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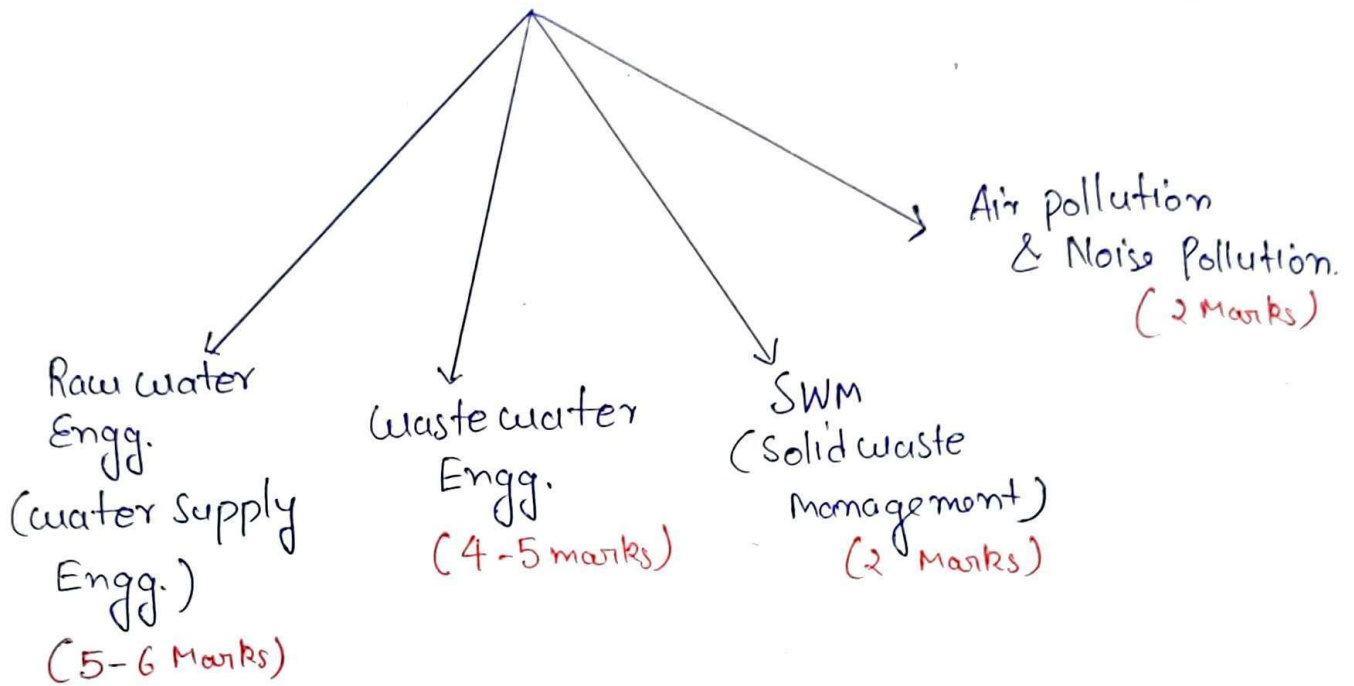
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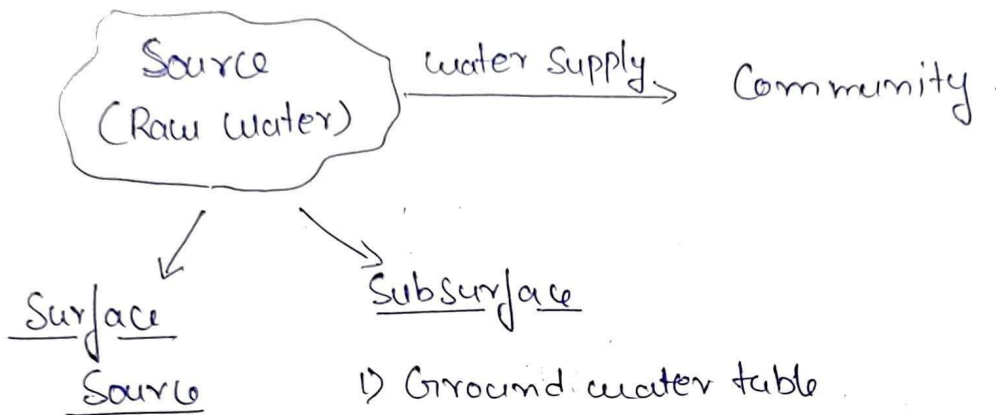
* ENVIRONMENTAL ENGINEERING (12-14 Marks)
(15-20 ESE)



* PRINCIPLE OF ENVIRONMENTAL ENGG. :-

- ① To protect environment against harmful impacts of Human.
- ② To protect human against harmful impacts of Environment.

