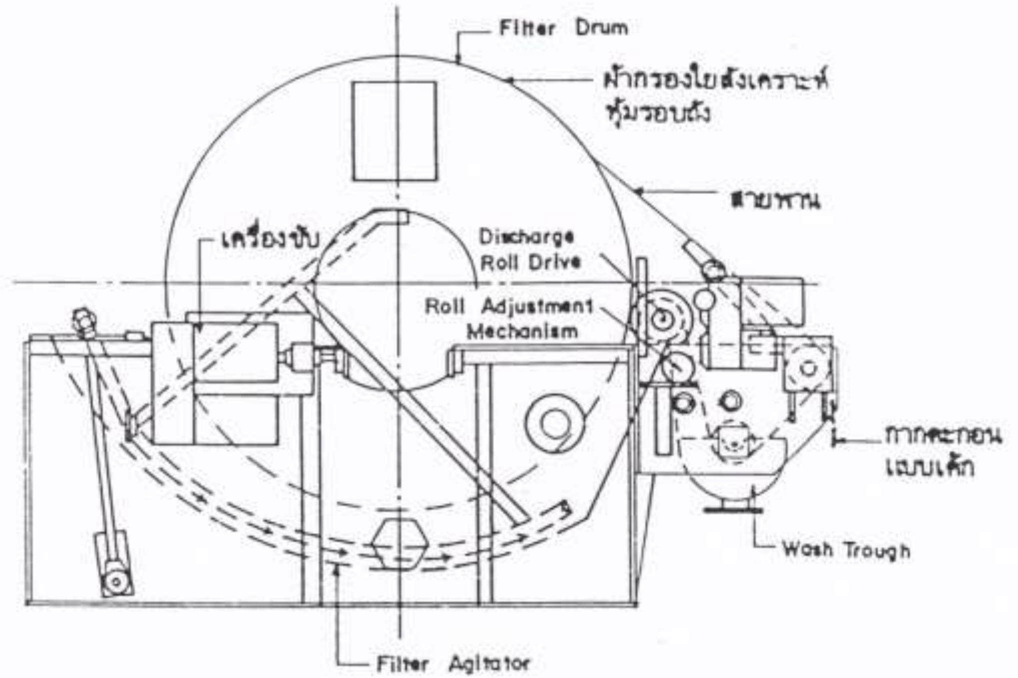


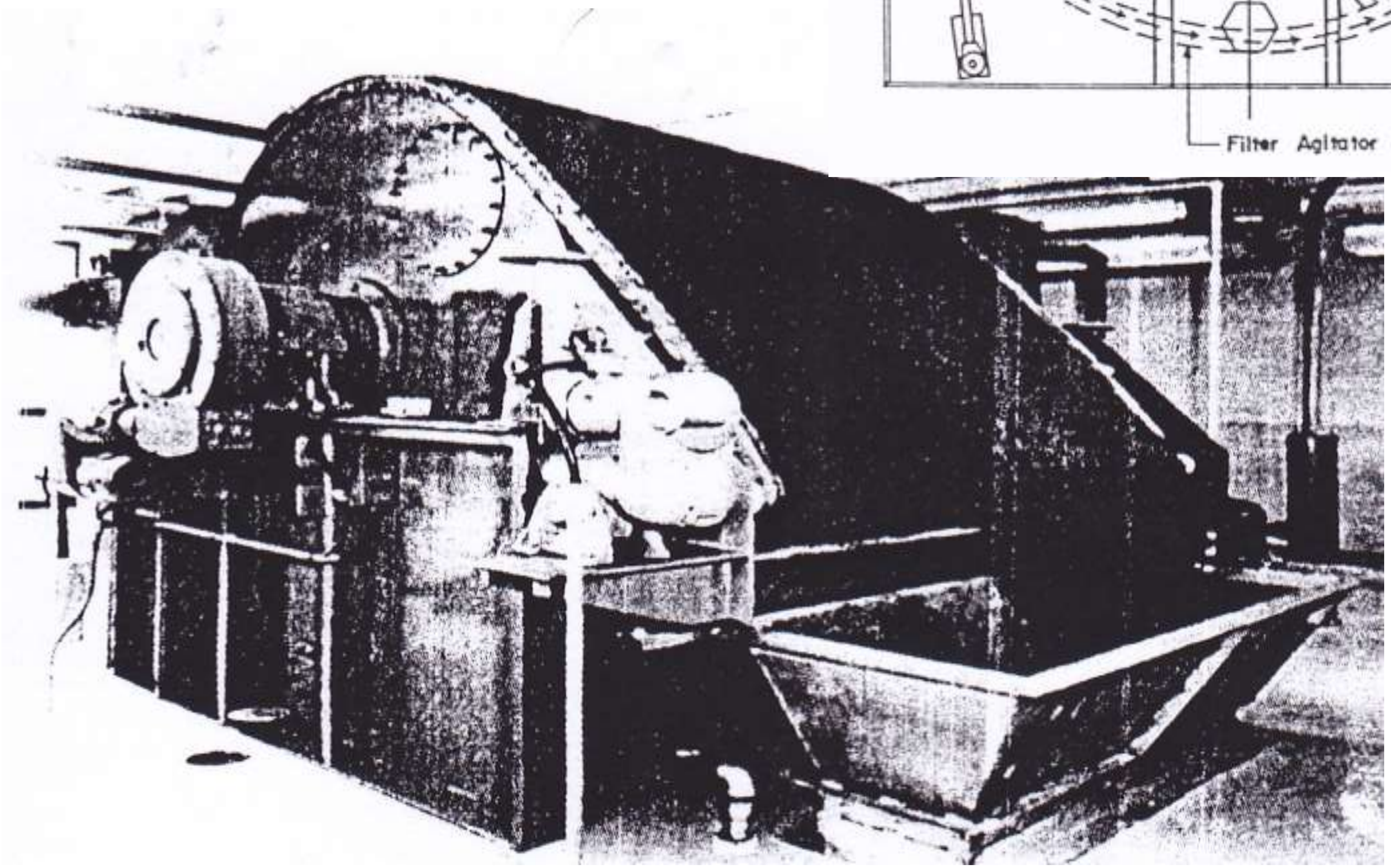
Belt filter



Filter press

Vacuum filter





Air drying (Sludge Lagoon)


4 2:47PM

