WATER DISTRIBUTION SYSTEM

SEC-D

NOTES

BY

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Course Content

Layout of distribution networks, methods of water distribution, storage capacity of ESR, and underground service reservoir.

Introduction…

- The purpose of distribution system is to deliver water to consumer with appropriate quality, quantity and pressure.
- Distribution system is used to describe collectively the facilities used to supply water from its source to the point of usage.

Requirements of Good Distribution System...

- Water quality should not get deteriorated in the distribution pipes.
- It should be capable of supplying water at all the intended places with sufficient pressure head.
- It should be capable of supplying the requisite amount of water during fire fighting.

- The layout should be such that no consumer would be without water supply, during the repair of any section of the system.
- All the distribution pipes should be preferably laid one metre away or above the sewer lines.
- It should be fairly water-tight as to keep losses due to leakage to the minimum.

Layouts of Distribution Network

- The distribution pipes are generally laid below the road pavements, and as such their layouts generally follow the layouts of roads.

- There are, in general, four different types of pipe networks; any one of which either singly or in combinations, can be used for a particular place.

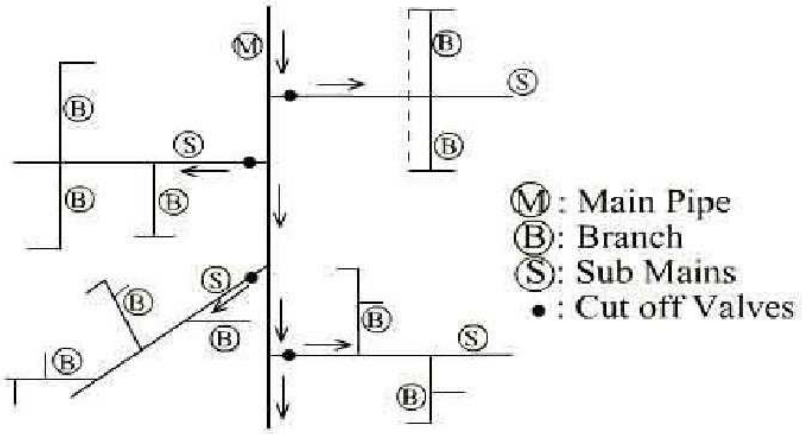
They are:

- ❖Dead End System
- ❖Radial System
- ❖Grid Iron System
- ❖Ring System

Dead End System...

- It is suitable for old towns and cities having no definite pattern of roads.

Dead End or Tree System



Advantages

- Relatively cheap.
- Determination of discharges and pressure easier due to less number of valves.

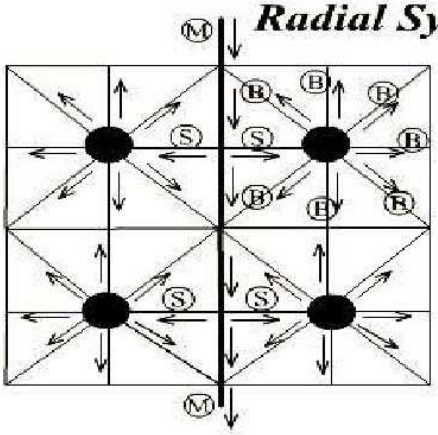
Disadvantages

- Due to many dead ends, stagnation of water occurs in pipes.

Radial System...

- The area is divided into different zones.
- The water is pumped into the distribution reservoir kept in the middle of each zone.
- The supply pipes are laid radially ending towards the periphery.

Radial System



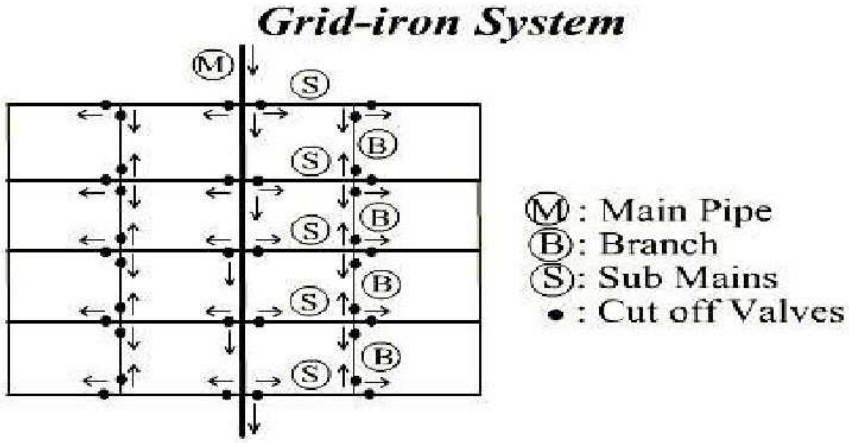
● : Distribution Reservoirs

Advantages:

- ❖ It gives quick service.
- ❖ Calculation of pipe sizes is easy.

