

Sub-Water and Waste water engineering

Module-1

(WSSE)

5th sem

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Dt-20th Aug

General requirement of water supply

The requirement of water for various purpose is divided into the following five categories.

- (i) Domestic purpose
- (ii) Public purpose
- (iii) Business or trade purpose
- (iv) Industrial purpose
- (v) Loss and waste.

(i) Domestic Purpose

The quantity of water required for domestic purpose is divided into following categories.

- (i) Drinking
- (ii) Cooking
- (iii) Bathing
- (iv) Household sanitary purpose
- (v) Private gardening and irrigation
- (vi) Domestic animals and private vehicles.

(ii) Civic or public purpose

The following are the example of water requirement for public purpose.

- (i) Road washing
- (ii) Sanitation purpose
- (iii) Ornamental purpose
- (iv) Fire demand

(iii) Industrial Purpose

The water is used for the industry in the form of

- (i) Factories
- (ii) Power station
- (iii) Railway and airport

(iv) Business and trade purpose :-

Some trades such as hotel, dairies, laundries, garages, restaurants, school, hospital require a large quantity of water.

(v) Loss and Waste :-

The quantity of water required under this category is unaccounted.

→ It includes ^{careless} use of water, leakage in pipe or in other fitting.

The Per Capita demand (q)

It is the annual average amount of daily water required by one person, and includes the domestic use, industrial and commercial use, public use, waste thefts etc, be expressed as,

$$\text{Per capita demand (q)} = \frac{\text{Total yearly water required in liter}}{365 \times \text{design population.}}$$

(lpdh)

Dt - 21st Aug

Factors affecting per capita demand

(i) Size of city :- The per capita demand for big cities is generally large as compared to that for smaller towns.

(ii) Climatic condition :- At hotter or dry places the consumption is more. In cold countries, more water may be consumed to avoid freezing.

(iii) Types of gentry and Habits of people :-

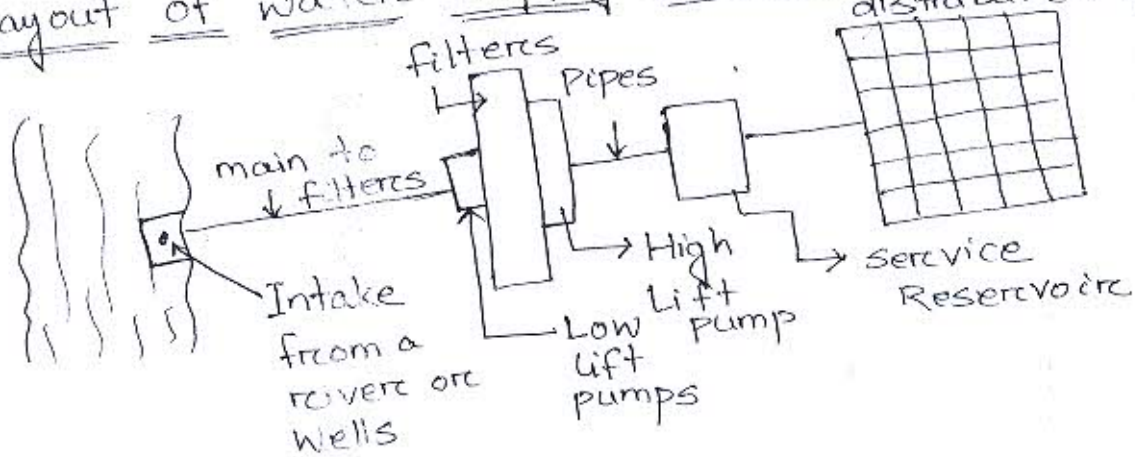
According to the living style water consumption varies.

(v) Quality of water supply :- If the quality and taste of the supplied water is good, it will be consumed more.

(v) Pressure in the distribution system :- If the pressure in the distribution pipe is high and sufficient to then consumption will be more.

(vi) Cost of water :- If the water rates are high, lesser quantity may be consumed by the people.

Layout of water supply schemes :-



21st Aug

Sources of water supply :-

The sources from which the water is available for water supply scheme is classified into two categories

- (i) Surface sources
- (ii) Under ground sources.

