

CHAPTER 3

INTRODUCTION TO

TREATMENT

PROCESSES



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Objectives of treatment

- Removal of: dissolved mineral matters, settleable suspended matter and non-settleable colloidal impurities
- To improve the aesthetic quality -- taste and odor
- To kill the troublesome bacteria.
- Making the water non-corrosive, suitable for industrial processing, and recreational uses.
- Softening of water for use in domestic washing laundries and boilers

Water Classification by Source

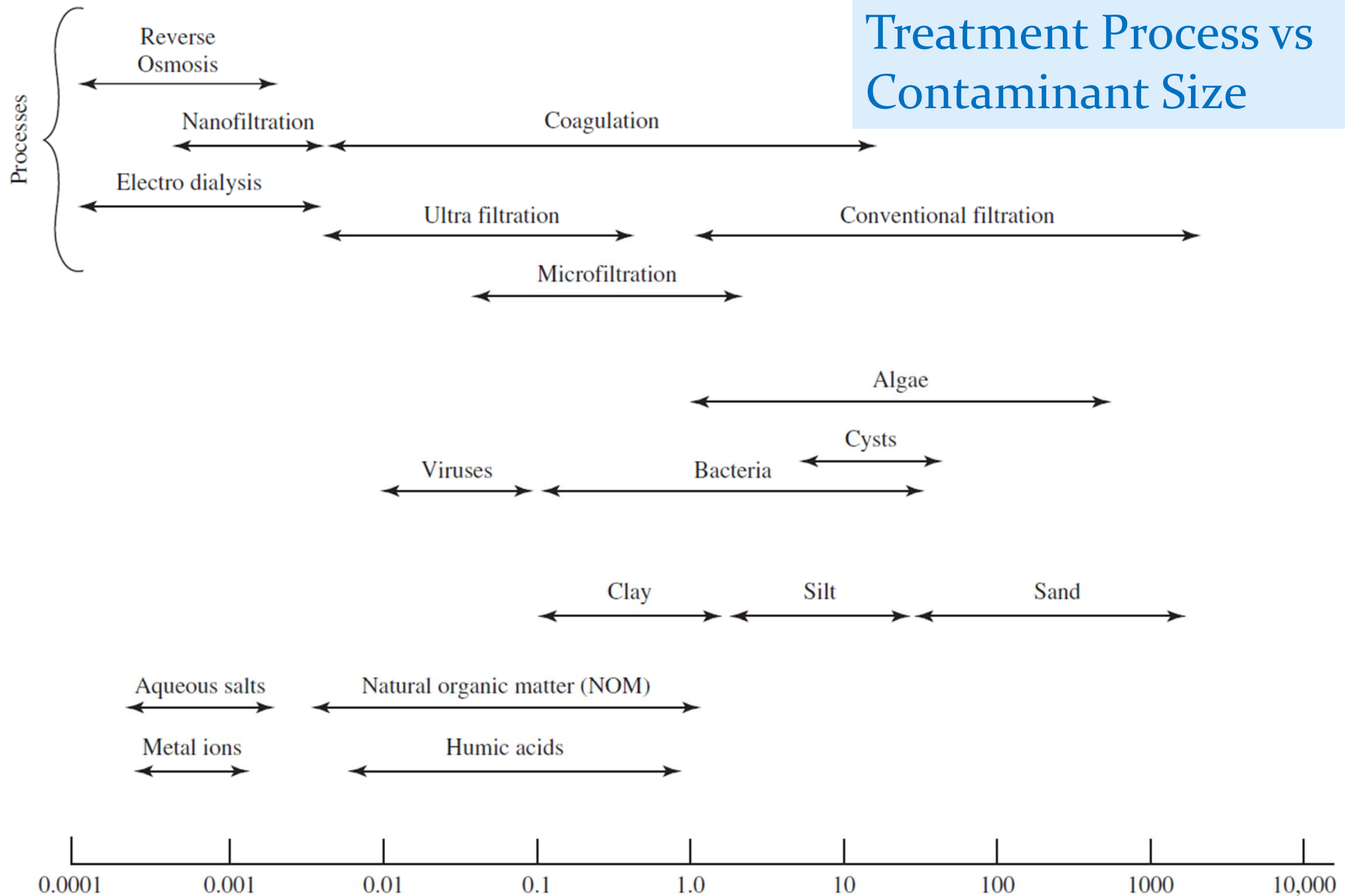
Ground	Surface
Constant composition	Varying composition
High mineralization	Low mineralization
Little turbidity	High turbidity
Low or no color	Color
Bacteriologically safe	Microorganisms present
No dissolved oxygen	Dissolved oxygen
High hardness	Low hardness
H ₂ S, Fe, Mn	Tastes and odors
	Possible chemical toxicity

