# DISCUSSION

## RAINWATER HARVESTING – A POSSIBLE SEASONAL ADDITION TO BANGALORE WATER SUPPLY by L.C. Curtis, Jour. Geol. Soc. India, v.50, pp.455-460.

**M.H.R. Rao**, 455, 18th Main, IV 'T' Block, Jayanagar, Bangalore - 560 041 comments:

The paper proposing harnessing of rainwater for solving the acute water shortage to City of Bangalore was studied with interest. It is my view that the proposed scheme is impracticable because of drawbacks and the unplanned growth of Bangalore which today is the cause for all problems. I list below the drawbacks as I see from the proposal.

1. According to the proposal, land required will be minimum 300m x 15m for every sq. km. Though not very clear it is presumed that the filling up of these cisterns is through bore-holes or other openings from surface. Water needs to be channeled into these cisterns. After suitable contour is established these holes will have to be provided with casing pipes and kept open all the time. No other structure can come up above this ground which will obstruct the flow of water into the cisterns. Free ground that is needed will be minimum 300m x 15m and land value today in Bangalore varies from Rs.1,000 per sq. ft. to Rs. 3,000 per sq. ft. At a lowest of even Rs. 1000 per sq. ft. cost of land for each unit will be Rs. 5 crores and for a total urban area of 500 sq. km total cost of land will be nearly Rs.2,500 crores. This cost is not taken into consideration and even if taken the question is, Is this land available in the urban area?

According to No.2 of benefits mentioned, if existing installations are not affected it would appear that the excavations are planned via the shaft with the existing structures on surface. The depth of excavation will vary depending upon the nature of subsoil. Heavy blasting will be required about 20 to 25 m below surface. Will the owners of installations and houses agree to this? Can the installation and structures built many years back withstand this shock and vibration. The answer is no and after excavation of nearly 53000 $m^3$ or 133 thousand tonnes of rock, there will always be the fear of subsidence because of such large scale excavations.

If this drawback is overcome with adequate support it will be difficult to course rainwater into the cisterns due to constructions on surface. The situation in river Arkavathy draining into T.G. Hally reservoir is similar. There is today less drainage into the reservoir due to the heavy constructional activity in the catchment area inspite of rainfall being the same and steady. A study is being entrusted to ISRO to examine this drainage solution.

2. *Treatment of Water:* If the drainage of rainwater via the storm water drains in the Jayanagar I Block area draining into Lalbagh is any indication of the quality of water which flows through the streets of Bangalore water will be so polluted that it is closer to sewerage water with perhaps little less solids but lot of silt and muck.

Recently a water treatment plant is under consideration for treatment of sewage water. The capital cost is Rs. 4 crores for only 10 lakh litres/day with an annual running and maintenance cost of Rs.24 lakhs. Is it feasible to provide such individual treatment plants for the whole of Bangalore of 500 sq. km?

3. *Pumping:* Water is to be pumped over a vertical head of 64m. Taking into consideration the other frictional head the total head will be at least 90 m or 300 ft. It will require power approximately 2000 HP per unit per day. Additional power will be required for the treatment plant and to lift this up to a overhead distribution tank.

*Maintenance:* Even though it is envisaged that this scheme is for 150 days in the year all the installations will require regular maintenance. Any unseasonal rain will cause flooding of the installations. So it must be in readiness for pumping all the year round, though it may remain an idle capacity for more than half the year or to augment the supply co-ordination between two different sources of supply with different capacities will be difficult to achieve.

*Safety:* As it is an underground installation safety regulations will be severe for the hoisting installation, ventilation requirement, precaution against flooding of the access and pump tunnel. The ground requires adequate permanent support to prevent subsidence.

*Ground level tank for each house:* This is a good idea. But this water can be used for washing purposes only as all the dirt and waste is washed into the sump. It will require separate installation of pump and service line as it will not be fit for consumption unless treated. Most houses do not have so much free space to construct a sump of reasonable capacity.

*Suggestion:* It is unfortunate that Bangalore, situated at an altitude of 1000 m above sea level was allowed to grow to its present status only because of favourable climatic condition without adequate infrastructure. There is enough water for domestic use of Bangalore in the rivers around Bangalore. The difficulty is the shortage of power to lift this large quantity of water to a height of 1000 m. Further growth of Bangalore must be stopped and no new layout around Bangalore must be allowed or such layout must have their independent source like villages of the olden days. All the hundreds of villages around old Bangalore with their own source of water have been absorbed into the Mega City. Instead of underground installations Bangalore must restore its old tanks, so that there can be large-scale impounding of water. This will help restore the high water table. Unfortunately most of tanks have disappeared and constructions have come up in their place. Increase power generation and the same power which is proposed for these small units could be earmarked for supply of quality water from Cauvery, without the need of a large scale treatment plant.

