Water Treatment Reservoirs : Underground Water Reservoir (UGR)

Municipal water supply sources, from water treatment plants, operate best at steady, design rates over relatively longer periods of time. However, demand in the water treatment distribution system constantly fluctuates. Most water treatment distribution systems experience short-term peak demands, which exceed the available rate of supply. **Underground service reservoir** provides a suitable reserve of treated water to supply by pumping arrangement from water treatment plant to distribution system during the distribution process.

1. Functions of Service Reservoirs

Service reservoirs are provided in the water treatment distribution system for the following functions:

- To equalize the variation in hourly demand of water by the consumers to a uniform rate of supply from the source by pumping,
- To maintain the desired minimum residual pressure in the distribution system,
- To provide the required contact time for the disinfectant added in order to achieve effective disinfection, and

2. Types of Storage Reservoirs

Service reservoirs can be of two types; balancing reservoir and service reservoir. Further they can be elevated reservoir (ER), also called Over Head Reservoir **(OHR)** or ground level reservoir (GLR), also called **Underground Reservoir (UGR).** ERs provide the necessary pressure in the distribution system while UGR serve as suction sumps for pumps.

Underground Reservoirs

Underground reservoirs, also known as sumps serve as suction sources for pumps. These reservoirs normally are built at the site of a supply source. It is common to design a well pump station where number of well pumps discharges to an onsite reservoir. Water treatment plants also commonly have large reservoirs to hold treated water. Service pumps draw water from the reservoir and discharge into the transmission and distribution system. The reservoir at the water treatment plant or well source can be either completely buried, partially buried or completely above grade. The onsite reservoir at each well site can help to solve potential water quality problems. Water discharged from wells often contains dissolved gases and silt or grit. If this water goes through a reservoir, the gases will dissipate and the grit will settle to the reservoir bottom and these problems could be eliminated. These underground reservoirs can also be used to provide storage for a portion of the overall storage volume needed in the system.

3 Storage Volume of Reservoirs

The volume of water storage needed depends upon the following:

1. Maximum rate of peak hourly demand,
2. Maximum rate of pumping, and
3. Duration and actual schedule of pumping and distribution in a day.

Volume of storage to be provided in the reservoirs and the rate of pumping are so fixed to permit the pumping at average rate during the period of maximum demand. For electrically operated pumps, the maximum duration of pumping is limited to 23 hours in a day leaving 1 hours rest during lean demand period. However, two shifts of 8 hours each totaling 16 hours pumping is commonly adopted. In very large water supply systems three shifts of 8 hours pumping, totaling 24 hours with dedicated electrical feeder line for power supply is practiced considering the economics of the transmission main. Diesel generators are also provided at the pumping station as redundant power to facilitate uninterrupted operation of pumps.

The general norms for volume of storage required with reference to duration of supply from the source are listed in Table

Volume of Storage Required Duration of Supply or Pumping	**Volume of Storage as percentage of daily requirement**
Above 16 to 24 hours	20 to 25%
Above 12 to 16 hours	33.33%
Above 8 to 12 hours	50%
Less **than 8 hours**	**100%**

The optimum volume of water treatment storage in the reservoirs can be determined from the duration of supply and the actual demand during different time period of distribution using the mass diagram method. The day is divided into number of periods of different rate of demands. For each of the durations the demand, the supply, cumulative demand, cumulative supply and cumulative deficits are worked out. The volume of water treatment storage required is the absolute sum of the maximum positive and negative cumulative deficits. This volume of water treatment storage should be provided in the service reservoir. Please wide the example in above table where volume of storage has been worked out for a typical situation.

The urban water supply system could have all of its storage in elevated tanks; but such practice may be very expensive. Providing a portion of the required volume in the underground water treatment storage reservoir is a solution to optimize the cost of the system.