Grid Iron System...

- It is suitable for cities with rectangular layout, where the water mains and branches are laid in rectangles.



Advantages

- Water is kept in good circulation due to the absence of dead ends.
- In the cases of a breakdown in some section, water is available from some other direction.

Disadvantages

- Exact calculation of sizes of pipes is not possible due to provision of valves on all branches.

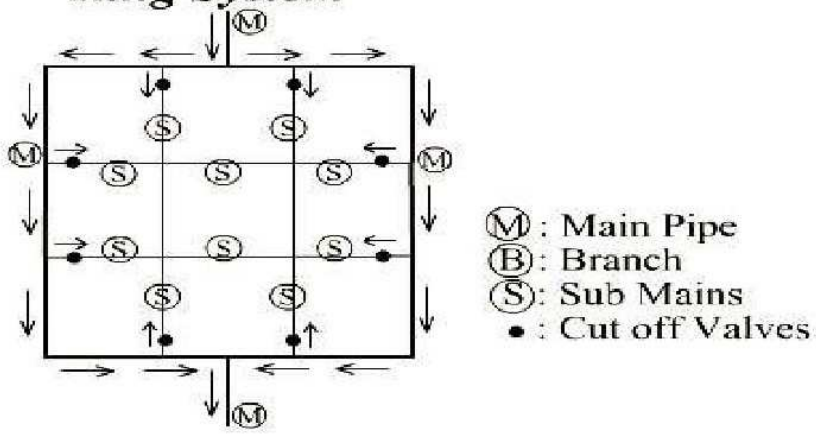
Ring System...

- The supply main is laid all along the peripheral roads and sub mains branch out from the mains.
- This system also follows the grid iron system with the flow pattern similar in character to that of dead end system.
- So, determination of the size of pipes is easy.

Advantages

- Water can be supplied to any point from at least two directions.