Treatment Systems

Unit process :an engineered system that employs particular kinds of influences or actions to effect certain intended state changes for the water.

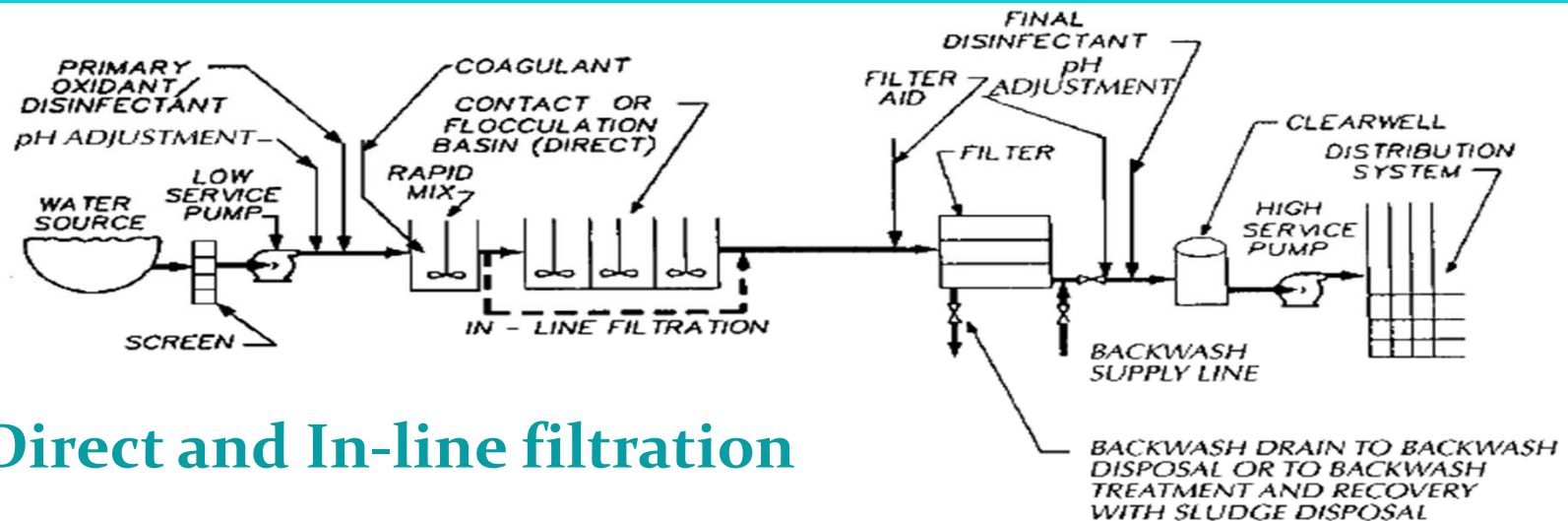
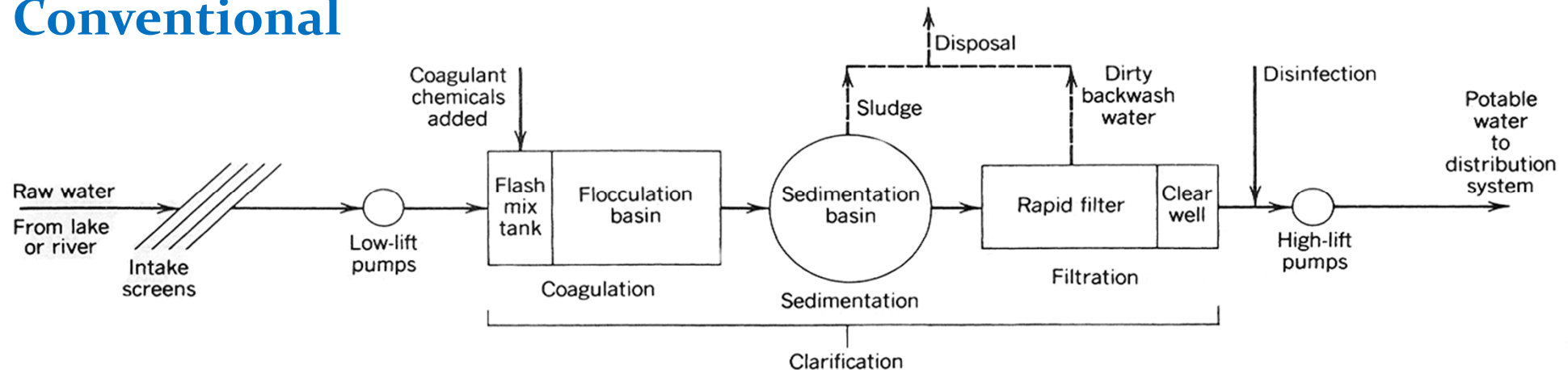
Unit treatment	Function (removal)
Aeration, chemicals use	Color, odor, taste
Screening	Floating matter
Chemical methods	Iron, Manganese etc
Softening	Hardness
Sedimentation	Suspended matter
Coagulation	Suspended matter, a part of colloidal matter and bacteria
Filtration	Remaining colloidal dissolved matter, bacteria
disinfection	Pathogenic bacteria, organic matter and reducing substances

