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BCPT The Bombay Community Public Trust

Mumbai's Water Supply

Had the then Mumbai's British administrators not taken seriously an agitation by the island's natives over the drinking water problem in 1845 and subsequent search for water sources even 100km deep into the mainland, Mumbai's citizens, perhaps, would have been as harassed for water as Chennai's people are now. Like Chennai, Mumbai also depended on wells and ponds/lakes for its water supply. Overdrawing of water by ever-increasing population caused depletion of ground water sources and also ingress of seawater in Chennai. The same could have happened to Mumbai, as both these are coastal cities. But, water supply in Mumbai kept rising with newer schemes to meet the increase in demand for the growing population and the city is, comparatively, better off. However, the reasons for water shortages are distribution losses, pilferage, wasteful use etc., causing about 40%-60% loss of water.

Mumbai's Water Sources

From just 32mld (million litres per day) from Vihar Lake in 1860 for Mumbai's then population of only 0.7million, the water supply from various schemes has now reached 2,950mld for the city's 13million people. Table 1 shows how the water supply to the island city was augmented through schemes on six water sources Vihar, Tulsi, Tansa, Modak Sagar, Upper Vaitarna and Bhatsa.

As the population is projected to grow from current 13million to 16million by 2021, future water sources have been identified in Vaitarna River basin and Ulhas River basin that can take the total water supply to 6,382mld by 2021. The plan for Middle Vaitarna is at an advanced stage and a dam will be constructed at a cost of Rs1,250crore to avail 455mld water. This dam will submerge 3,473 hectares of land in Vaitarna basin and people from eight villages will be displaced. Middle Vaitarna, Gargai and Pinjal are gravity sources, whereas the Ulhas river basin sources will need pumping water adding to the cost; 5,108hectares will be submerged, while people of 19 villages will be affected.

Distribution System

Before Independence, Tansa was the major source and these water pipelines run along Bombay-Agra road. After independence, Vaitarna-cum-Tansa project envisaged a tunnel between Vaitarna and Tansa and the water supply to Malabar Hill Reservoir and Bhandarwada Reservoir increased, besides serving the remaining areas directly from the main trunk. The Upper Vaitarna Scheme, in 1973, provided 554mld through tunnels under the Thane Creek. Then came the Bhatsai Scheme which also envisaged construction of pumping, treatment and conveyance at Pise, Panjrapur and Bhandup. Bhatsai water is pumped into Vaitarna mains and brought through tunnels to Bhandup's water treatment-cum-pumping-cum-reservoir complex. From Bhandup's Master Balancing Reservoir I (MBR I) and MBR II at Yewai Hills, water is supplied to the city and suburbs through 17 service reservoirs and 650km transmission mains, 3,000km of distribution mains and 3,200km of service pipes. This, in a nutshell, is how water is conveyed to the city from the sources located at a distance of about 100km, although

distribution is a very complex structure. The cost of production is Rs 6 per kilolitre. This cost is low due to old assets but the cost of water from new Schemes will be much higher.

Table 1

Year	Water Scheme	River	Water Supply (mld)
1860	Vihar Lake Dam on Mithi	Mithi	32
1872	Vihar Lake Dam height raised	Mithi	36
1879	Tulsi Lake - Another Dam on Mithi	Mithi	18
1891	Powai Lake - Mithi Tributary (To Aarey Colony)	Mithi	4
1892	Tansa I - Dam on Tansa	Tansa	77
1915	Tansa II - Additional Water Pipieline		82
1925	Tansa III - Dam height raised		98
1948	Tansa IV 38 floodgates provided		198
1948	Total Water Supply for Mumbai's `2 million population		541
1957	Vaitarna cum Tansa Dam on Vaitarna and tunnel between Vaitarna & Tansa Lakes	Vaitarna	490
1967	Ulhas (entire water supply to Kalyan since 1994)	Ulhas	90
1973	Upper Vaitarna Dam upstream of Vaitarna Lake	Vaitarna	554
1981	Bhatsai I Pise pick weir	Bhatsai	455
1989	Bhatsai II	Bhatsai	455
1998	Bhatsai III	Bhatsai	455
	Total Water Supply for Mumbai's current 13 million population		2,950
	Sources Identified for Future Projects		
	Vaitarna River Basin		
	- Middle Vaitarna	Vaitarna	455
	- Gargai	Vaitarna	455
	- Pinjal	Vaitarna	865
	Ulhas River Basin		
	- Kalu	Ulhas	590
	- Shai	Ulhas	1067
2021	Total availability of water for Mumbai's projected 16million population		6,382

Domestic Water Consumption

Table 2 shows the average requirement of water in terms of litres per consumer per day - lpcd).

Table 2

Purpose	**Maximum**	**Average**	**Minimum**
Drinking, Cooking & Dishwashing	50	40	30
Bathing	50	25	15
Toilet Flushing	50	40	30
Washing Clothes	50	20	15
Cleaning & Gardening	25	10	-
Car Washing	5	-	-
TOTAL	**230**	**135**	**90**

As against average requirement of 135lpcd, Municipal Corporation of Greater Mumbai (MCGM) actually supplies 90lpcd because of water shortage. “But in slums, it supplies only 25litres per day per household (not person), which is very unfair”, says Kisan Mehta a renowned environmentalist.

