CE-05/CE-2K6

Types of Distribution Reservoirs

The distribution reservoirs may be made of steel, R.C.C., or masonry. Depending upon their elevation with respect to the ground, they may be classified into the following two types:

1. Surface reservoirs/ ground reservoirs and
2. Elevated reservoirs.

Surface reservoirs/ ground reservoirs

The surface reservoir is suitable in gravity system of supply. It is constructed below the ground surface or just on the ground surface according to the condition of the site. It is rectangular or circular tank constructed with brick masonry or R.C.C. The tank is plastered with rich cement mortar and finished with neat cement polish. The storage capacity depends on the water requirement of the scheme. The water from the treatment plant is stored in the tank. As shown in the figure, the wash pipe is provided at the bottom. The outlet pipe is provided about [illegible] above the bottom level of the tank.

Elevated reservoirs

The elevated reservoirs are constructed high above the ground. The height of the reservoir depends on the pressure head to be developed to supply water to all points of the distribution zone. The shape of the tank may be circular or elliptical. Normally, the pump runs at a constant speed to meet the average demand. But in slack period the excess water is stored in the reservoirs. At the period of peak demand, the water is supplied by pumping as well as from the reservoir. So, such types of reservoirs are essential in dual systems of water supply.

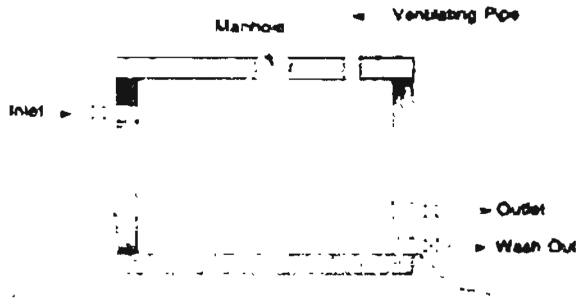


Fig.: Surface reservoirs

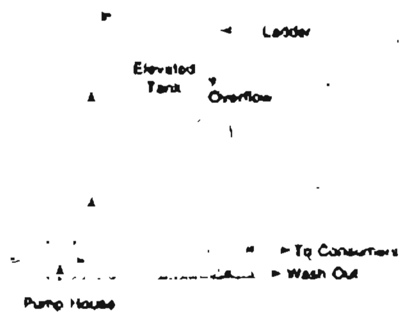
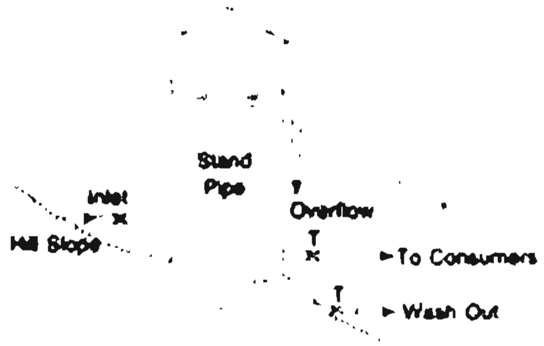


Fig.: Elevated reservoir

Stand pipe

Stands pipes are a kind of elevated tanks without any erected towers for resting the tank body. It is a vertical cylindrical tank constructed of steel or R.C.C. It consists of inlet pipe, overflow pipe, wash pipe, distribution pipe and other miscellaneous facilities, such as manholes, ladders, etc. for inspection, repairs and maintenance. The water from the surface sources like natural lake, stream, spring etc. is stored in this tank by pumping and then distributed to the consumers by force of gravity. The diameter of stand pipe varies from 8 m ~ 12 m and its height varies from 10 ~20 m. This system is suitable for hilly areas.



Collection of surface water

Intake:

An intake is a structure which is constructed at a surface water source to facilitate for conveys of water to the treatment plants either by gravity or into a pump when pumping is required.

