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Water Demand

Environmental Engineering-I

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Intake work, Demand of water,

Intake Work

The basic function of the intake structure is to help in safely withdrawing water from the source over predetermined pool levels and then to discharge this water into the withdrawal conduit (normally called intake conduit), through which it flows up to water treatment plant.

Intake wells

Factors Governing Location of Intake

- As far as possible, the site should be near the treatment plant so that the cost of conveying water to the city is less.

- The intake must be located in the purer zone of the source to draw best quality water from the source, thereby reducing load on the treatment plant.

- The intake must never be located at the downstream or in the vicinity of the point of disposal of wastewater.

- The site should be such as to permit greater withdrawal of water, if required at a future date.

- The intake must be located at a place from where it can draw water even during the driest period of the year.

- The intake site should remain easily accessible during floods and should not get flooded. Moreover, the flood waters should not be concentrated in the vicinity of the intake.

Water Quantity Estimation

The quantity of water required for municipal uses for which the water supply scheme has to be designed requires following data:

Water consumption rate *(Per Capita Demand in litres per day per head)*

Population to be served.

Quantity= Per capita demand x Population

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WATER DEMAND......................

Introduction

Average person consumes no more than 5 to 8 lit. of water per day.

However total water drawn from public water supply is quite high.

Types of demand

1. Residential or domestic
2. Institutional use
3. Public or civic use
4. Industrial use
5. Water system loses

1. Domestic use

Water is needed for

- Drinking

- Cooking

- Bathing

- Washing of cloths

- Washing of utensils

- Washing of house

- Flushing of WCs

As per **IS 1172-1957** water consumption is 135 lpcd

Water requirement for domestic purposes

S. No.	Description	Amount of water in lpcd
1	Bathing	55
2	Washing of cloths	20
3	Flushing of WCs	30
4	Washing of house	10
5	Washing of utensils	10
6	Cooking	5
7	Drinking	5
	Total	135

Consumption of water for animal and Live stock

S. No	Animals	Water consumption in lit per animal per day
1	Cow and buffalo	40 to 60
2	Horse	40 to 50
3	Dog	08 to 12
4	Sheep and goat	05 to 10

Water for domestic and non-domestic needs

Description	Amount of water (lpcd)
1. For communities with population up to 20,000	40 (min.)
a) Water supply through stand post	70 to 100
b) Water supply through house service connections	
2. For communities with population 20.000 to 1,00,000	100 to 150
3. For communities with population above 1,00,000	150 to 200

2. Institutional use

S.No.	Institution	Water requirement (lit/head/day)
1	Hospitals (including laundry) a. No of beds exceeding 100 b. No of beds not exceeding 100	 450 (per bed) 340 (per bed)
2	Hotels	180 (per bed)
3	Hostels	135
4	Nurse's home and medical quarters	135
5	Boarding schools and colleges	135
6	Restaurants	70 (per seat)
7	Airports and seaports	70

8	Junction stations and intermediate stations	70
9	Terminal stations	45
10	Day schools and colleges	45
11	offices	45
12	factories	45
13	Cinema, concerts halls and theaters	15

3. Public or Civic use

- Road washing → 5 lit/cap/day
- Sanitation → 3 to 5 lpcd
- Public parks → 2 to 3 lpcd
- Fire fighting → calculated by various formulae
- P= Population in thousands
- Q= Quantity of water in Lit/min
- F= number of simultaneous fire streams

	Authority	Formulae (P in thousand)
1	American Insurance Association (National Board of Fire underwriters formula)	Q (L/min)=4637 $\sqrt{P}$ (1-0.01 $\sqrt{P}$)
2	Kuchling's Formula	Q (L/min)=3182 $\sqrt{P}$
3	Freeman's Formula	Q (L/min)= 1136(P/5+10) and F=2.8 $\sqrt{P}$
4	Ministry of Urban Development Manual Formula (MUD)	Q (kilo liters/d)=100 $\sqrt{P}$ for P>50000
5	Buston's formula	5663 $\sqrt{P}$

Problems on fire demand (Home work)

1. Compute fire demand for cities having population

i.   1,40,000

ii. 3,50,000

iii. 40,000

iv. 35, 000

Use all formulae

Ans

Industry	Unit of production	Water requirement in kilolitres per unit
1. Automobile	Vehicle	40
2. Distillary	Kilolitre (proof alcohol)	122–170
3. Fertilizer	Tonne	80–200
4. Leather	100 kg (tonne)	4
5. Paper	Toone	200–400
6. Special quality paper	Toone	400–1000
7. Straw board	Tonne	70–100
8. Petroleum refinery	Tonne (crude)	1.5–2.0
9. Steel	Tonne	200–250
10. Sugar	Tonne (cane crushed)	1–2
11. Textile	100 kg (goods)	8–14

5. Water System Losses

1. Leakages and overflows from reservoirs
2. Leakages from main and service pipe connections
3. Leakages and losses on consumers premises
4. Leakage and losses from public taps
5. Under registration of water meters (Water thefts)

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# WATER DEMAND (CONTINUED . . . . . .)

Factors Affecting rate of demand

- **Size of the city:** Per capita demand for big cities is generally large as compared to that for smaller towns as big cities have sewered houses.

- **Presence of industries:** more the industries more will be the water required

- **Climatic conditions:** in winter seasons lesser water demand and in summer season water demand is more

- Habits of people and their economic status i.e. standard of living
- Lawn Sprinkling
- <u>Age of community-</u> new community →more water and vice-versa
- <u>Quality of water:</u> If water is aesthetically and medically safe, the consumption will increase as people will not resort to private wells, etc.
- <u>Pressure in the distribution system:</u> more pressure more will be demand and vice versa.

