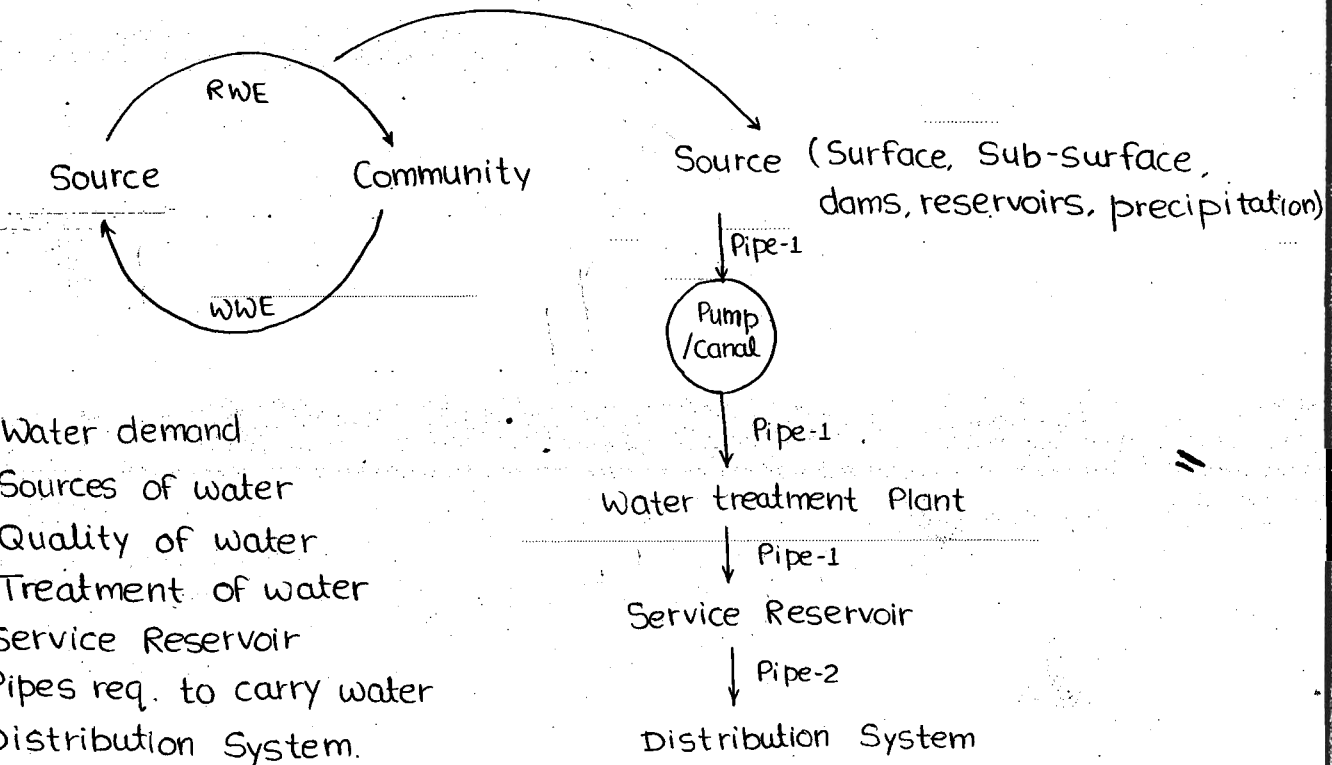
Environmental Engineering

- Raw water Engi.
- Waste water Engi.
- Air & Noise Pollution



* Water demand
* Sources of water
** Quality of water
** Treatment of water
* Service Reservoir
* Pipes req. to carry water
* Distribution System.

Water Demand.

- Any sample of water which is been utilized from the natural source & is not being subjected to artificial treatment is termed as raw water.
- Before designing the raw water scheme, following quantities are being computed -

i) Total amount of water req. in the community in 1 year (Note- Annual draft.)

ii) Total amount of water req. in the community in 1 day (Annual average daily draft)

iii) Total amount of water req. in the community in 1 day by each individual (Annual average per capita daily draft)

The total demand of the water consist of the following -

i) Domestic water demand :- It is the amount of water req. to satisfy the domestic needs ~~by~~ like drinking, cooking, washing, bathing etc.

For a city having full flushing system - it is in the range of 135-225 lit/c/d. Normally taken to be 200 lit/c/d.

ii) Industrial water demand :- It is the amount of water req. to satisfy the industrial needs.

Depending upon the extent of industrialisation, it is in the range of 50-450 lit/c/d.

iii) Institutional water demand :- It is the amount of water req. to satisfy the needs of diff. institutes in the community like - schools, hospitals, railway station, airport etc.

It is in the range of 20-50 lit/c/d.

iv) Water for Public use :- It is the amount of water req. for public utility purposes like washing of roads, gardening etc.

