Water Demand Supply & Distribution (CE-562)
Lecture - 2

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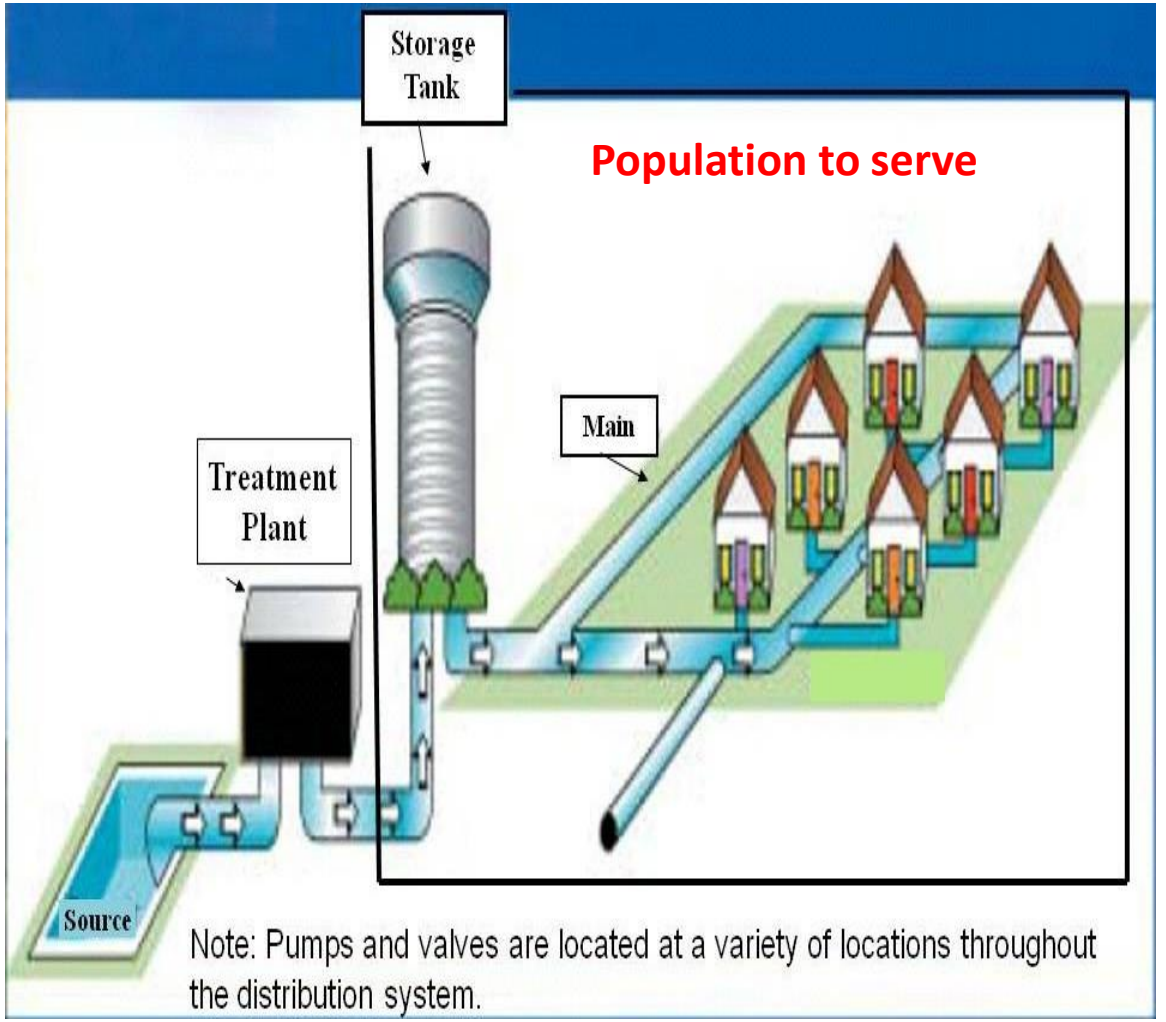
COMPONENTS OF WATER SUPPLY SYSTEM

1. Source
2. Treatment system **(Optional)**
3. Storage Tanks/Reservoirs
4. Water Transmission / Distribution System



Water Demand Forecasting / Estimation

- Estimating water demand for which Water Supply Systems to be designed requires two basic parameters:

1. Water consumption rate (Per Capita Demand in liters per day)
2. Population to be served

Water Demand = Per capita demand x Population

Water Demand is normally calculated for daily usage.