Ring System



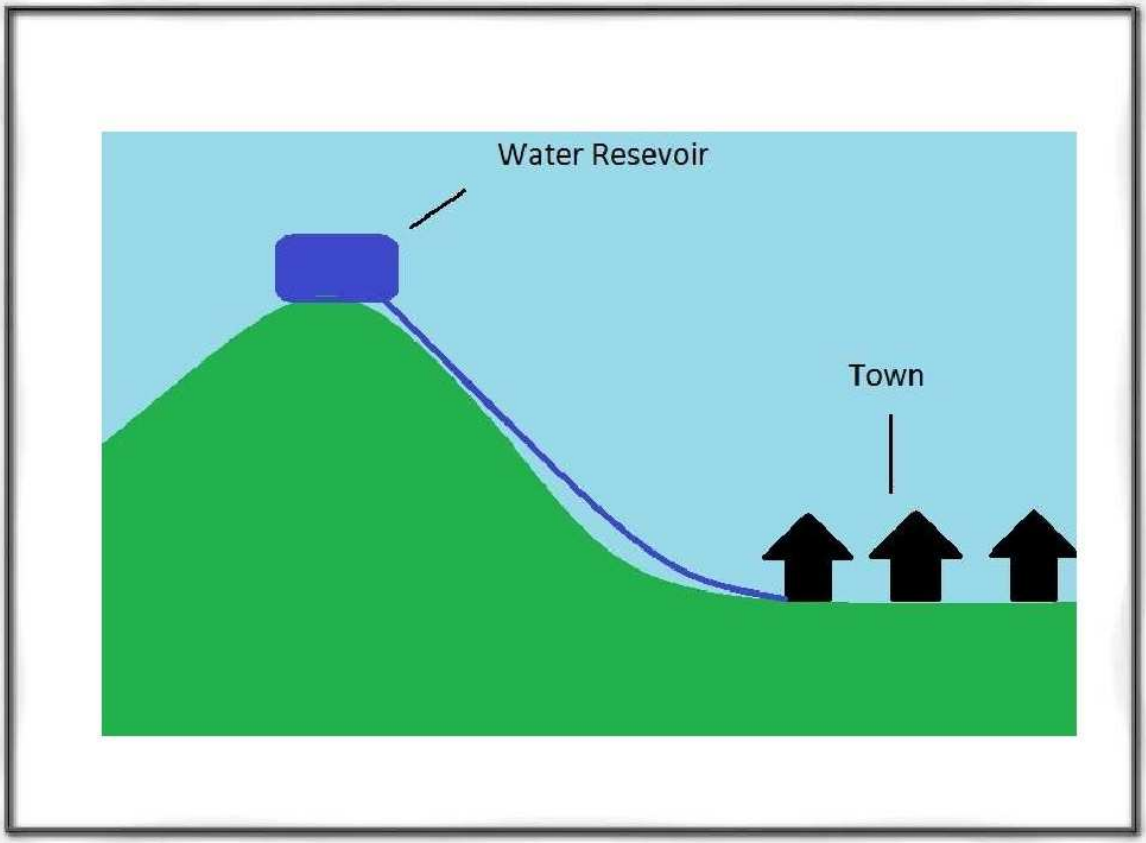
Methods of water distribution…

- For efficient distribution system adequate water pressure required at various points.
- Depending upon the level of source, topography of the area and other local conditions the water may be forced into distribution system by following ways -