It will be interesting to have more details of such installations of Roman times in North Africa. Similar and many other innovative systems existed in India to course the water through aqueducts and create head to work fountains etc. in olden days, but they are no more relevant due to technological advances of today and large quantity of water required to the whole community.

**L.C. Curtis,** 33 Berlie Street, Langford Town, Bangalore - 560 025, replies:

I thank Sri Rao for his observations, on which the following replies are offered.

1. The paper was not intended to be a blueprint but only suggested possible scheme. Accordingly specific details will require much further consideration and evaluation.

Sri Rao's presumption that the cisterns will be filled through bore-holes or other openings is incorrect. The last para of p.456 clearly states that an inflow main (feeding the cisterns) would be provided in the shaft. Trash removal could be arranged on surface prior to the water entering the inflow main. Using the large diameter ventilation bore-hole as a second inflow point infers the provision of a main in the bore-hole.

The contention that an area of 4,500 sq. metres would be required at tremendous cost is not correct. All excavations (except the shaft of course) would be sited below adequate barrier pillars to ensure long term stability and eliminate the possibility of surface subsidence. The granite on

which Bangalore stands is a competent rock, able to stand unsupported over the suggested width of the cisterns of 15 metres, below the barrier pillars. The surface area necessary will therefore be only a fraction of Sri Rao's estimate, consisting of the shaft area (a friction hoist could be mounted directly over the shaft to save space), space for services, trash removal, settling tanks and treatment plant. Using present day water purification technology a gravity sand filter and treatment plant for 1.5 million litres/day should not require more than about 100 sq. metres. With shaft and service areas the unit may require not more than 500/600 sq. metres. When considering the future of a city like Bangalore cost should be a secondary consideration.

As stated in para 4, p.457, water collection drains/pipes would be routed so as to utilise the existing infrastructure to the maximum extent possible.

Sri Rao's apprehension of possible damage to existing surface structure from blasting is misplaced. Properly controlled, such blasting will be nothing more than a minor nuisance over very short periods of time to local residents. At worst this will be a muted rumble near the shaft and high frequency sound waves, not shock waves, transmitted through the bedrock and possibly audible in buildings in the close vicinity. In most areas these effects will probably not be noticed, being submerged in the traffic and other noise.

As the excavations will constitute a mine IMMR 109 will apply, in which case the pumping depth will be increased to about 90 metres as against 64 metres indicated in the paper. This requirement further eliminates possible damage to any surface structures. As such structures exist only on the basis of surface rights agreement of the owners of the structure to underground work would not appear to be necessary. Was such permission necessary in the case of undertakings such as the Calcutta Metro where it passes well below surface structures?

2. The quality of water harvested will depend largely on the degree of segregation from polluting material that can be achieved. Obviously pipes are better and these could be linked directly to the down pipes from building roofs suggested for individual house tanks. With adequate trash removal and treatment the quality would probably be at least as good as the present supply or of the resurrected tank water recommended by Sri Rao. It is understood that the Government of Karnataka has already initiated such a scheme and the cost and effectiveness will be of great interest. Unfortunately, the remaining tanks are on the outskirts of the city and can only partially solve the problem even if the scheme is successful and the problem of pollution, periodical silt removal and distribution will remain. Sri Rao's reference to, and comparison with, the treatment of sewage water is therefore unwarranted and irrelevant.

3. Pumping will be a major cost but as the basis for Sri Rao's estimate of '2,000 HP per unit per day' is not known, no comment can be offered. In any case the power requirement will be immeasurably less than that required to pump the same volume of water over a distance of about 98 kms against the head of 1,000 m (Sri Rao's figure).

It is regretted that many concerned with the problem of future water supplies to the burgeoning Bangalore accept the easiest path of pumping additional supplies from the Cauvery. This virtual utter dependence on a single source is tantamount to putting all one's egg in one basket. Should there be, in the future, a major or prolonged disruption of this source, either man-made or natural, then Bangalore will, literally, be left 'high and dry'.