- **<u>Efficiency of water works administration:</u>** Leaks in water mains and services; and unauthorised use of water can be kept to a minimum by surveys.

- **<u>Cost of water-</u>** more cost less use and vice-versa.

- **<u>Policy of metering and charging method:</u>** Water tax is charged in two different ways: on the basis of meter reading and on the basis of certain fixed monthly rate.

- **<u>System of supply-</u>** continuous system increases water use whereas intermittent system

Variation in water demand
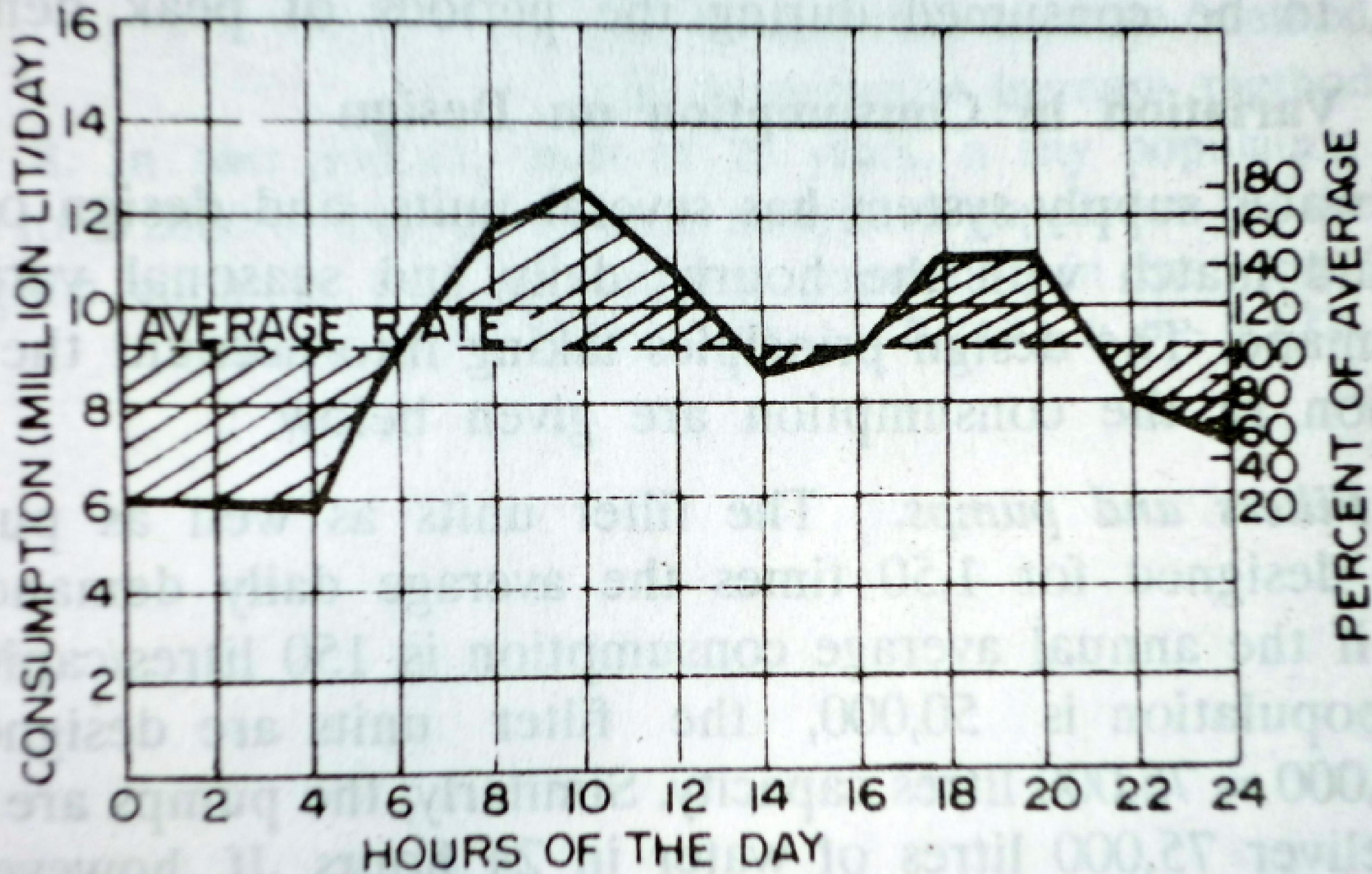
Seasonal variation: The demand peaks during summer. Firebreak outs are generally more in summer, increasing demand. So, there is seasonal variation .

Daily variation depends on the activity. People draw out more water on Sundays and Festival days, thus increasing demand on these days.

Hourly variations are very important as they have a wide range. During active household working hours i.e. from six to ten in the morning and four to eight in the evening, the bulk of the daily requirement is taken. During other hours the requirement is negligible. Moreover, if a fire breaks out, a huge quantity of water is required to be supplied during short duration, necessitating the need for a maximum rate of hourly supply.

Objective Questions

1. As per IS 1172-1957, water demand for bathing is __ lpcd.

2. As per IS 1172-1957, water demand for cooking and drinking is __ lpcd respectively.

3. For restaurants _____ lit/seat/day water is required.

4. In different fire demand formulae fire demand Q is expressed in _____.

5. For 1 lac population, fire demand by Buston's formula is _____.

6.In national board of underwriters formula P indicates _____.

Theory Questions

1. Write short notes on the following

i.   Various types of Water demand

ii. Fire demand

iii. Intake structures

2. Explain factors affecting water demand