1. Gravity system
2. Pumping system
3. Combined gravity and pumping system

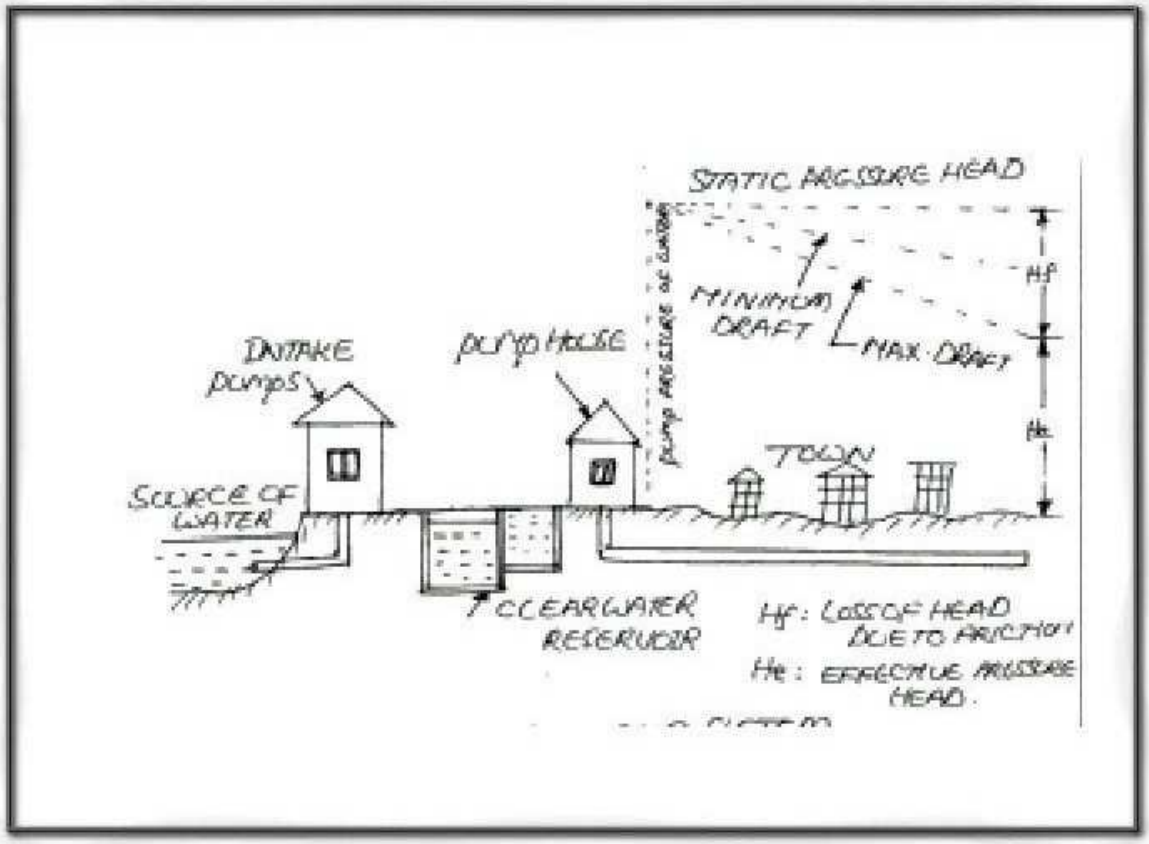
Gravity system…

- Suitable when source of supply is at sufficient height.
- Most reliable and economical distribution system.
- The water head available at the consumer is just minimum required.
- The remaining head is consumed in the frictional and other losses.



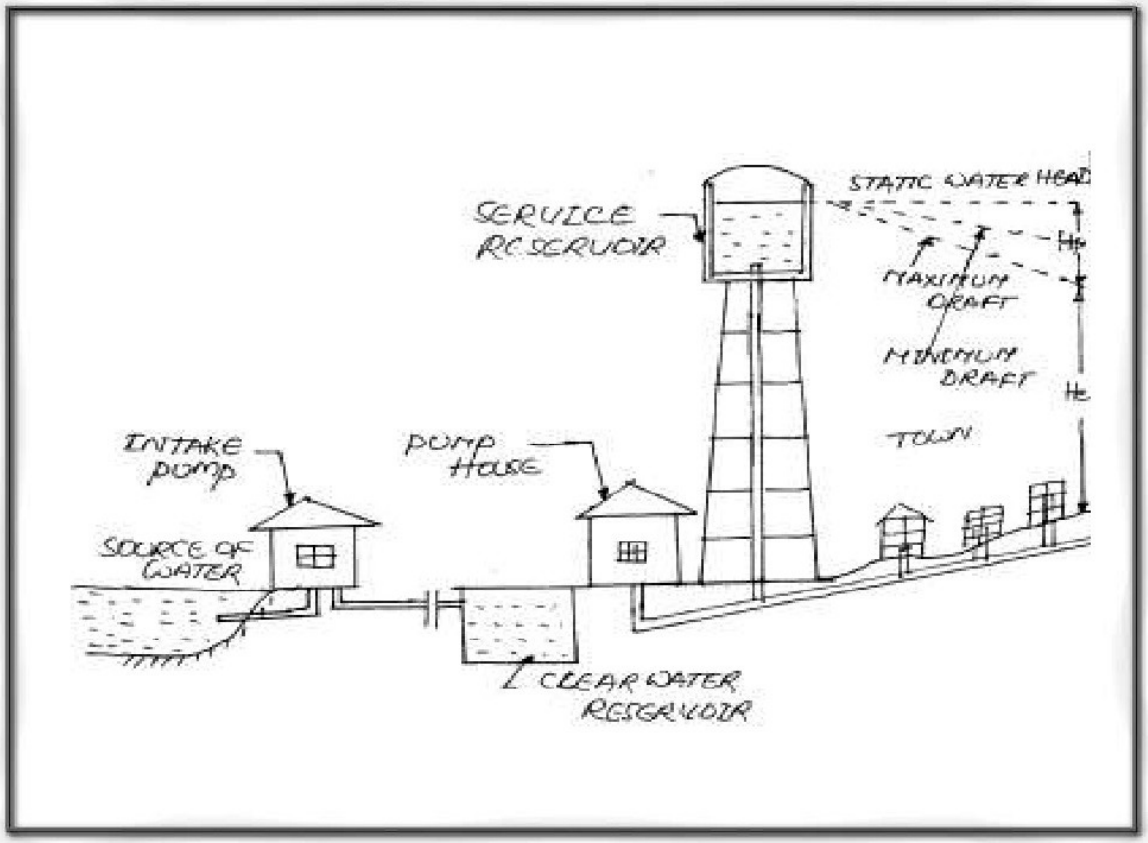
Pumping system…

- Treated water is directly pumped in to the distribution main with out storing.
- Also called pumping without storage system.
- High lifts pumps are required.
- If power supply fails, complete stoppage of water supply.
- This method is not generally used.