I RAW WATER ENGI. { water supply Engg. }



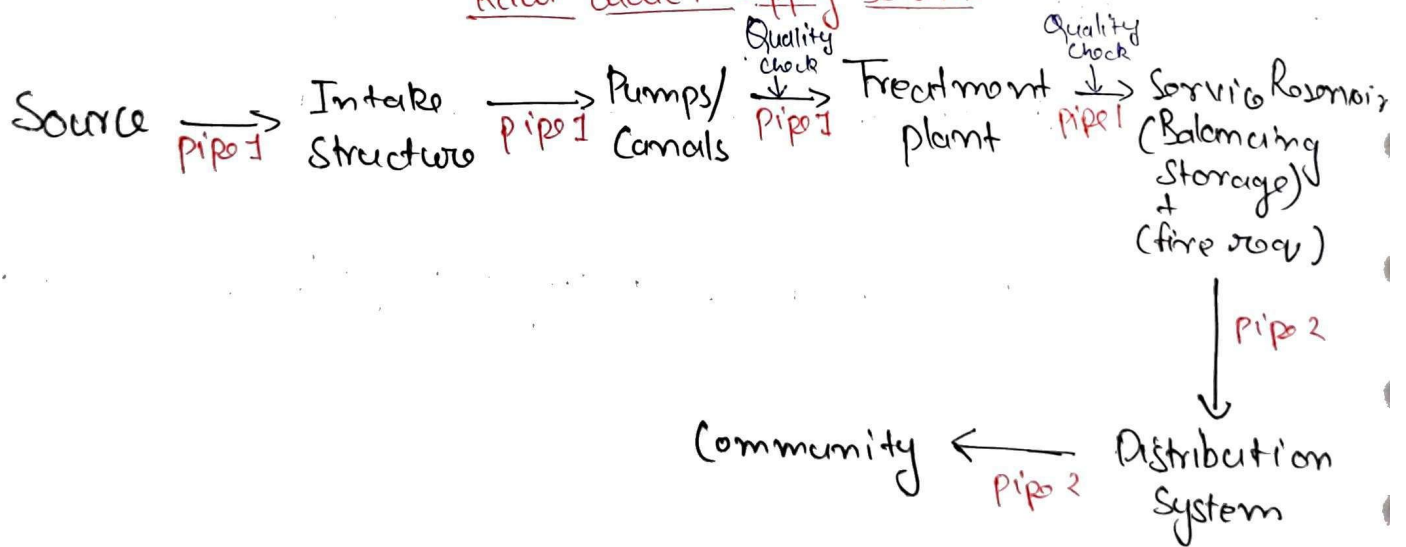
1) River

2) Lakes

3) Ponds

4) Ocean

Raw water supply scheme



CH 1: WATER DEMAND

- In order to Design Effective raw water Supply Scheme for a Community, we should know water Requirement of people living in the community.
- This water requirement is known as **Water Demand**.

* TYPES OF WATER DEMAND

1) ANNUAL AVG. WATER DEMAND:- Total Quantity of water Required by Population living in a Community in a given year.

It is represented as Volume (V). unit Liters (L)

2) ANNUAL AVG. DAILY DEMAND:- It is the total Quantity of water required by population of a Community in a given day of given year.

365 days → V

1 day → $\frac{V}{365}$ { for population P }

3) ANNUAL AVG. DAILY DL PER CAPITA DAILY DEMAND:-

It is Quantity of water required by 1 person living in a Community on a given day of year.

P → V/365 water in 1 day of year.

1 Person → $\frac{V}{365 \times P}$

$$\frac{V}{365 \times P} = \text{Liters Per Capita per day (LPCD)}$$

Hence, Annual Avg. per capita daily demand is represented as LPCD {Liters per capita per day}

* Depending upon per capita daily demand various kinds of demands are classified:- { IS 1172 : 1993 }
: 2012 }

- 1) DOMESTIC WATER DEMAND
- 2) INDUSTRIAL WATER DEMAND
- 3) INSTITUTIONAL WATER DEMAND
- 4) DEMAND FOR PUBLIC USE/UTILITY
- 5) LOSSES AND THEFT
- 6) FIRE DEMAND.

1) DOMESTIC WATER DEMAND:- water required to fulfill all the needs is known as Domestic water Demand.