Though 90 or 135lpcd is adequate to meet a person's water needs, the future water sources, conveyance, treatment plants, reservoirs and distribution network is designed for 240lpcd for the projected population to take care of transit losses, evaporation losses, higher standard of living in future and increase in allied services with the growth of the city.

Snags in the System

Though the water supply system is successfully laid, technically, the real problem is that the system is mismanaged and misused through un-metered and unaccounted water supply. Moreover, low tariff rates, the policy of subsidy and low recovery rate as well as metering errors and billing mistakes burden the system. People are yet to come out of the mindset that water is naturally available and hence, a free commodity. But, one has to pay for the transport of this commodity after refinement. As Kisan Mehta puts it, “When a dam is constructed and harnessed water is freely taken away, the people dependent on the water downstream are deprived of their right over this water. Do we compensate them?” When groundwater is extracted freely for commercial purpose, like by soft drinks

industry, it amounts to impinging on the local people's right over their ground water. So, it is time people realise that the concept of free and low cost has to go and a rational pricing will have to be accepted to balance at least income-expenditure of the system which can be well maintained and managed. This needs a strong political will to end the political-criminal intervention, especially in the slums. Also, incentives should be offered through rebates on advanced payments, conservation practices such as rainwater harvesting and water recycling.

Mumbai: Water Tariff Structure

Table 3

Category	Water Charges (Rs/1,000 litres)
Domestic - Stand Post	2.25
- Buildings & Chawls	3.50
Halls, Hospitals, Playgrounds, Swimming Pools etc	10.50
Industries, Dhobi Ghats, Government Premises, etc.	18.00
Refineries, Airports, Public Sector Undertakings, etc.	25.00
Race Courses & Star Hotels	38.00
Sewerage charges are at 60% of water charges	

The daily water bill for a family of five consuming about 1,000litres of water is Rs3.50 only. The domestic consumption of water is highly subsidised by commercial and industrial users.

Woes of the Service Provider

The Water Utility Department of the MCGM too faces innumerable difficulties basically because the demand for services outstrips supply. The planned/unplanned development and growing slums require increase in the length of distribution network, besides carrying on regular maintenance work of pipelines and attending to frequent breakdown on a war footing. Under the economy measures, no new recruitments are made, while workload keeps mounting with the expansion of the services; this results in low efficiency and poor performance of the staff. The Department is not able to handle the complaints from the citizens. Often, materials for repairs and maintenance are lacking. The field difficulties are even graver, especially in thickly populated slums. Often, the number of water pipes run in bunches through narrow passages and side gutters in slums. Under these circumstances, it is extremely difficult to locate the fault or leakage and fix problems, especially in water contamination cases. The concretisation of roads has added its share of woes for the Maintenance Department. Though a systematic approach for diversion of existing water mains and other utilities prior to concretisation was necessary, it was not given any thought. So, spotting and repairing leakages or pipeline bursts is very difficult,

as it requires breaking through the concrete. Attending to contamination problems in the mains below the concrete roads is also difficult. It has also become very difficult to take action even after detecting cases of pilferage or theft as the staff is threatened. During the action, entire labour force has to leave aside their work and attend to the problem. MCGM officials hope that the citizens become aware of these hardships in bringing water from 100km and distributing in complex environment so that they can lend a hand and fulfil their duty of paying for the services and conserve scarce water resources.

Alternative to High Cost Solution

While population has increased 6.5 times from 2million in 1948 to nearly 13million now, water supply increased five-fold from 541mld to 2,950mld during these five decades. The population is projected to rise by 25%, to 16million by 2021 and potential to augment water supply is more than double at 6,382mld by developing sources in Vaitarna and Ulhas river basins. But these are costly propositions both in monetary as well as human and environmental terms. For Mumbai's luxurious need of water, is it fair to displace people from eight villages in Vaitarna and 19 villages in Ulhas river basins and submerge some 9,000hectares of fertile land as well as cause environmental degradation? Instead, can we look at alternatives to these major water projects? These are questions each one of us should be asking.

Rain Water Harvesting & Ground Water Use

Earlier, rainwater was the main source of water supply and it was collected in tanks. People used to measure the height of collected rainwater in the tank and accordingly decide how much to draw from it to make it last over the year, recalls Kisan Mehta. Now, with piped water supply, this traditional way of conservation of water has been forgotten.
Mumbai was blessed with number of tanks like Mumba Devi, Manamala, Babula, Govalia, Gilder, Banganga, etc. These tanks, wells and lakes were sources of water then. After the pipelined water came, these traditional water sources fell into disuse and got closed with idol emersion and land grabbing businesses. If these old methods of rainwater harvesting are restored, perhaps, there will be no need for future water supply schemes on Vaitarna and Ulhas river basins. There are many other benefits from rainwater harvesting. The groundwater table will rise, water quality will improve, salinity in water will reduce, cracks in the buildings will be minimised, etc.

