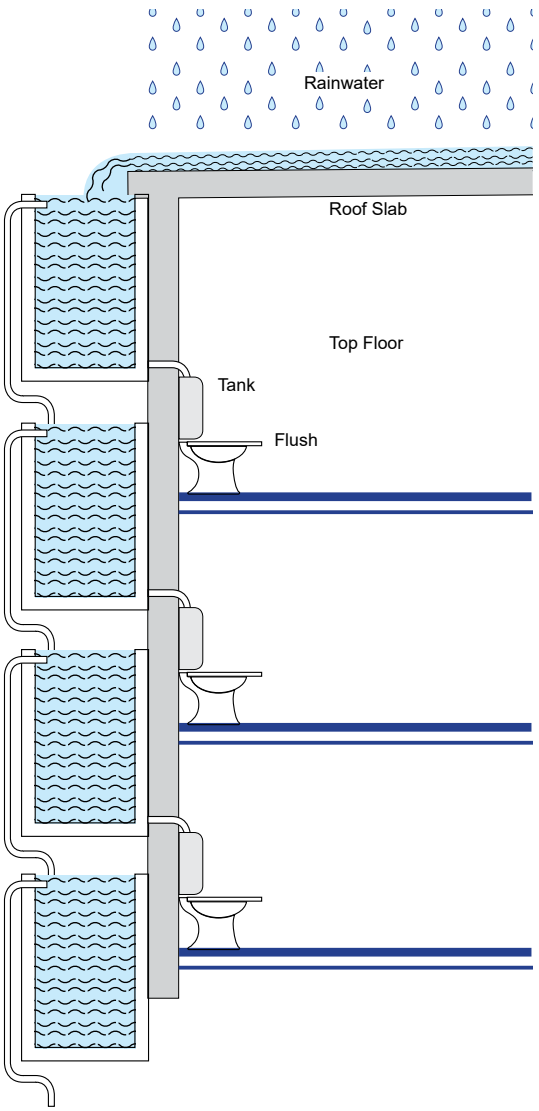
Rainwater harvesting in cities with good rainfall

This column (to appear in the fourth issue of every month) is all about openly sharing expertise and knowhow with our readers, regardless of industry, product or service. The aim is plant the seeds of inspiration, strengthen the knowledge base, and hopefully, lead to new opportunities and innovations.

While the column is being rolled out with the ideas of Prof. V.C. Malshe, an academician, researcher, innovator, consultant and businessman, it is open to one all. Simply write to editorial@chemicalweekly.com. (If you would rather speak informally, that too can be arranged).

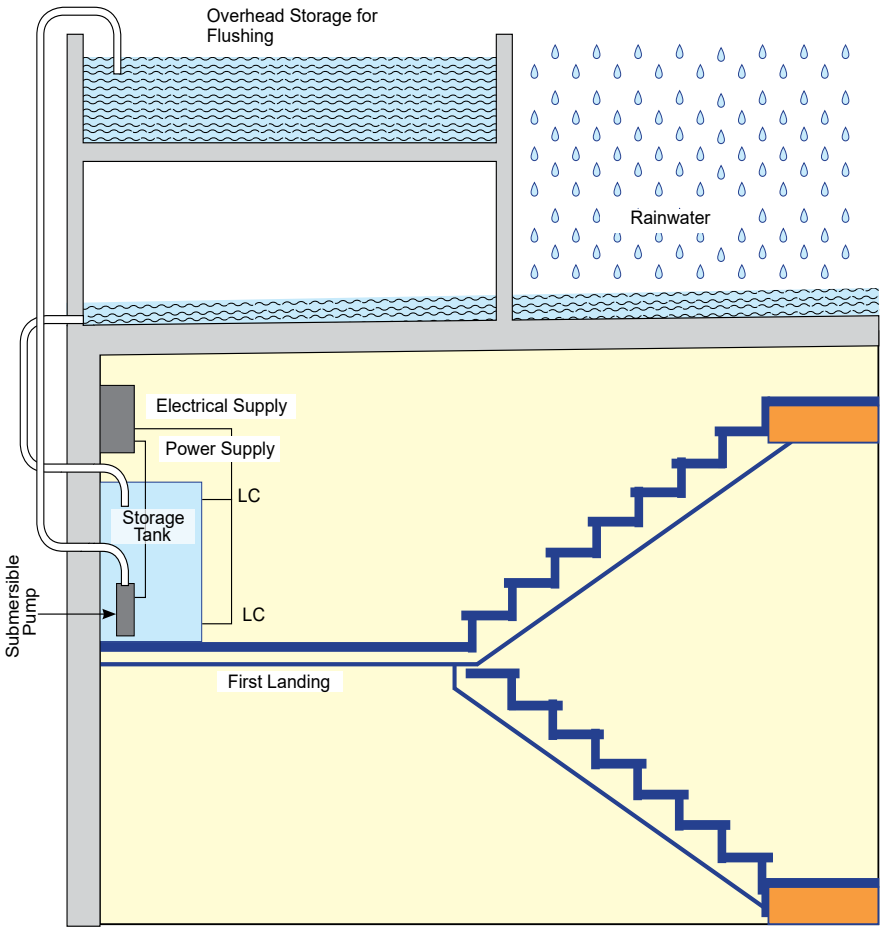
A city like Mumbai receives on average about 2,640-mm (2.64-meters) of rainfall every year. Most buildings are ground+3 stories, though the trend to install tall buildings is catching up fast. Typical size of a flat is 50-m^2. Thus, the terrace of every flat receives 132,000-litres of water every rainy season. If there are four residents per flat and there are four floors, then about 8,250-litres of water is available for every resident for the four months of the rainy season. That is about 65-litres of water per resident per day for 120 days, enough for his flushing needs.