Combined gravity and pumping system

- Most common system.
- Treated water is pumped and stored in an elevated distribution reservoir.
- Then supplies to consumer by action of gravity.
- The excess water during low demand periods get stored in reservoir and get supplied during high demand period.
- Economical, efficient and reliable system.



Distribution Reservoirs...

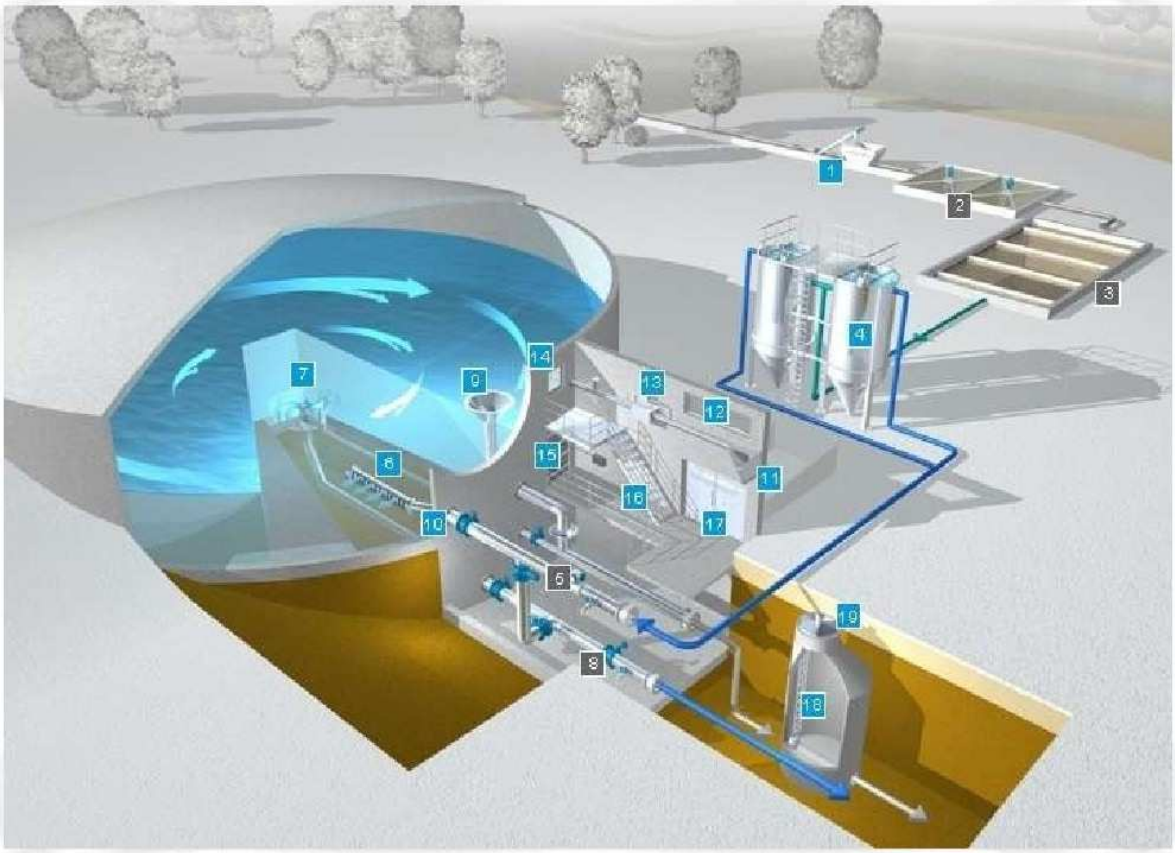
- Distribution reservoirs, also called service reservoirs, are the storage reservoirs, which store the treated water for supplying water during emergencies (such as during fires, repairs, etc.) and also to help in absorbing the hourly fluctuations in the normal water demand.

Functions of Distribution Reservoirs

- to absorb the hourly variations in demand.
- to maintain constant pressure in the distribution mains.
- water stored can be supplied during emergencies.

Location and Height of Distribution Reservoirs

- should be located as close as possible to the centre of demand.
- water level in the reservoir must be at a sufficient elevation to permit gravity flow at an adequate pressure.



Types of Reservoirs...