According to Groundwater Survey & Development Agency (GSDA), the area occupied by phreatic aquifers (porous rock layers transmitting underground water) is limited between the seacoast and hill ranges in Mumbai and scope for recharge from rainfall is limited. Therefore, it is advisable to draw well water to empty these aquifers for natural rainwater recharge. Also, deep aquifers can yield water for meeting the growing demand for water and these can artificially be recharged with rainwater. Wherever there is heavy withdrawal of bore well water, problem of seawater ingress is likely to arise and, hence, it is necessary to recharge the wells from which water is drawn. Industrial effluents, open drains and open defecation causes polluted water to seep into groundwater affecting its quality. Rainwater recharge can improve the deteriorating water quality and reduce salinity.

Rainwater harvesting by capturing runoff from the rooftops / terraces and surrounding surface water will not only increase ground water recharge and stop ingress of sea water but will get Mumbai out of its monsoon floods problem. Water harvesting in Mumbai will reduce storm water discharge as well as reduce the load of sewerage treatment, thus controlling the dreadful monsoon floods. Rainwater can be stored in tanks or can be recharged into the groundwater. However, there is no space in Mumbai for residential complexes to provide for tanks to store rainwater. Hence, recharging the groundwater is the right solution.

There are many agencies that can give guidance and consultation to citizens' groups who would like to set up the rain water harvesting system in their locality. The bore well water then can be used for washing and flushing purposes, if the water quality is not suitable for the drinking purpose. Some rain water harvesting agencies are:

- National Water Harvesters Network (NWHN).
- Centre for Environmental Science, Delhi.
- Central Ground Water Authority, Nagpur.
- Groundwater Survey & Development Agency, Thane & Pune.

Desalination

Mumbai can make use of abundant availability of seawater, desalinate for potable water and thus, augment water supply instead of going in for complex method of constructing dams & reservoirs and supporting that system. According to Arvind Deshmukh, Chief Engineer, BARC, investment in a desalination plant of capacity 10-20 MGD is Rs15crore compared to Rs10crore for conventional water supply system. But, the saving in terms of environmental protection and human misery is tremendous. With every dam, there is submergence of cultivated land and forest and the resultant displacement of local population. The record of rehabilitation of project affected persons is well known.

Water Recycling

About 80% of distributed water is discharged as wastewater. If a part of wastewater is treated and re-used, it can cover the projected demand deficiency. It can also prevent encroaching on a source which can be spared for other water-scarce areas. An example of water recycling can be seen at Chhatrapati Shivaji Terminus of the Central Railway which set up a water recycling plant of 0.2million capacity in 1999 at a cost of Rs24lakh. The operational cost of the 0.2million-litre water treatment plant is Rs10 per kilolitre which is less than the commercial water charges of Rs18. The used water is collected and treated for cleaning concrete aprons of the railway platforms thus saving potable water.

Water Conservation

About 71% of the earth's surface is covered with water but 97% of this is seawater, 2% is locked in polar ice caps and glaciers and hardly 1% of water is available as freshwater. Hence, we need to conserve every drop of water. We have got to develop the habit of

using less water and stopping wasteful and luxurious use of water. Given below is a checklist of Dos and Don'ts.

- Use leak proof cocks, preferably aerated ones, with periodical replacement of washers.
- Do not throw away stored water; water never gets stale.
- Use a glass to rinse after brushing of teeth. It needs only half a litre of water. Keeping the washbasin tap open while brushing teeth wastes at least four litres of water.
- Aerate shower; low flow showerheads reduce water use by 50% or more.
- Bathing needs only 20litres of water. Shower bath needs at least 80litres and tub bath 110litres of water. Remember the average daily water need for all purposes is 135litres per day per person but availability is hardly 90litres.
- Washing clothes require 40litres of water; keeping the tap running during washing consumes 250litres of water.
- Water plants with rinse water from the washing machine.
- Sprinkling water on the ground needs 10litres of water but hosepipe watering consumes 50litres of water.
- Throwing glassful water after just few sips wastes 300ml water. Pour only as much water, as you want, in the glass.
- Use a bucket to wash the car, not a hose.

Ideally, therefore, the housing complexes should have proper rain water harvesting system and draw groundwater for non-drinking purposes. Even if water from bore-wells is used for toilet flushing (50lpcd) and cleaning (10lpcd), the load on the piped water supply will come down to 50%. This means that the same piped water supply will be sufficient for double the population. Recycling of the water used for washing is possible by re-using it for watering the garden, further bringing down the load on the overworked system. Desalination of sea water will obliterate the need to set up newer projects that require transporting water from 100km at a high capital cost; it will also make that resource available to other needy water scarce areas.

Surekha Sule, a freelance journalist and environment activist, specialises in sanitation issues, with focus on waste management in cities. She advocates waste segregation with Reduce-Recycle-Reuse strategy.

The facts presented and opinions expressed in this booklet are those of the author alone.

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