Distribution Pumping Station

Above Ground

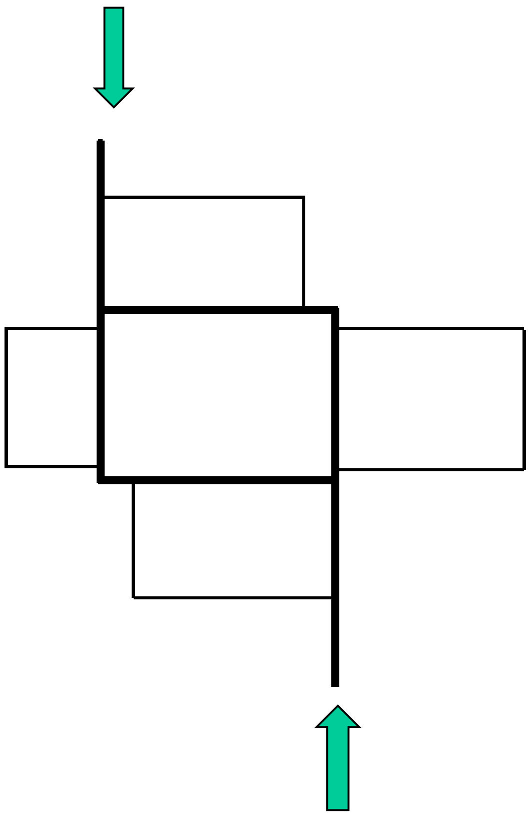
Dry Well

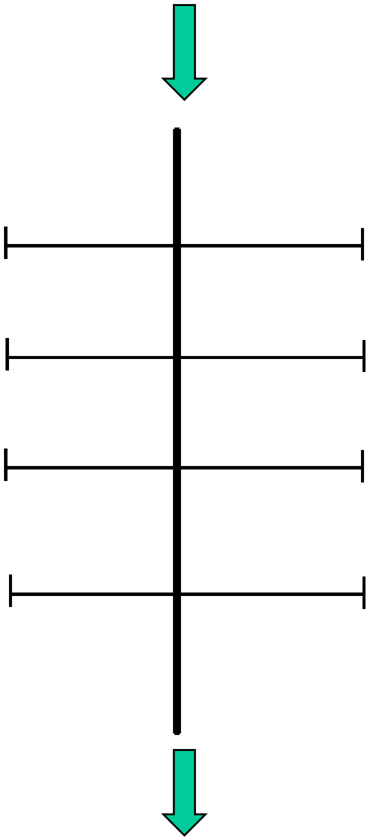
Above Ground Distribution Pumping Station