Surface sources

The water which is available from the surface of ground is known as surface sources.

- (i) Lake and stream
- (ii) Rivers
- (iii) Pond
- (iv) Storage reservoir.

(i) Lake :- A lake represent the body of water with impervious bed. So it is the source of water supply system. These water are free from undesirable impurities.

(ii) Rivers :- River is the main source of water supply system. The river is full of silt and suspended material. So river water can not use directly for public purpose.

(iii) Pond :- A pond is a man made body of standing water. The water in the pond are full of impurities and also small for intake.

(iv) Storage Reservoir :- An artificial storing of water by construction of dam across a valley is known as storage reservoir.

Underground source of water :-

In this type of source, the water that has percolate into the surface.

The following are the different underground sources of water,

(i) Infiltration galleries :-

- It is the horizontal or nearly horizontal tunnels which is constructed through the water bearing.
- The gallery is usually constructed of brick wall and the roof truss with slab roof.
- The gallery obtains its water from different water bearing strata.
- The gallery is laid at a slope and the water is collected in the gallery.

(ii) Infiltration Wells :-

- To obtain the large quantity of water the infiltration wells are sunk in series in the bank of a river.
- The water infiltrates through the bottom.
- At bottom sand bed is provided, so when pass through sand bed, it gets purified to some extent.

(iii) Spring :-

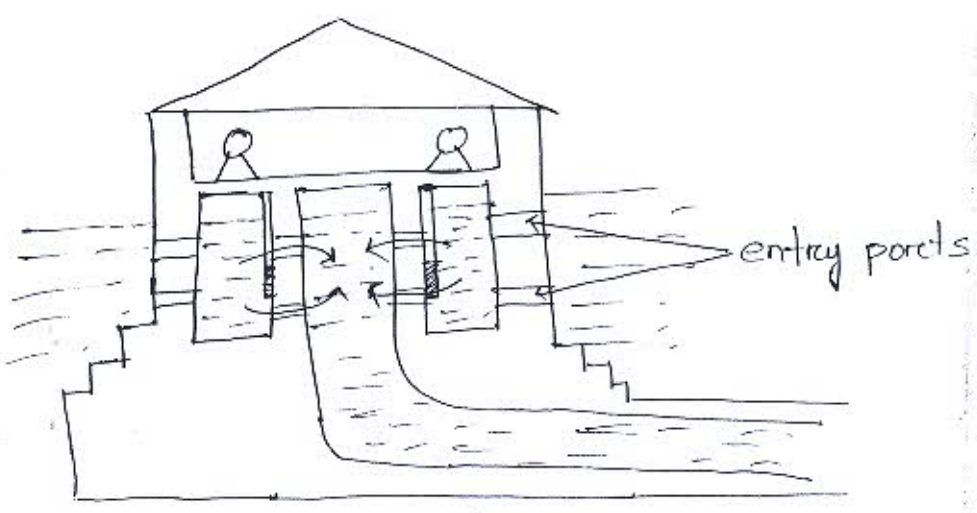
When the ground water appears at surface due to any reason is known as spring. It is source of water near the hilly area and base of hill.

- Artesian spring
- Gravity spring
- Surface spring

(iv) Wells :-

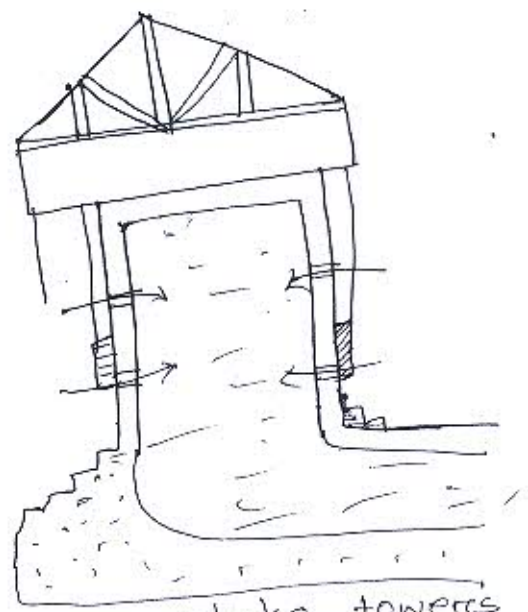
A well is an artificial hole or pit made in the ground for the purpose of tapping water. Different type of wells are :-