A water intake consists of the following components-

1. Intake Structure
2. A conduct with protection works
3. Inlets (A narrow passage of water, as between two islands.)
4. Screen
5. Gates or valves

Selection of intake point

Following points should be considered while selecting the site for intake works

1. The intake point should satisfy the condition for the availability of water throughout the year.
2. The water at the site should be more or less clear so that excessive treatment is avoided.
3. The intake site should be easily accessible.
4. The site should not be on the curve of a river.
5. The site should not be selected at the zone of heavy current which may damage the structure of intake works.
6. The site should not be at the zone of the river where pollution of water is suspected.
7. The site should be selected as near as possible to the treatment plant to reduce the conveyance cost.

Classification of Intake

Intake works may be of various types depending on the available source of surface water. Generally the intake may be of following types:

1. River intake
2. Lake intake
3. Reservoir intake
4. Canal intake

1. River intake

A circular or rectangular sump (A low-lying place, such as a pit, that receives drainage) well is constructed with masonry work in the bank of the river in such a way that the water can enter the well in both the conditions such as H.F.L and L.W.L. The water enters the sump well through the pipes installs at different levels. Screens are provided at the end of the pipes to eliminate suspended matters. A main suction pipe having strainer at the bottom is inserted into the sump well. The main pipe is connected to the pumping unit which delivers water to the treatment plant.

The site condition will guide the type of structure to be constructed. Sometimes intake works may be constructed in the middle of the river. In that case, all precautions should be taken to protect the structure from silting and heavy current of the river.

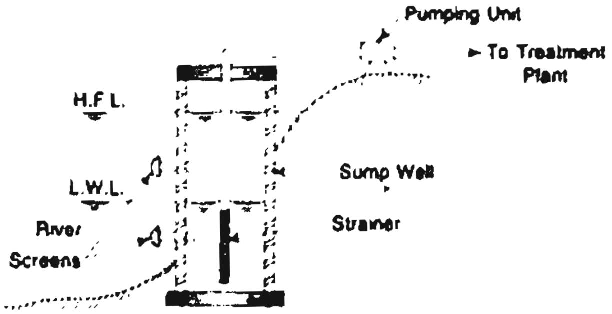


Fig.: River intake

2. Lake Intake

A submersible rectangular chamber is constructed at the bed of the lake from where water can be available throughout the year. The top cover of the chamber consists of several holes having grating on it to prevent the entry of debris, weeds, aquatic lives etc. into the chamber. A bell mouthed pipe is provided in the chamber which contains screen at the top. The bell mouth pipe is connected to the pumping unit through the suction pipe as shown in the figure. The pump house draws water from the chamber and delvers that to the treatment plant.

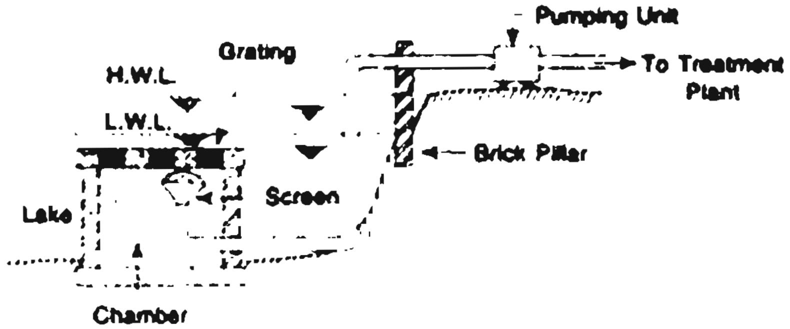


Fig.: Lake Intake

3. Reservoir Intake

If an inundation river becomes the only nearby source of water for a town, then weir or low dam may be constructed across the river to form a reservoir. The dam may be earthen or gravity type which depends on the site condition. However, an intake well is constructed on the body of the weir or dam in such a way that the water can be tapped throughout the year. Intake pipes with screens at its ends are fitted at different levels to a vertical pipe which is provided inside the well. The vertical is again connected to the pumping unit as shown in the figure. The pumping unit draws water from the reservoir directly and delivers it to the treatment plant.