Types of Water Demands

- It is very difficult to assess the quantity of water required by the public, since there are many factors affecting water consumption. Various types of water demands in a city / locality:

1. Domestic water demand
2. Industrial demand
3. Institution and commercial demand
4. Demand for public use
5. Fire demand
6. Loses and wastes

Types of Water Demands

1. Domestic water demand

- Water required in the houses for drinking, bathing, cooking, washing etc.
- Domestic water demand mainly depends upon the habits, social status, living standards and climatic conditions of the area.

2. Industrial demand

- Water required in the industries mainly depends on the type of industries, which are existing in the city.
- The water required by factories, paper mills, cloth mills, Cotton mills, Breweries, sugar refineries etc. comes under industrial use.

Types of Water Demands

3. Institution and commercial demand

- Universities, Institutions and commercial centers including office buildings, warehouses, stores, hotels, shopping centers, health centers, schools, cinema houses, railway and bus stations etc come under this category.

4. Demand for Public Use

- Quantity of water required for public utility purposes such as for washing and sprinkling on roads, cleaning of sewers, watering of public parks, gardens, public fountains etc. comes under public demand.

Types of Water Demands

5. Fire demand

- During the fire breakdown large quantity of water is required to extinguish it, therefore provision needs to be made especially in urban areas to supply sufficient quantity of water or keep as reserve in the water mains for this purpose.

- Kuiching's formula may be used for fire demand as given below

$$Q = 3182\sqrt{p}$$

Where 'Q' is quantity of water required in liters/min
'P' is population of town or city in thousands

Types of Water Demands

6. Losses and Wastes

- It includes losses due to defective pipe joints, cracked and broken pipes, faulty valves and fittings.
- Losses due to continuous wastage of water.
- Losses due to unauthorized and illegal connections.

Types of Water Demands

Water Consumption for Various Purposes

	Types of Consumption	Normal Range (lit/capita/day)	Average	%
1	Domestic Consumption	65-300	160	35
2	Industrial and Commercial Demand	45-450	135	30
3	Public Uses including Fire Demand	20-90	45	10
4	Losses and Waste	45-150	62	25

Factors Affecting Water Demands

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

2. **Presence of industries**

3. **Climatic conditions**

4. **Economic status**

5. **Pressure in the distribution system**

Factors Affecting Water Demands

6. **Quality of water:** If water is aesthetically & hygienically safe consumption will increase.

7. **Efficiency of water works administration:** Leaks in water mains and services; and unauthorized use of water increases water uses.

6. **Cost of water**

7. **Policy of metering and charging method:** Water tax is charged in two different ways: on the basis of meter reading and on the basis of certain fixed monthly rate. So these charging methods affects water consumption.

Factors Affecting Water Demands

- An adequate quantity of water must be available to meet the peak demand.
- To meet all the fluctuations - pumping machinery , supply main, service reservoirs and distribution pipes must be properly designed.
- The effect of weekly / daily variation influences the design of storage reservoirs and the hourly variations influences the design of pumps and service reservoirs.

Design Period of Water Supply Schemes

- The future period for which a provision is made in the water supply scheme is known as the **design period**. Design period is estimated based on the following:

1. Useful life of the system components, wear & tear etc.

2. Expandability aspect.

3. Anticipated rate of growth of population, including industrial, commercial developments & migration etc.

4. Available resources / funds

5. System Performance .

Population Forecasting

1) Arithmetical Increase Method

- This method is based on the assumption that the rate of change of population with time is constant.

- This method is suitable for large and old city with considerable development. If it is used for small, average or comparatively new cities, it will give lower population estimate than actual value.

- In this method the average increase in population per decade is calculated from the past census reports. This increase is added to the present population to find out the population of the next decade / forecasting period.

Population Forecasting

1) Arithmetical Increase Method

- Thus, it is assumed that the population is increasing at constant rate:

- Therefore population after nth decade will be **Pn : P(1+ n*r)**

Where **Pn** is the projected population , **n** is the number of decades or years , **P** is the present population and **r** is the annual growth rate.

Population Forecasting

2) Geometrical Increase Method

- In this method the percentage increase in population from decade (year) to decade (year) is assumed to remain constant.

- Since this method gives higher values and hence should be applied for a new industrial town at the beginning of development for only few decades.

- Formula used for Geometric population forecasting is given as:

$$\mathbf{Pn: P(1+r)^n}$$

Thank You