# How to save crores in the cost of overhead water storage tanks for new water distribution projects

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The government has taken up large number of projects for distribution of potable water to all citizens of the country. The typical plan is to provide a pumping station, preliminary steps of sedimentation, filtration and disinfection, followed by pumping to newly constructed overhead tank.

The Centre has allocated Rs. 74,226-crore for the Department of Drinking Water and Sanitation in the Union Budget 2025-26, with most of it – Rs. 67,000-crore – allotted to the *Jal Jeevan* Mission (JJM) which aims to provide tap water connections to every rural household by 2028. The allocation shows a substantial jump from the revised estimates of Rs. 22,694-crore in 2024-25. Finance Minister Nirmala Sitharaman, presenting her eighth budget, highlighted that JJM has already provided tap water access to 15-crore rural households, representing 80% of India's rural population (https://hotscup.com/budget-2025-focus-on-rural-water/). This is a record achievement.

The main problem with water supply to villages is development of a source. Check dams, village wells, and running rivers are the major source of water. In some places, river canals are also available.

Whereas not much improvement can be done in the primary treatment of filtration, and disinfection, some possibilities exist for improvement. This includes use of ferric alum or even ferric chloride for flocculation to avoid health problems related to residual aluminium. As the rural population has developed significant resistance to bacterial contamination but not to chemicals (such as alum, chlorine and other flocculants) used in water treatment, it may be a good idea to use alternate methods of disinfection like membrane filtration, ultraviolet light or ozone. Use of chlorine for disinfection can lead to generation of trihalomethanes, which are suspected to be behind the high incidence of several cancers in the developed world.

The World Health Organisation (WHO) has issued the fourth edition of its recommendations for drinking water. The list of possible contaminants is scary (see https://iris.who.int/bitstream/handle/10665/352532/9789240045064-eng.pdf). I do not think we have so many pollutants in drinking water sources. If we encounter these pollutants in water sources, it is better to avoid such sources. Ultrafiltration can tackle most of these impurities. Use of reverse osmosis (RO) for domestic water purification has already led to deficiency of calcium and magnesium in the urban population. The villagers should be spared this agony.

## Ground water contamination

Another important factor is contamination of ground water. While open defecation has completely stopped, and toilets have been funded for millions of citizens, I have no idea what happens to the sewage. I do not know of any scheme to collect the sewage from the village and treat it in one place. More likely, simple soak pits might have been used. The water from the digester does not essentially become bacteria-free and if left untreated in the soak pit contaminates well waters. The wells may not be used for drinking purposes any more, but if the villagers do not get the water directly in the kitchen and are required to store it underground and

then pump it back to the overhead tank, there is every chance of contamination of the treated water. This is what is happening in Mumbai city. Here the population has access to domestic water purification units. This will not be so in villages. They should be provided storage facilities above ground to prevent recontamination of water.

Most of the cost of water storage is incurred in the construction of overhead tanks. Depending on the hight of the tank, the cost is in the range of Rs. 15,000 per $m^3$ for a height up to 20-m. Typically, there are two pumps operating in parallel feeding the water from an underground storage tank and take it all the way up to the top of the tank and drop it in the tank whether it is empty, half-filled or nearly full.

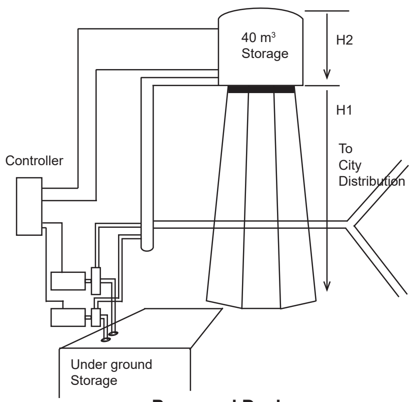
## Conventional models of water supply

There are two models of water supply: intermittent (one or two times a day for certain number of hours) and continuous. In Mumbai city, water is supplied only for certain hours in a day, and the residents are expected to store the water in underground storage tanks and fill up their overhead tanks. In some cities, water is directly supplied to homes all the time and the need of overhead storage is obviated. With increasing population, the first model is more popular. For this reason, large storage tanks at an elevation of about 20-m are being constructed in thousands of villages that did not have piped drinking water for years.