2. Dry Well Distribution Pumping Station

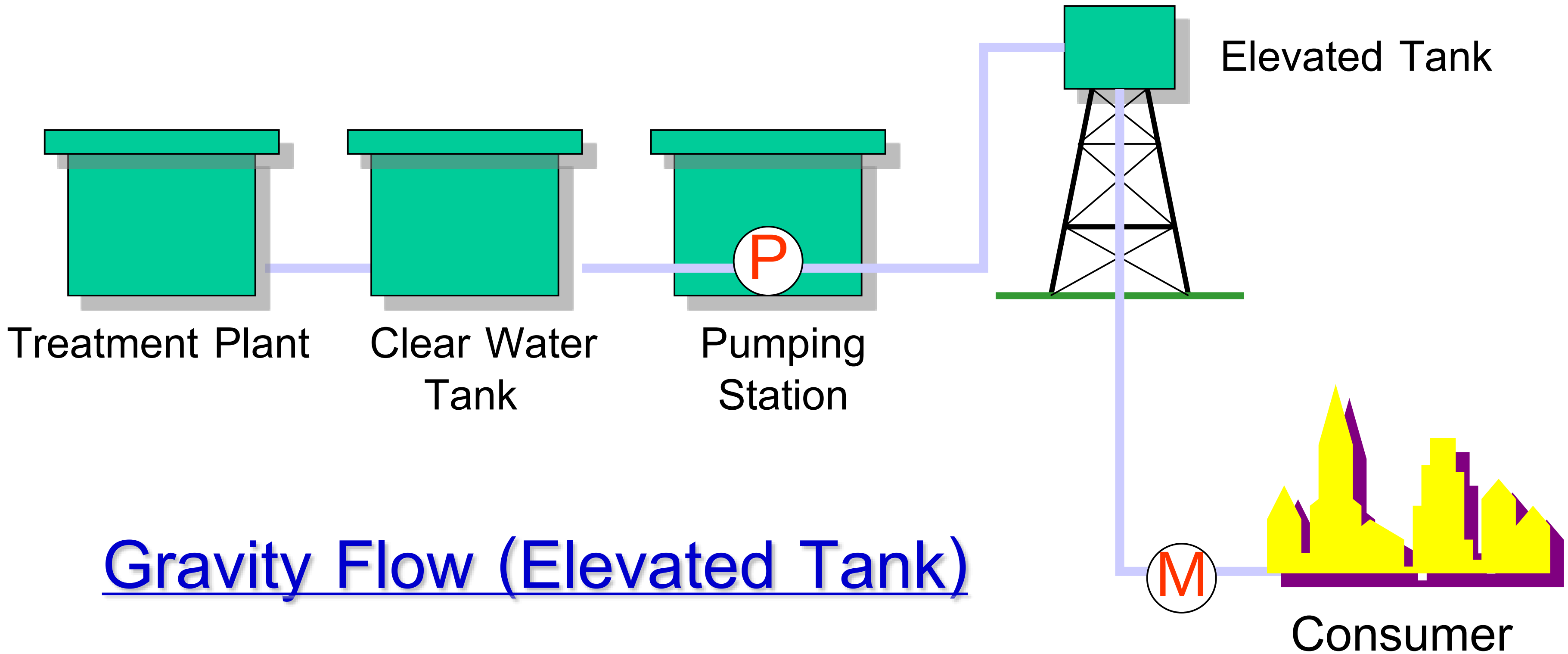
Elevated Tank

Water Distribution Networks