Treatment Process vs Contaminant Size



Treatment Systems

Conventional



Direct and In-line filtration

NOTE:
Chemical application points may be different than shown above. This is one potential alternative.



Treatment process selection

- Contaminant removal
- Source water quality
- Reliability
- Existing conditions
- Process flexibility
- Utility capabilities
- Costs
- Environmental compatibility
- Distribution system water quality
- Issues of process scale

Treatment process selection

Source	Treatment required
1. Ground water and spring fairly free from contamination	No treatment or chlorination
2. Ground water with chemicals, minerals and gases	Aeration, coagulation (if necessary) filtration, and disinfection
3. Lakes, surface water reservoirs with less amount of pollution	Disinfection
4. Other surface waters, such as rivers, canals and impounded reservoirs with a considerable amount of pollution	Complete treatment



Preliminary treatment processes

- **Pumping and containment** - appropriate materials and constructed to avoid accidental contamination.
- **Screening** - remove large debris such as sticks, leaves, trash and other large particles.
- **Storage** - natural biological purification and equalization
- **Pre-conditioning** – remove hardness
- **Pre-chlorination** - minimize growth of fouling organisms on the pipe-work and tanks
- **pH adjustment**

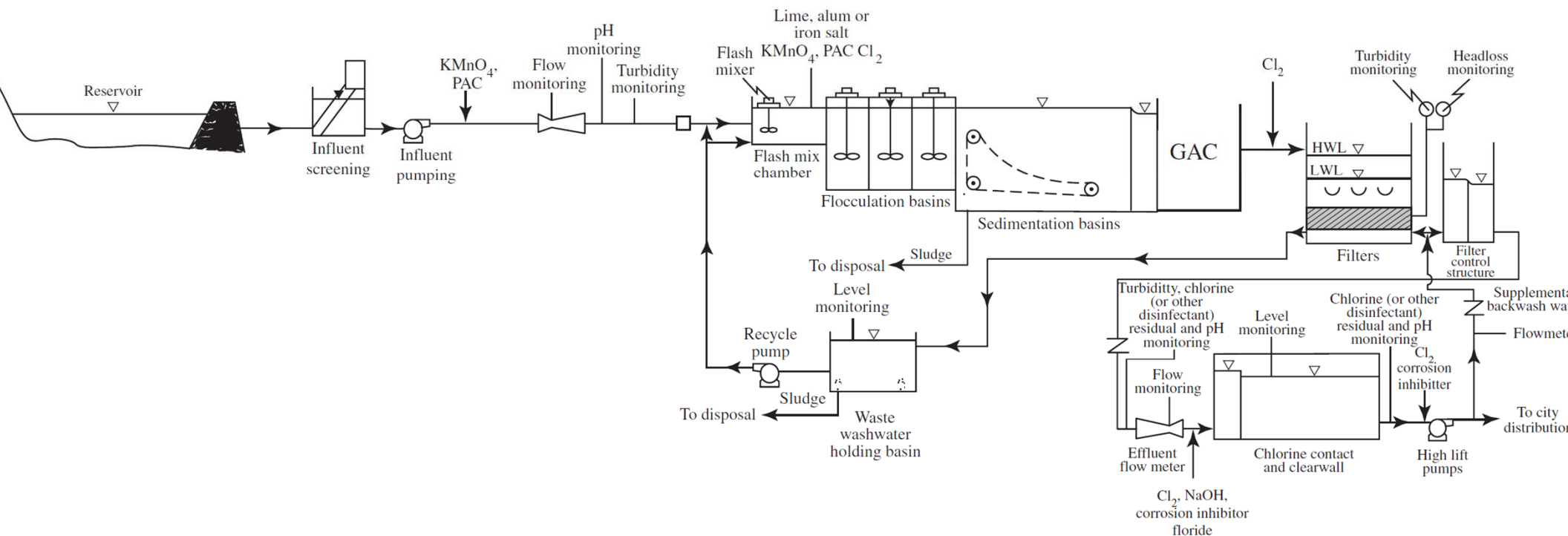


Plant Layout

- All the unit processes in the correct sequence.
- All the major pipe connections with flow directions.
- All the chemicals that are to be used and the application points of each.
- All the major sampling points.
- The location and size of all major flow meters, valves, and connecting pipes.
- The location of all major pumps, blowers, and screens.
- The control points for pressure, water level, flow rate, and water quality.