There is a design which has been used for small houses where the source of water was a home well. The idea was to provide water with pressure to serve the entire single-storey home without the need of a overhead tank. The pump from the well was connected to the bottom of a closed tank of about 200-litre capacity and water was pushed against the air inside the tank. Once the pressure inside the tank reached the controlled level, the pump would shut off. The pump was operated by a pressure controller and shut off after a certain pressure was reached. It could possibly be used for a small cluster of houses, but not for a large population because of high capital costs.

## Alternate model

There is another possibility. Instead of constructing a large overhead tank, a tank of only 10% capacity can be constructed. The connection of the pump can be at the bottom of the tank with a non-return valve (NRV). The line after the NRV can be directly used for distribution in the village in the form of a ring of which both the ends terminate at the same point. The water supply can be made with the pump directly. Now, with more reliable power supply, a sizeable population can depend on the supply from the pump. In any case, a small (10%) overhead tank is available for emergencies. The overhead tank would be provided with two level controllers – a lower level to switch on the pump and upper level to put it off. The water supply would be met by the pump or pumps and the fluctuation in demand will be taken care by the overhead tank. Whenever the requirement is higher than the pump capacity, water from the overhead tank will supplement; whenever demand is less, excess water would be pumped to the overhead tank. Whenever the overhead tank is filled to the upper limit, the pump is shut, and will be put on only after the lower limit of the storage tank is reached.



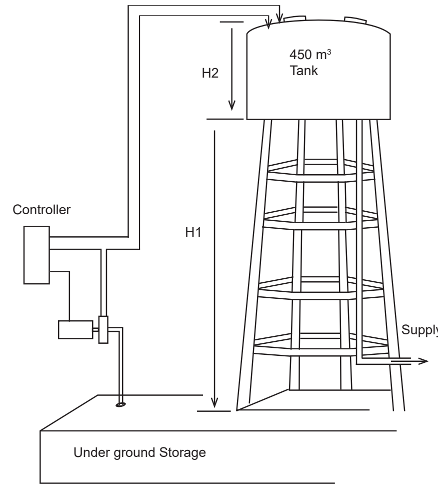
**Proposed Design**

I started the discussion with a government project under a specific scheme, but this is applicable equally to industries that create infrastructure for their employees, like colonies, schools, hospitals and offices. Large cement plants, large projects with residential facilities, railway stations, airports, etc. can save significantly by adopting this design.

## Savings accrued

By this arrangement, three major savings will accrue.

1. Larger overhead tanks not just cost more money, they also require more space, take long time to construct, and pose hazard during natural calamities like earthquake. The capital cost of the overhead tank would be reduced by 90%. This significant saving can be used for other capital equipment. Typically, for a population of 500 families with 4-5 members per family, daily water requirement is about 450,000 litres. If a storage tank of this size is constructed, the cost would be about Rs. 67.5 lakhs. Instead, if a tank of only 10% capacity is constructed, the cost will come down to just about Rs. 6 lakhs. It would take mush less space and very little time to construct.
2. Since all the water will be pumped at the bottom of the tank and not be raised to the maximum height of the storage tank, 5-7% savings in pumping cost can be expected. This could be significant when we consider operations for 365 days of the year. Pumps with lower head can also be used to further reduce the capital cost.
3. Since most such water supply schemes will be installed in villages or distant locations away from large population, cheap land and open sky would be easily available and the power supply could be solar. Timings of water supply can be adjusted with day light, removing the need for alternate power supply.



**Conventional Design**

The accompanying drawings compare the two arrangements to illustrate the difference.