- Depending upon their elevation w.r.t ground it may be classified into

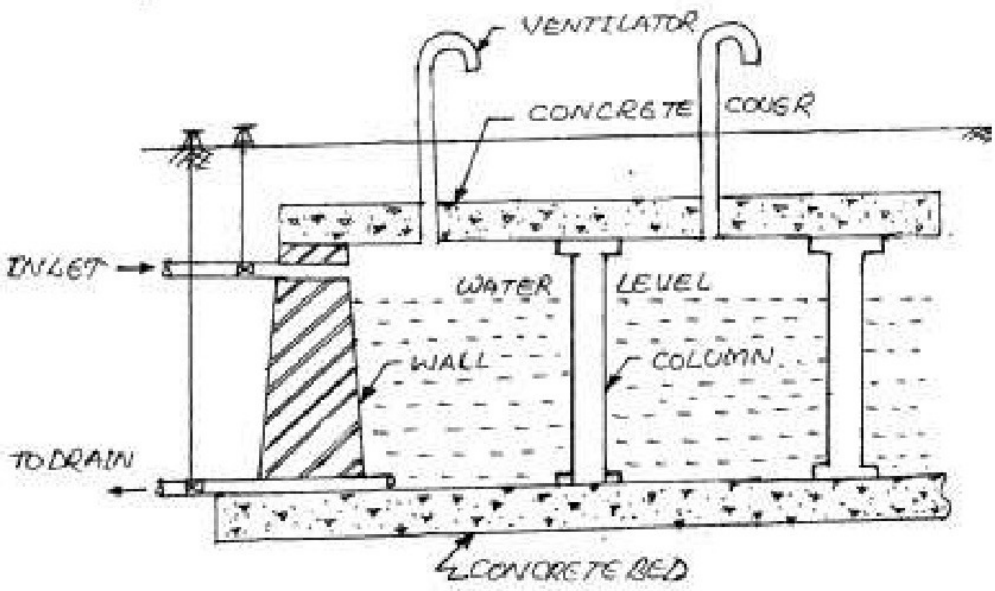
1. Surface reservoirs
2. Elevated reservoirs

Surface reservoirs…

- These also called ground reservoir.
- Mostly circular or rectangular tank.
- Under ground reservoirs are preferred especially when the size is large.
- These reservoirs are constructed on high natural grounds and are usually made of stones, bricks, plain or reinforced cement concrete.

- The side walls are designed to take up the pressure of the water, when the reservoir is full and the earth pressure when it is empty.
- The position of ground water table is also considered while designing these reservoirs.
- The floors of these reservoirs may constructed with R.C.C slab or square stone blocks resting on columns.

- To obtain water tightness bitumen compounds are used at all construction joints.
- At the top of roof about 60cm thick earth layer is deposited and maintained green lawns to protect the reservoir from cold and heat.
- For aeration of water and inspection, ventilation pipes and stairs are provided.



Under Ground Reservoir

TYPES OF TANKS

R.C.C TANKS: R.C.C tanks are very popular because

1) They have long life
2) Very little maintenance
3) decent appearance

G.I. TANKS: G.I. tanks are generally in rectangular or square in shape. Now a days G.I. tanks are not preferring because

1) Life of the tank is short
2) Corrosion of metal
3) maintenance cost may be more

HDPE TANKS: Now a days HDPE tanks are very popular for storing less quantity of water and hence useful for residential purpose. The following are the advantages of HDPE tanks

1) Handling is easy because of light weight
2) Cheap in cost
3) Maintenance cost is low
4) Cleaning of tanks are easy

