WATER MANAGEMENT OF PUSHKAR SAROVAR AND ITS REJUVENATION

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INTRODUCTION

The famous and world renowned Pushkar lake sacred to religious Hindus is about 13 km from Ajmer, another equally well known religious place to Muslims due to a Darga Ajmer Sheriff located there. Of late due to expanding population and increasing influx of pilgrims and tourists both Indian and foreign, water management has run into serious problems causing shrinking of the lake and at the same time deterioration in quality of the water in the Lake. Pushkar is also famous for its camel fair in the desert surroundings that draws tourists from all over the world during the season. In addition this is the only place in the country where there is a Brahma temple that draws crowds from the country all over the year. Consequently the lake water body is put to heavy strain from pollution and decrease in quantity. If this process continues unabated it will not be too long when the lake may dry up undermining the religious importance of this place and also affecting the livelihood of hundreds of priests and others who depend upon the tourists for religious activities and sacred worship. The paper deals with the traditional practices of water management in the past and the current practices in around the lake region that has led to the rapid deterioration. The paper also deals with suggestions to arrest the process and reverse the trend to make the lake sustainable restoring its importance and the old glory.

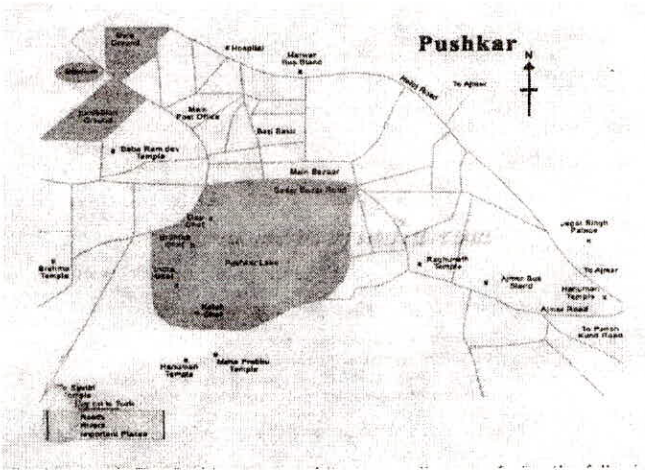
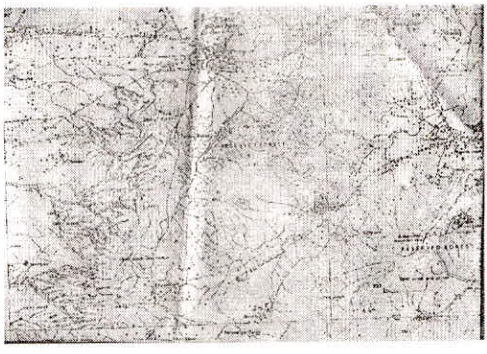


Fig. No 1
(coloured photograph is given at the end of the book)

PROBLEMS IN THE LAKE

The lake situated in the heart of the town has an internal drainage area of 21.60 sq.km. The catchment is surrounded by low hills of the Aravali ranges on three sides having three main streams namely Gorinadi, Savithrinadi and Gomukhnalla originating from these hills. The area of the lake is 1.1sq.km. with a storage capacity of 56,865 cu. Mts. The annual rain fall is about a 409 mm upto 1970 and about 20 rainy days. It is reported that from 1976 to 1995 the annual rainfall has come down to 404 mm having an average of 18 rainy days. It is estimated that in 1968 the lake received 21% of the rain fall as rainfall recharge and 7% as runoff during the monsoon. Further it has been reported that the depth of water in some key wells below the ground level in the area of Pushkar has gone down from 4.3mts in 1966 to 12.50mts in 1971. In the year 1995 these wells were dry in pre-monsoon and the water level below the ground surface was 20.4mts. This gives an idea that the water table is gradually going down year to year and that the recharge in the lake is correspondingly reducing



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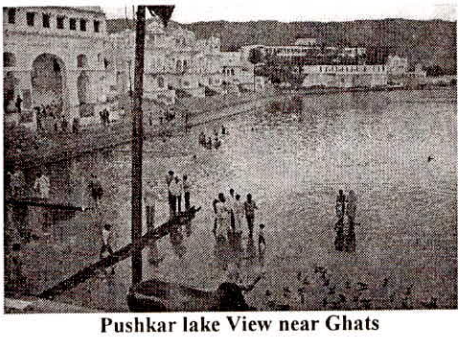
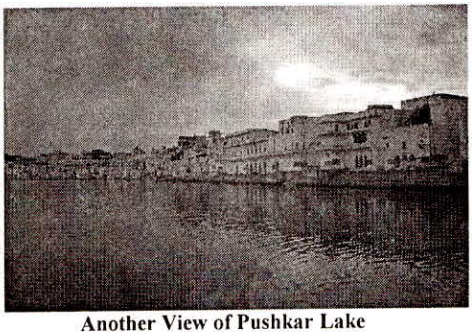


Pushkar lake View near Ghats



Another View of Pushkar Lake

There are two other lakes about 55 feet above the Pushkar Lake a few kilometers upstream and close by. The bigger one is know as Budha Pushkar which has a large area but practically dry with deep sand deposits in the bed. The other is the Madhya Pushkar which is smaller and is also dry with a well in the middle containing some water deep down. It is reported by the local people that both these lakes were full with large surface areas some 50 years back and also from times immemorial. However during the last 3-5 decades there has been sunk a number of tube wells coming up from the foot of the hills right upto the Pushkar town which surrounds

the Pushkar Lake. Since then due to the pumping of water from all these tube wells, the recharge to the Pushkar Lake has gone down drastically. Like wise the two upper lakes Budha and Madhya Pushkar have not only lost the water in them and which were also recharging the Pushkar Lake have contributed to the decrease in recharge through underground flows.