- (a) Shallow well
- (b) Deep well
- (c) Tube well
- (d) Artesian Well



Wet Intake towers

Canal Intake



Dry intake towers

24th Aug

Intake:-

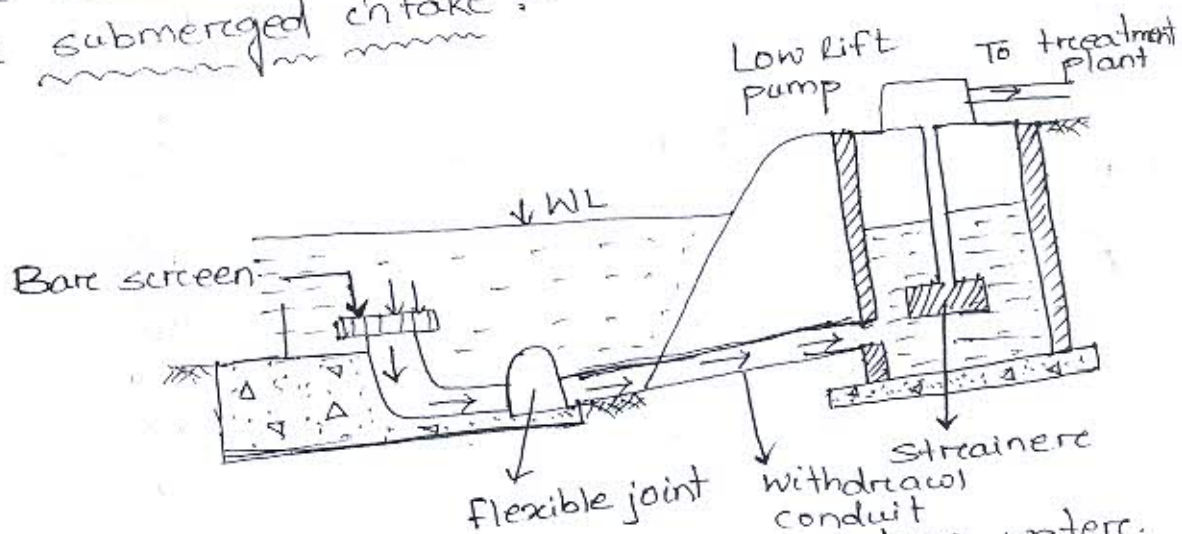
The basic function of the intake structure is to help in safely withdrawing water from the source and then to discharge this water into the conduit.

Factors governing the location of an Intake

- (i) As far as possible, the site should be near the treatment plant so that the cost of conveying water to the city is less.
- (ii) The intake must be located in the purer zone of the source so that the possible quality of water is withdrawn from the source, thereby reducing the load on the treatment plant.
- (iii) The intake must never be located at the downstream of disposal of waste water.
- (iv) The site should be such that sufficient scope for future addition and expansion be possible.

Types of Intake

- (i) Simple submerged intake:-



- ⇒ It consists of simple concrete block under water.
- ⇒ The intake openings are covered by screens so as to prevent the entry of debris, ice etc.
- ⇒ Such intake structure should be placed in streams or lakes at a place where they may not get buried under sediment.
- ⇒ They are used for small water project drawing water from river and stream.

(ii) Intake Towers

- They are widely used on large water supply projects drawing water from rivers or reservoirs having large change in water level.
- Gate controlled openings called ports are provided at various level in these concrete towers to regulate the flow.
- If the entry ports are submerged at all levels, there is no problem of any clogging or damage by debris etc.
- There are two major intake towers are,
 - (a) Wet intake towers
 - (b) Dry intake towers

Wet intake towers

- It consists of a concrete circular shell filled with water upto the reservoir level. It has a vertical pipe which is connected to the withdrawal pipe.
- Openings are made into the outer concrete shell as well as into the inside shaft.

Dry intake towers

- The water is directly drawn into the withdrawal conduit through the gated entry ports.
- It has no water inside the tower if its gates are closed.

(iii) Medium sized river Intake str

- Generally constructed for withdrawing water from almost all rivers.
- Classified into :-
 - (a) Twin well type
 - (b) Single well type.