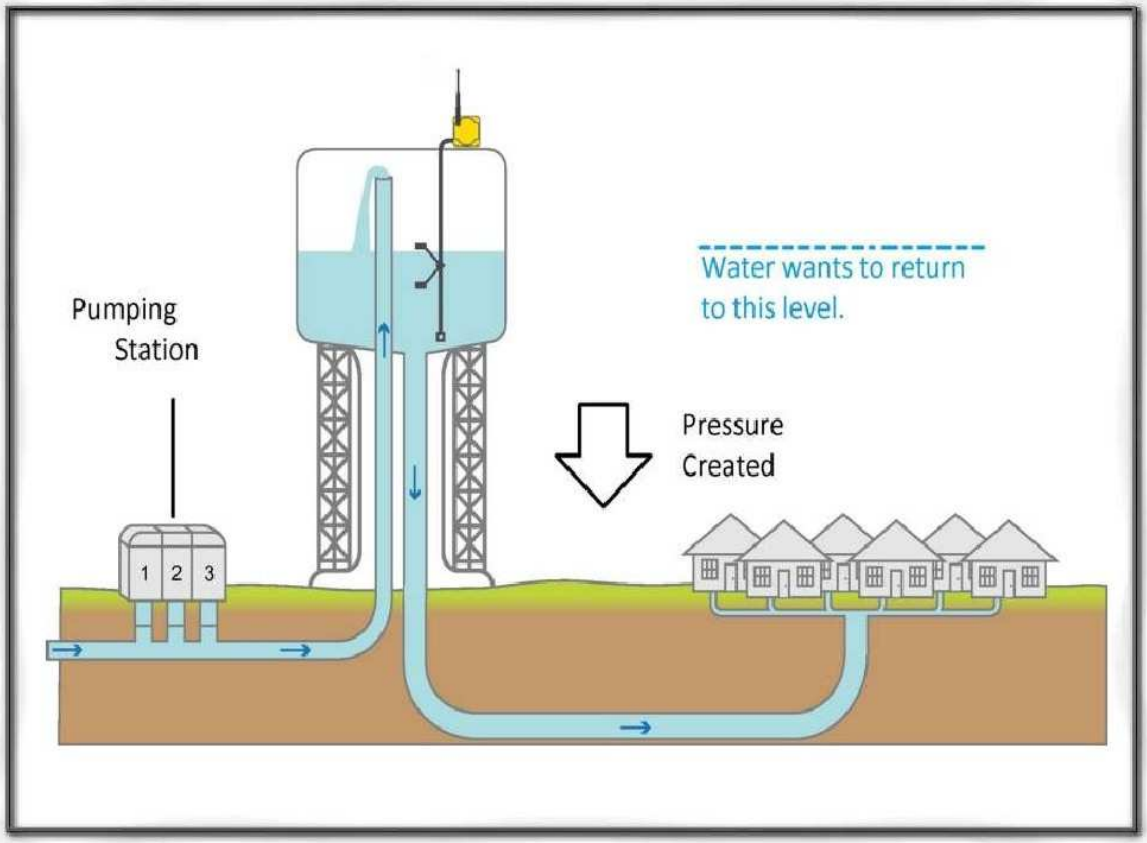
ESR...

- Elevated Storage Reservoirs (ESRs) also referred to as Overhead Tanks are required at distribution areas which are not governed and controlled by the gravity system of distribution.
- These are rectangular, circular or elliptical in shape.
- If the topography of the town not suitable for under gravity, the elevated tank or reservoir are used.

- They are constructed where combine gravity and pumping system of water distribution is adopted.
- These tanks may be steel or RCC.
- Now RCC is commonly preferred.

The accessories of ESR are-

- Inlet and outlet pipe, overflow pipe discharging into a drain
- Float gauge, indicating depth of water.
- Automatic device to stop pumping when the tank is full.
- A manhole and ladder.
- Ventilator for circulation of fresh air.



Storage Capacity of Distribution Reservoirs...

- The total storage capacity of a distribution reservoir is the summation of:
- ***Balancing Storage:*** The quantity of water required to be stored in the reservoir for equalising or balancing fluctuating demand against constant supply is known as the balancing storage (or equalising or operating storage).

- ***Breakdown Storage:*** The breakdown storage or often called emergency storage is the storage preserved in order to tide over the emergencies posed by the failure of pumps, electricity, or any other mechanism driving the pumps.
- A value of about 25% of the total storage capacity of reservoirs, or 1.5 to 2 times of the average hourly supply, may be considered as enough provision for accounting this storage.

- ***Fire Storage:*** The third component of the total reservoir storage is the fire storage.
- This provision takes care of the requirements of water for extinguishing fires.
- A provision of 1 to 4 per person per day is sufficient to meet the requirement.

- When reserve storage is elevated, amount of fire reserve may be determined by
- R= (F-P) T
- R= Reserve storage (liters)
- F= Fire demand, liters/min
- P= Reserve fire pumping capacity, liters/min
- T= Duration of the fire in min

The total reservoir storage can finally be worked out by adding all the three storages.