As per IS 1172 :-

<u>DOMESTIC NEEDS</u>	<u>WATER DEMAND (LPCD) (Minimum)</u>
1) Drinking	5
2) Cooking	5
3) Bathing	55
4) Washing cloths	20
5) Washing utensils	10
6) Flushing	30
7) Washing floors	10
	<u>Total = 135 LPCD</u>

∴ Minimum Domestic water Demand = 135 LPCD

* FOR HIGI, Domestic water Demand l/c/w = (150-225) LPCD

* For LIGI, Domestic water demand = (135-225) LPCD

}
for full flushing system.

∴ Domestic water Demand for full

flushing system = (135-225) LPCD

→ If full flushing system does not exist, it contributes
- (90-110) LPCD

→ It contributes 50-60% of total water demand.

→ In general value can be taken as 200 LPCD {if not specified}

2) INDUSTRIAL WATER DEMAND:- It is the total quantity of water required to fulfill the demand of an industry in a community.

(IS 1172:2012)

<u>INDUSTRY</u>	<u>WATER REQ. (PER UNIT QUANTITY)</u>	<u>UNIT QUANTITY</u>
1) Automobile	40	vehicles
2) Distillery	120-170	Tonnes
3) Textiles	80-140	Tonnes
4) Fertilizer	80-120	Tonnes
5) Paper	200-400	Tonnes
6) Special type of water	400-1000	Tonnes
7) Straw board	75-100	Tonnes
8) Petroleum	1-2	Tonnes (crude oil)
9) Sugar	1-2	Tonnes (cane)
10) Steel	200-250	Tonnes
11) Leather.	40	Tonnes.

→ Since extent of industrialisation in a community cannot be judged, it shows Maximum Variation.

→ Standard Value can be taken as (40-45) LPCD.

→ Hence for Designing Raw Water Supply Scheme, industrial water plays an important Role.

→ Avg. value can be taken as 250 LPCD

3) INSTITUTIONAL WATER DEMAND:-

→ Quantity of water required to fulfill the demand of Institutes.

<u>INSTITUTES</u>	<u>WATER DEMAND (LPCD)</u>
1) Office	45-90
2) Factories	45-90
(a) with bathroom	< 30-60
(b) without bathroom	
3) Schools	45-90
(a) Day school	135-225
(b) Residential School	
4) Hostel's	135-180
5) Hotel	180 L/bed/ person
6) Restraunt	70 L/ seat /day
7) Nursing homes	135-225
Δ Medical Quators	
8) Hospital (a) Beds < 100	340 L/Bed/day
(b) Beds > 100	450 L/Bed/day

→ Institutional water Demand is also known as "Commercial water Demand"

→ It contributes to 20-50 LPCD

4) DEMAND FOR PUBLIC UTILITY / USE :- It is water Required to fulfill the needs of public, other than Domestic needs :-

like Road washing, Gardening, Sprinkling, public play grounds, Park etc.

→ The standard value can be taken as (10-20) LPCD

→ It contributes to (5-6)% of total Demand.

5) LOSSES AND THEFT :- Truly speaking, it is not a water Demand, but plays a significant Role while designing Raw water Scheme.

→ When a large network of pipes are provided, they joined with the help of various Joints.

wherever joints are provided, there is a possibility of leakages, hence water is lost.

→ Due to some unauthorized and illegal connections, certain quantity of water is being lost as "theft".

→ It contains 10-15% of total water Demand.

6) FIRE DEMAND :- Amount ^{or Quantity} of water required to extinguish fire in a community if it breaks out.

→ Minimum 1 LPCD of water is required as per code.

→ Fire demand can be estimated Empirically :-

★★★ Grade
(a) GIOI Manual Formula

★★★ Grade
(b) Kuchling's Formula

★★★ Grade
(c) Buston's Formula

★★★ PSC
(d) National Board of Fire underwriter's (NBFIU) Formula

★★★ PSC
(e) Freeman's Formula.

1) GIOI MANUAL FORMULA :-

$$Q_{FD} = 100\sqrt{P}$$

Q_{FD} = Fire demand (kiloliters/day)

P = Population {in thousands}

2) KUCHLING'S FORMULA

$$Q_{FD} = 3182\sqrt{P}$$

Q_{FD} = Fire demand (L/d min)

P = Population {in thousands}

3) BUSTON'S FORMULA

$$Q_{FD} = 5663\sqrt{P}$$

Q_{FD} = Fire demand {L/min}

P = Population {in thousands}