Most people think of harvesting this water on a storage tank kept on the ground floor or an underground tank. It is then required to be pumped to the top floor for utilisation. Since this water cannot be treated and can be used for only flushing toilets, it also requires a separate overhead storage tank and a separate distribution pipeline. Such a scheme is not implemented due to high capital costs and limited utility. The water is free, but the cost of electricity to pump the water to the top floor takes away a good amount of incentive.

We need to appreciate where the value of the rainwater is maximum. Considering the cost of electricity at about Rs.12 per kWh in Mumbai, the highest value of the rainwater is at the highest height. Taller the building, more the value. Therefore, to conserve energy, most water should be used at the highest possible level without using a pump, or with minimal effort. Therefore, the idea is to construct a segmented storage tank parallel to the height of the building and collect all the water right at the ceiling level in a tank that would meet the needs of the residents of the top floor. The overflow of the first tank should be collected in a tank right below the first tank that would provide water to the next floor. The overflow of the second tank should flow to the third and so on. Any excess over the full tanks may have to be drained during very high rainfall or could be stored above ground.

It is very easily possible to construct a separate overhead tank parallel to the building concrete or steel structure with plastic tanks. The rainwater can be selectively connected to the flush tank water supply as an optional source, since this is not always available right through the year. The municipal corporations should allow such construction and provide incentives to residents to do the same.



Another possibility is to collect all the rainwater from the top floor at one point by providing adequate slope to the top slab (typically 1/100 slope) at the time of construction. The lowest point should be at the center of the staircase. A pipe should transfer entire water to a small 400-500 l plastic tank kept on the last flight of the staircase, about 2-2.5 meters below the ceiling. This tank should be provided with two level controls and a submersible pump. The water collected in the tank should be pumped to the tank through a sand filter, supplying water for toilet flushing, which should be constructed separately at the time of building construction. Lines can also be provided for car and floor washing at different levels from this tank. In this way, the residents would be able to save considerable cost of electricity required for pumping the water.

When I hear of the possibilities of desalination of seawater for supply to Mumbai city, I wonder why simpler options cannot be explored.

Two other possibilities

There are other possibilities of rainwater harvesting around Mumbai. Two of them are discussed below:

Blocking a large number of waterfalls all along the Parsik Hills of Mumbra, from Kalva to Panvel, where huge amounts of rainwater is simply drained to the sea, and the large rivers flowing east and west of Mumbai which can be partially blocked to create freshwater lakes enough for the city.

There is a large river, Barvi, meeting the sea at Vasai. The main source of water in this river is the catchment area after the dam at Ambernath and tail water from Tata dam using it for power generation. If this river is partially blocked at a point between Diva and Mumbra, it would result in a sweet water storage that could provide water to the population from Kalyan to Mumbra, which is presently taking away a big part of water supply to Mumbai. The height of this dam should be just about the highest tide level in the Arabian sea to prevent mixing of sea water in the sweet water. Water purification and distribution can be situated on the Mumbra hills. This would obviate the need for pumps for distribution. Water can be distributed right up to Panvel and pressure on the water supply on Mumbai can be drastically reduced. Very serious effort will, however, be needed to restrict the flow of domestic and industrial waste in these primary streams. This can serve as a long-term solution to the needs of the growing population in the suburbs of Mumbai, which have grown industrially as well as residentially. There may be plans to operate waterways in these streams. This can be incorporated in the plan of construction of the check dams. Arrangements like Panama Canals can be incorporated to allow the boats to move from sweet water to salty water and *vice versa*.

Alternatively, several small dams can be constructed all along the Parsik Hills and Matheran Hills to provide water for at least 6-7 months to the population living close to these areas. There are only a limited number of dams in this part. These were constructed for irrigation purposes but have not served the purpose due to change of land use from agri to non-agri. The location of dams would have to be about 50-60 meters above sea level so that after filtration water can be distributed by gravity. **V.C. Malshe**