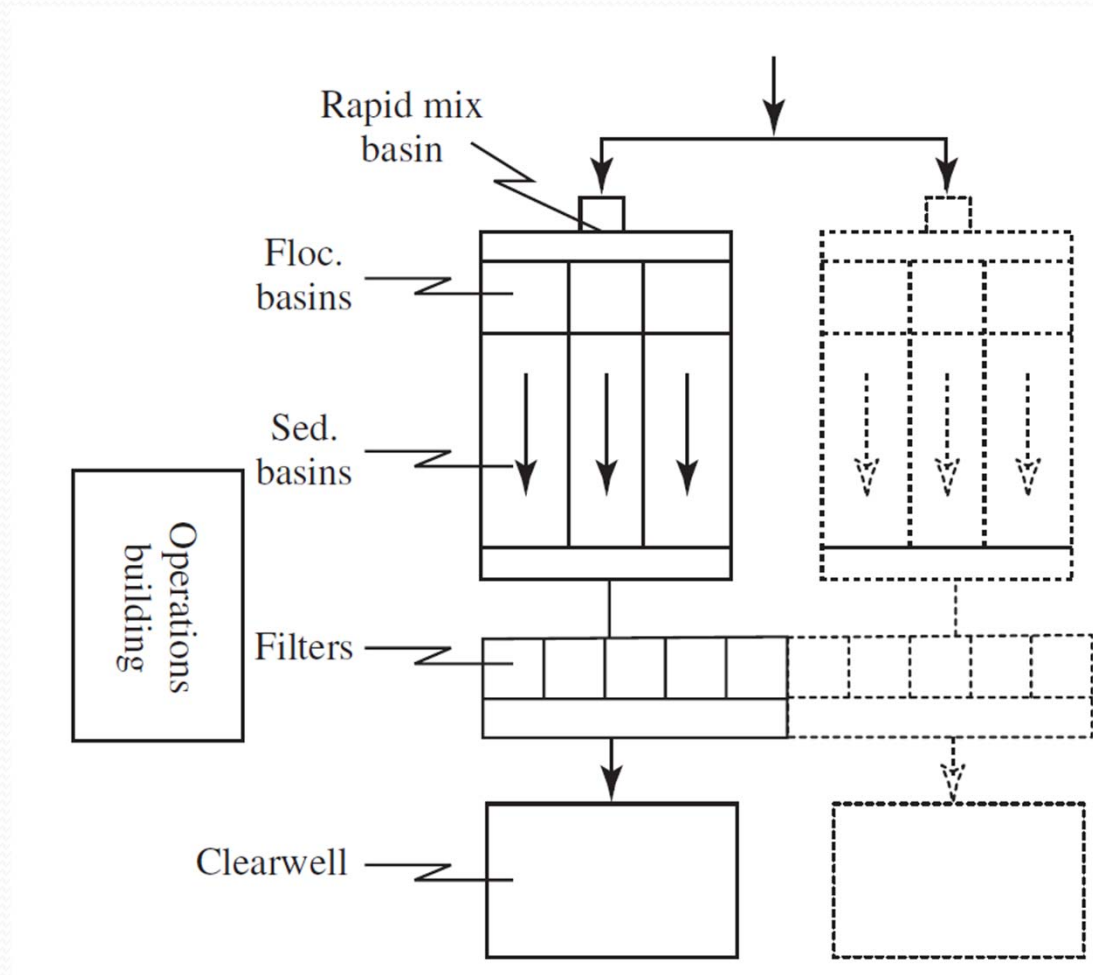
Process flow diagram

The available land area and topography dictate the plant layout.