It is taken to be 5-6% of total demand of water. (10-20 lit/c/d)

v) Fire demand :- It is the amount of water req. in case fire breaks out. It is taken to be 1 lit/c/d & can also be found empirically as follows -

$FD = 100\sqrt{P}$ (kl) or $FD = 4637\sqrt{P}(1 - 0.01\sqrt{P})$ (l/min)

↑ GOI Manual ↑ National board of fire under writers method.

P → Population (in thousand)

vi) Losses & theft :- It is the amount of water which is being wasted out due to leakages & theft in raw water scheme. It may extend upto 10-15% of total demand of water.

Unless given fluctuation in the demand of water are taken as follows -

i) Max. daily demand = 1.8x Annual avg. daily demand.

Max. hourly demand of max. day $= (1.5) \times$ (hourly variation factor) $\times$ Avg. hourly demand of max. day

$$= 1.5 \times \frac{\text{Max. daily demand}}{24}$$

$$= 1.5 \times 1.8 \frac{\text{Annual avg. daily demand}}{24}$$

Max. hourly demand of max. day $= 2.7 \times$ Annual avg. hourly demand $\left(\frac{V}{365 \times 24}\right)$

Note:- % ratio of Max demand to the avg. demand for any duration can be computed using goodrich eq as follows-

$$P = \frac{\text{Max. demand}}{\text{Avg. demand}} = 180\, t^{-0.1}$$

t = time (days)

$t \geq 1$ day

Demand - fluctuation

Hourly - 2.7
Daily - 1.8
Weekly - 1.48
Monthly - 1.28
Yearly - 1

Fluctuation in hourly demand is observed to be max. & it tapers off from hourly to yearly demand due to increase in sample size.

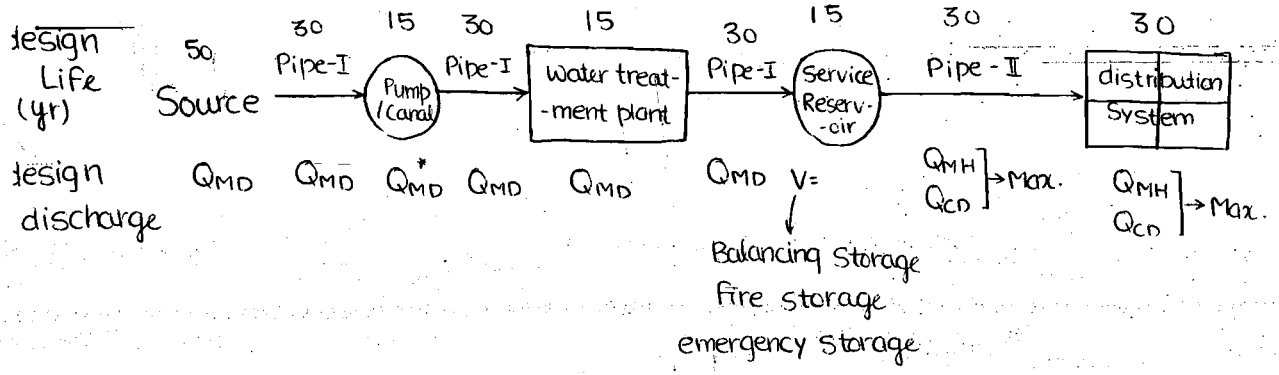
Fluctuation in hourly demand is termed as peak factor which also depends upon the population as follows.

Population	Peak factor
< 50000	3
50000 - 200000	2.5
> 200000	2

Coincident demand:- It is defined as the aggregate of max. daily demand & fire demand.

$$\left.\begin{array}{l} Q_{MH} \\ Q_{MH} + Q_{FD} \\ Q_{MD} + Q_{FD} \end{array}\right\} \begin{array}{l} Q_{FD} = Q_{MH} \\ = Q_{CD} \end{array} \Big]_{Max}$$

-design life & design discharge of different component in raw water scheme are as follows -



Q- A city with the population of 1.8 Lakh has per capita water demand of 300 lit/day. It is to be provided with the water supply scheme. Report the imp. type of demand of this water supply scheme & also indicate the design capacity of different components of this water supply scheme.

Annual avg. daily demand = $300 \times 1.8 \times 10^5 \times 10^{-6}$

$q = 54$ MLD

Max. daily demand $Q_{MD} = 1.8 \times q = 97.2$ MLD

Max. hourly demand $Q_{MH} = 2.7 \times \frac{q}{24} = 6.075$ MLH

or

145.8 MLD

Fire demand $Q_{FD} = 4637\sqrt{P}\,(1 - 0.01\sqrt{P})$

$= 4637\sqrt{180}\,(1 - 0.01\sqrt{180})$

$= 53865.28$ ℓ/min

$= 53865.28 \times 10^{-6} \times 60 \times 24$

$= 77.56$ MLD