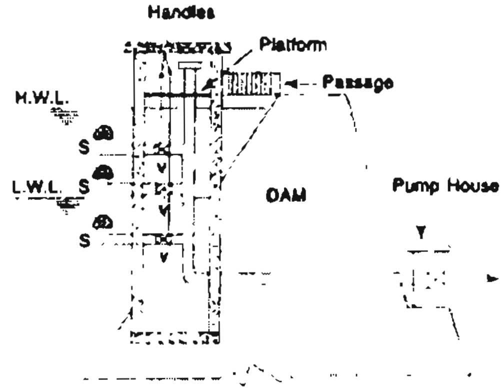


Fig.: Reservoir Intake

4. Canal Intake

If a canal becomes a source for a town, then an intake well is constructed by the bank of the canal. The well may be circular or rectangular and it is constructed with masonry work. An inlet pipe is inserted into the well for drawing water. On the canal side, the well consists of an opening with screen as shown in the figure. The intake pipe is extended below the lowest water level of the canal and it carries a hemispherical screen at the end. A manhole is provided on the well cap for inspection work. The intake pipe is connected to the pumping unit for sending water to the treatment unit.

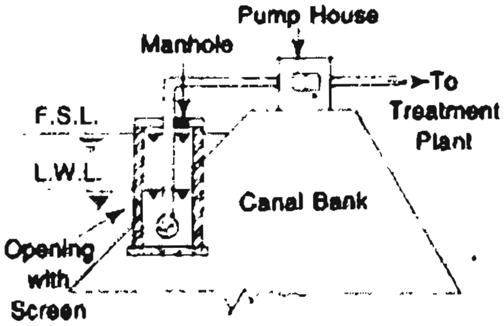


Fig.: Canal Intake

Intake velocity and depth

Intake entrance should lie 10 to 15 ft below the water surface but 4 to 6 ft above the rivers or lake bottom. Entrance velocity of water is limited to 3 ~ 4 in/sec. Screens at 2 to 8 mesh per inch are provided at the intake entrance.

Intake design Consideration

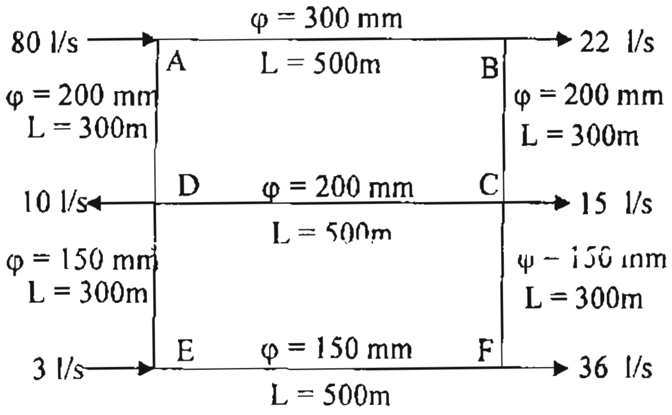
1. Selection of a particular type for the given source.
2. Consideration of the total hit from the sources to the treatment plant and selecting of a suitable pumping limits.
3. Deformation of the total length of section and delivery means head losses due to friction and bends enlarge and construction.
4. Selection of a suitable screen to provide around the intake by not to permit entry of large and small floating & suspended objects.
5. Installation of intake valves or port-holes (An opening in a fortified wall; an embrasure) at two or three different levels to get best available quality of water.
6. Cost- benefit ratio.
7. Assume of safety
8. Stand by units.

Requirements of Distribution System

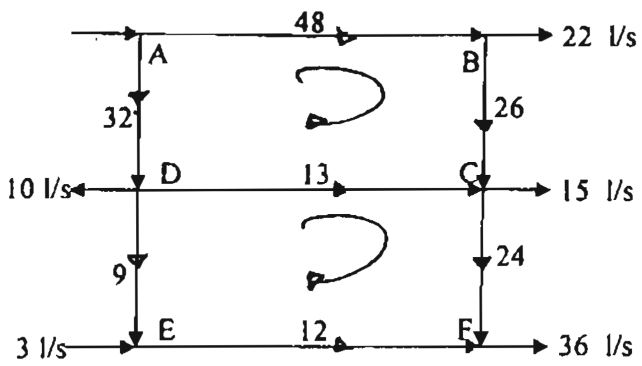
The following are the requirements of distribution systems:

a. The main pipe line should carry water three times the average demand.
b. The branch lines should carry water twice the average demand.
c. The water demand at the various zones should be recorded.
d. The length and diameter of pipes at various sections should be marked on site plan with the positions of fire hydrants, valves, functions etc.
e. The pressure drops at different sections of main pipe line should be recorded.
f. The pipe lines should be cleared periodically.