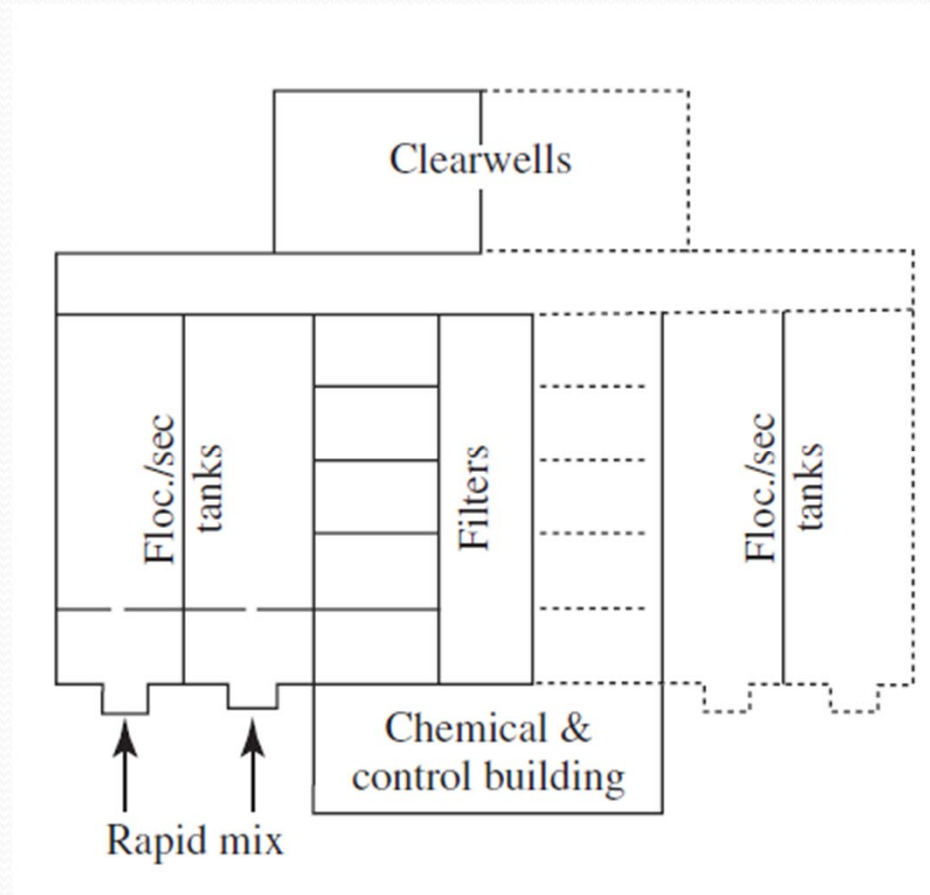
Basic plant layout styles

Linear



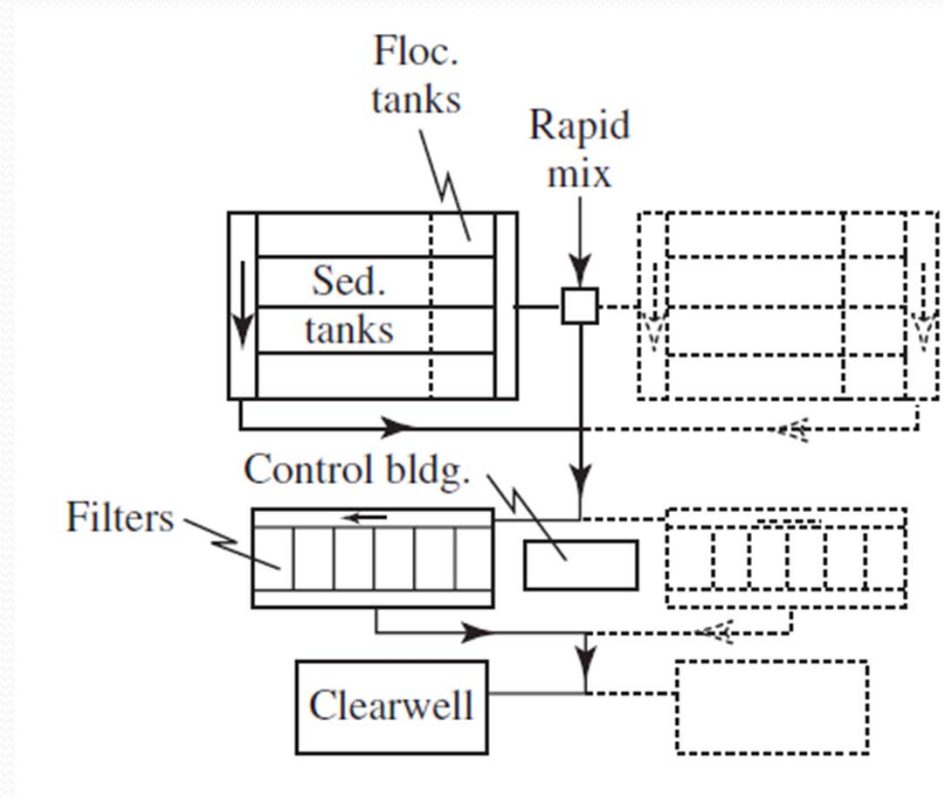
Basic plant layout styles

Compact



Basic plant layout styles

Campus





Advantages of the linear and campus styles

- easier construction because each treatment process is easily accessible,
- less potential for structural damage between different processes because of differential settling,
- upgrading with new technology between units is relatively easy,
- if the site is not flat, there is a potential savings in earthwork, and
- an inherent increase in safety is realized because of separation from chemical spills and/or fire.