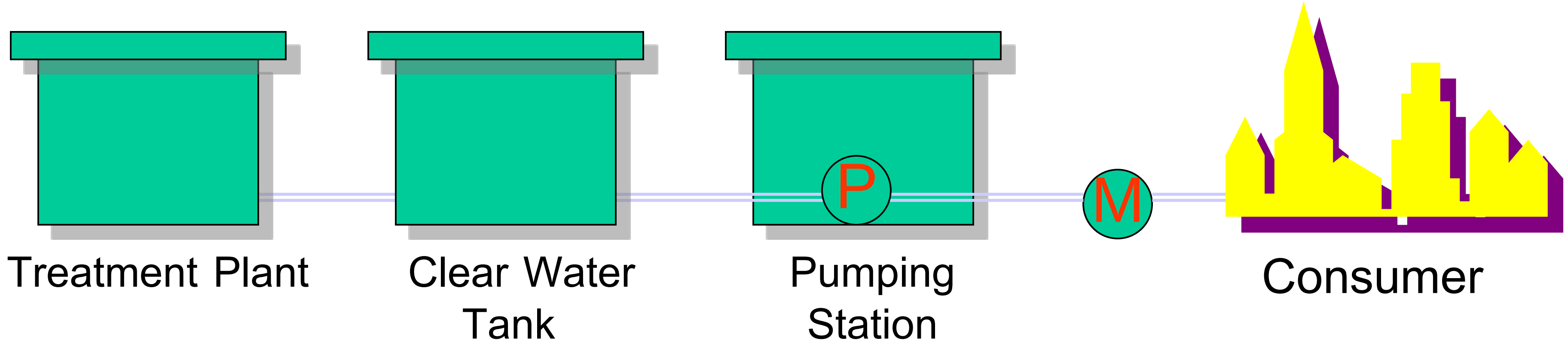


TYPE OF DISTRIBUTION SYSTEM



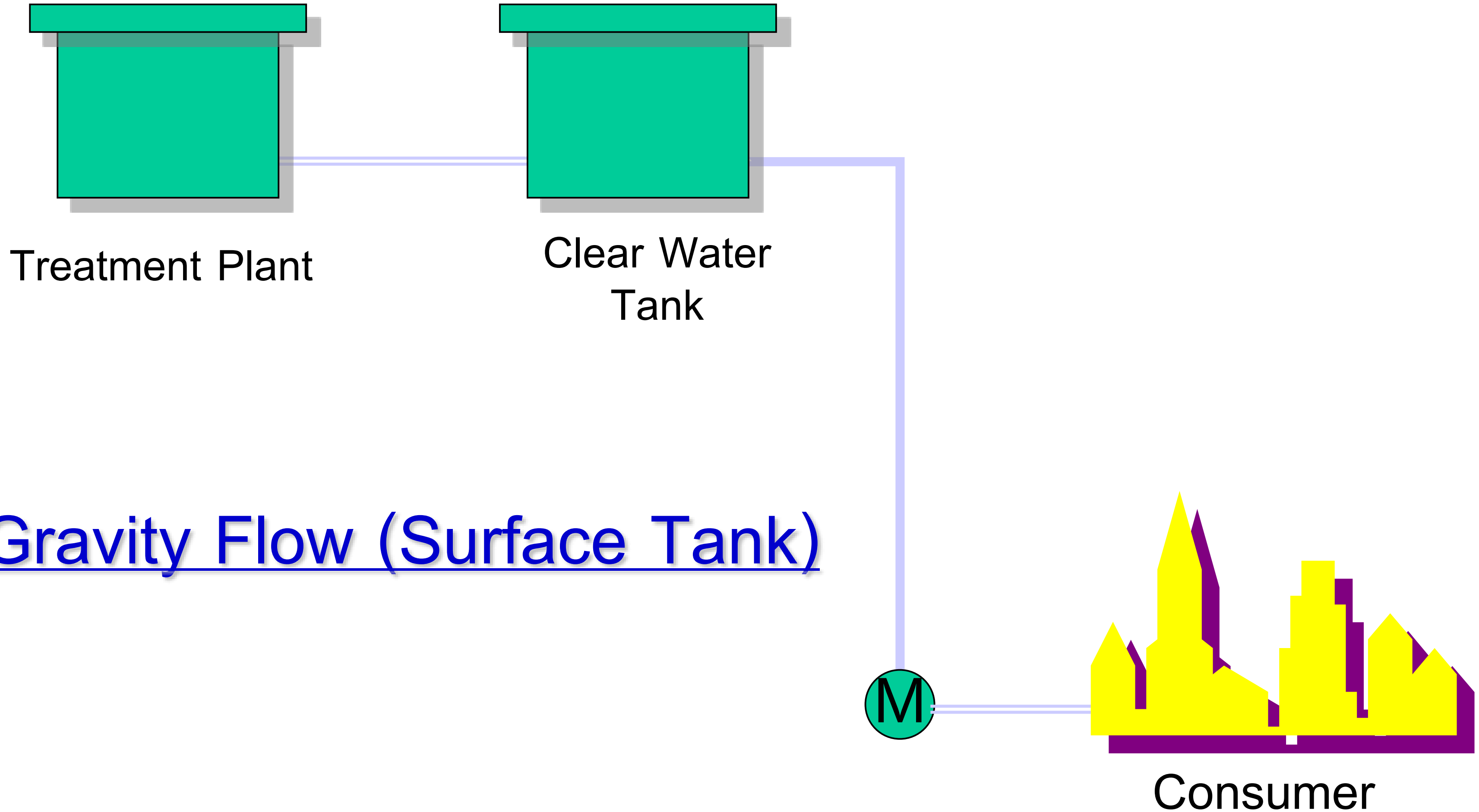
Gravity Flow (Elevated Tank)