(iv) Canal Intakes

- In case of canals, the intake well is generally located on the bank of the canal, and water enters the chamber through an inlet pipe covered with a fine screen.
- The water coming out of the chamber through the outlet conduit may be taken to the sump well or city.

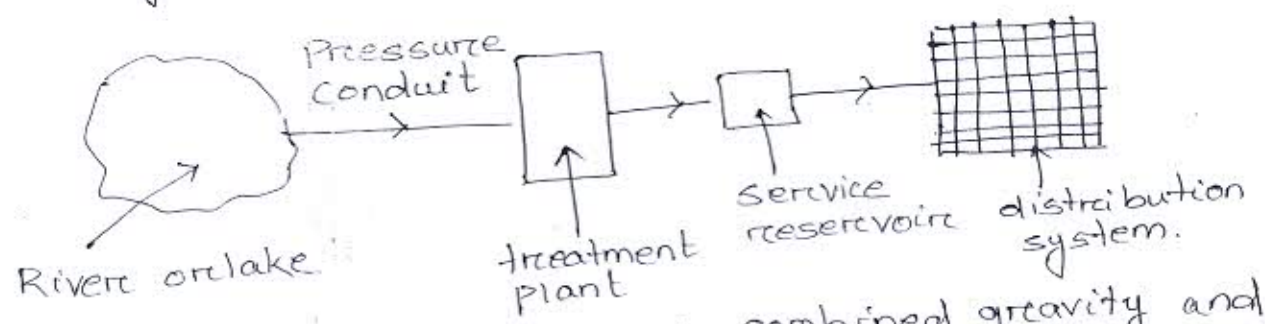
Pumping

In a water supply scheme, pumps are required at one or more of the following stages.

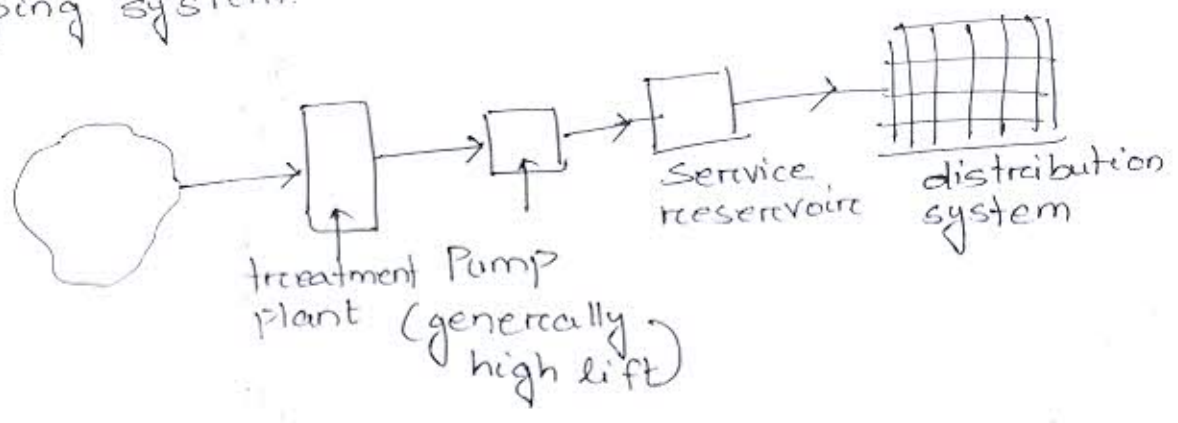
- (i) To lift the water at the source, when water can not flow by gravity into the mains.
- (ii) To lift the water at the treatment plant, if sufficient natural slope is not available.
- (iii) To lift the water after the treatment, so as to force the water in the distributing mains, either directly or through a service reservoir.
- (iv) When the pressure in the distributing mains has to be increased or boosted at some intermediate points within the distribution system, so as to enable the water reach up to the required height of three storeys.

⇒ The lifts and other operations which are commonly involved in different cases are sketched.

(a) Where absolutely no lift is required is a gravity flow system.



(b) Where partial lift is a combined gravity and pumping system.



(c) Where lift is a must, is a purely pumping sy