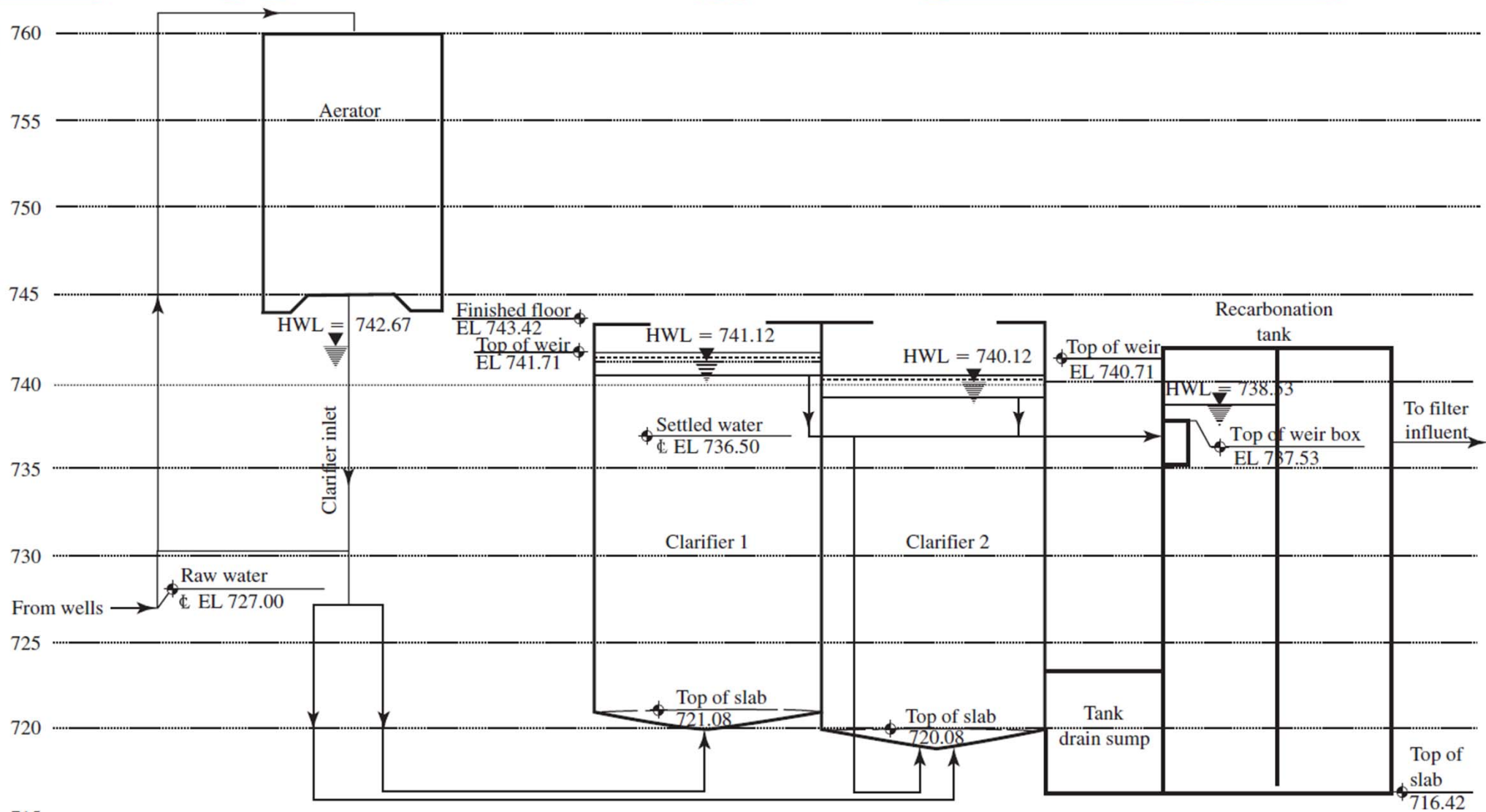
Disadvantages of the linear and campus styles

- larger plant site requirements,
- More yard piping,
- operators must travel greater distance between each process, and
- Construction costs may be greater.



Plant Hydraulics

- Represented by a drawing that shows the hydraulic grade line across the treatment plant.
- The drawing must show
 - the elevations of the walkway (top of the structure),
 - The water level, and
 - the bottom elevation of each unit process as well as the invert and crown of all the connecting pipes and the invert of all the channels.



NOTE: High water levels (HWL) calculated at 23,000 m³/d with parallel flow through clarifiers and one filter in backwash