Problem: Calculate the head losses and the corrected flows in the various pipes of a distribution network as shown in figure. The diameters and the lengths of the pipes used are given against each pipe. Compute corrected flows after one correction.



Solution: First of all, the magnitudes as well as the directions of the possible flows in each pipe are assumed keeping in consideration the law of continuity at each junction. The two closed loops, ABCD and CDEF are then analyzed by Hardy Cross method as per tables 1 & 2 respectively, and the corrected flows are computed.



$H_L = 1.59 \times 10^6 \, Q^{1.85} / D^{4.87}$

$x = 1.85$

$\frac{H_o}{L} = \frac{1.59 \times 10^6 \times Q_o^{1.85}}{D^{4.87}}$

1st Trial with assumed flow, Q_o

Circuit	Pipe	Length, m	Dia, mm	Q_o	H_o/L	H_0	H_o/Q_o	Δ, lps	Q_1, lps
I	AB	500	300	48	0.001771	0.88528	0.018443	0.847151	48.84715
	BC	300	200	26	0.004103	1.23084	0.04734	0.847151	26.84715
	AD	300	200	-32	0.006024	-1.80730	0.056478	0.847151	-31.1528
	DC	500	200	-13	0.001138	-0.56904	0.043773	0.847151	-9.62676
								2.52609	
					Sum	-0.26021	0.16603		
		Δ	$= \frac{-\Sigma H}{x.\sum \frac{H}{Q}}$		0.847151				
Circuit	Pipe	Length, m	Dia, mm	Q_o	H_o/L	H_0	H_o/Q_o	Δ, lps	Q_1, lps
II								-0.84715	
	DC	500	200	13	0.001138	0.56904	0.043773	-2.52609	9.626759
	CF	300	150	24	0.014362	4.30868	0.179529	-2.52609	21.47391
	DE	300	150	-9	0.002340	-0.70194	0.077994	-2.52609	-11.5261
	EF	500	150	-12	0.003984	-1.99199	0.165999	-2.52609	-14.5261
								-2.52609	
					Sum	2.18379	0.46729		
		Δ	$= \frac{-\Sigma H}{x.\sum \frac{H}{Q}}$		-2.52609				

2nd Trial with assumed flow, Q_o

Circuit	Pipe	Length, m	Dia, mm	Qo	H_o/L	H_0	H_o/Q_o	Δ, lps	Q_1, lps
I	AB	500	300	48.84715	0.001829	0.91441	0.01872	-0.60195	48.2452
	BC	300	200	26.84715	0.004354	1.30606	0.048648	-0.60195	26.2452
	AD	300	200	-31.1528	0.005733	-1.71978	0.055205	-0.60195	-31.7548
	DC	500	200	-9.62676	0.000653	-0.32643	0.033909	-0.60195	-10.3525
								-0.12381	
					Sum	0.17426	0.15648		
		Δ	$= \frac{-\Sigma H}{x.\sum \frac{H}{Q}}$		-0.60195				

Circuit	Pipe	Length ,m	Dia, mm	Q_o	H_o/L	H_o	H_o/Q_o	Δ,lps	Q_1,lps
								0.60195	
	DC	500	200	9.626759	0.000653	0.32643	0.033909	0.123807	10.3[illegible]52
	CF	300	150	21.47391	0.011691	3.50743	0.163335	0.123807	21.[illegible]72
	DE	300	150	-11.5261	0.003698	-1.10934	0.096246	0.123807	-11.4023
	EF	500	150	-14.5261	0.005673	-2.83647	0.195267	0.123807	-14.4023
II								0.123807	
					Sum	-0.11195	0.48876		
		Δ	$= \frac{-\Sigma H}{x \sum \frac{H}{Q}}$		0.123807				