TYPE OF DISTRIBUTION SYSTEM



Direct Pumping

TYPE OF DISTRIBUTION SYSTEM



Gravity Flow (Surface Tank)

TYPE OF DISTRIBUTION PIPES

- Polybuthylene Pipe (PB)
- Polyvinyl Chloride Pipe (PVC)
- Galvanized Steel Pipe (GS)
- High Density Polyethylene Pipe (HDPE)
- Asbestos Cement Pipe (AC)
- Steel Pipe (S)

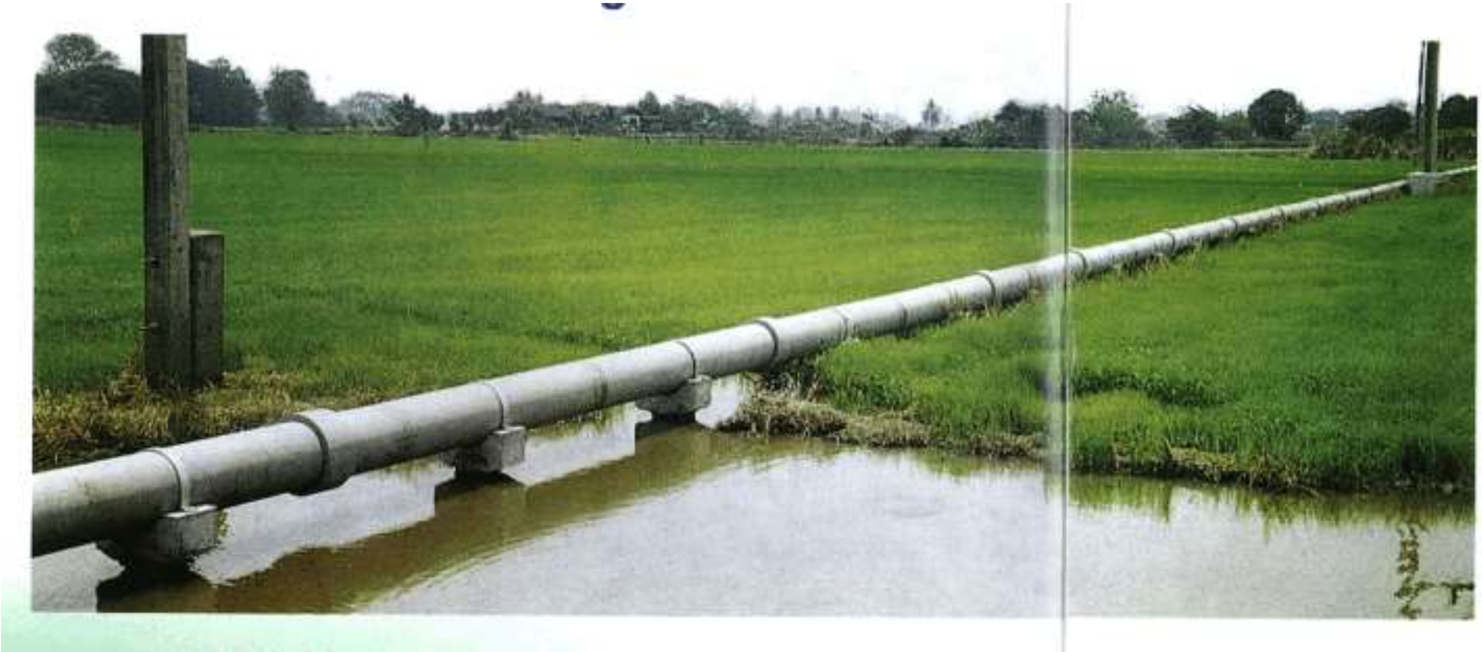
Polybuthylene Pipe (PB)

Polyvinyl Chloride Pipe (PVC)

Galvanized Steel Pipe (GS)

High Density Polyethylene Pipe (HDPE)

Asbestos Cement Pipe (AC)



Steel Pipe (S)

Thank You