This is further compounded by the fact that the Railway authorities have a large pump house in the bed of the Budha Pushkar taking away the water to Ajmer railway junction for purposes of washing the yards, bogies and other railway properties. It appears that the above factors have adverse effects in reducing the ground water flow to Pushkar lake causing the quantity in the lake getting reduced year after year. Added to this, the steep hill slopes bring down lot of sand moving into the Lake through the streams causing heavy siltation in the Pushkar Lake.

The hills comprise sedimentary sand stone formations with numerous joints vertically as well as horizontally and in some places there are a number fractures and fissures. Due to weathering action, sand particles are carried away by the rainfall and flow into streams. In the ring of hills surrounding the lake there is a gap which leads to the Thar Desert that is marching towards Pushkar through the gap owing to desertification due to denudation of greenery and disappearance of forests in the hills by human activities. The hills have become barren with only shrubs, consequent to the unabated cutting of trees for fuel by the inhabitants. Strong winds in summer carry sand of the desert through the gap in the hill ranges and get deposited in the lake beds leading to heavy siltation.

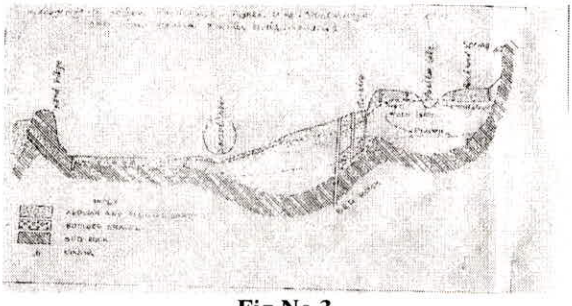


Fig No 3

The siltation is aggravated further by the devotees and pilgrims who throw the ashes of their dead after cremation into the lake as a ritual and encouraged by the local priests. The pollution in the lake is increasing day by day due to population expansion in the town as well as the increasing influx of tourists and pilgrims year to year. The tourists consist not only from India but also Foreigners from abroad. The tourist's traffic is heavy during the winters when the famous Pushkar fair of camels held every year. The feeding of the fishes by the pilgrims and tourists for ritual and as well as for fun, exacerbates the pollution. Apart from this bathing is considered as a must and part of a religious act and bathers do not wash their body outside before entering the lake unlike they have to do while entering the swimming pools.

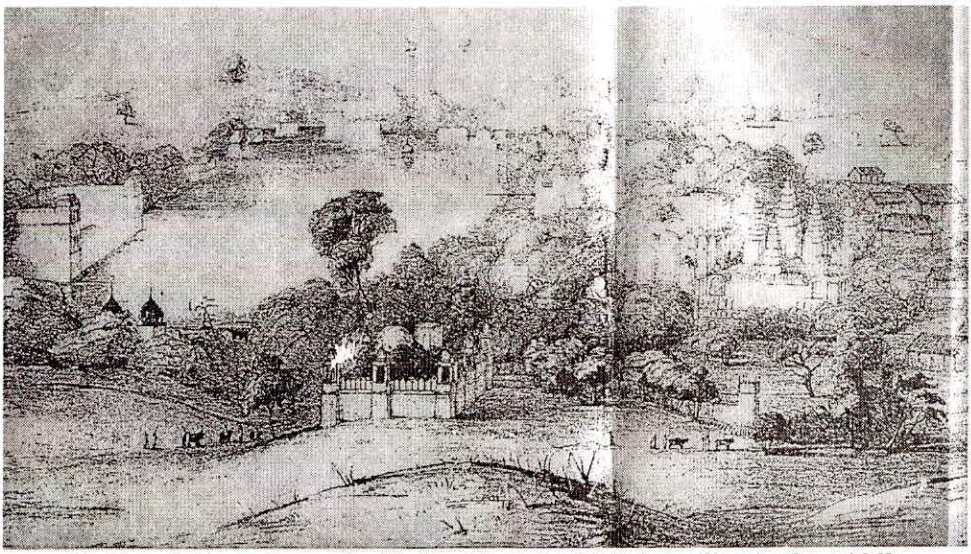
The inflow into the lake has reduced over the years both from the surface and through underground due to the numerous tube wells that has increased year to year both for agriculture and for domestic use in and around the lake as well as in the catchment plains. In addition a number of posh hotels have come up since the years to cater to the needs of the

foreign tourists and many of them have swimming pools whose water is not recycled or used for recharging the ground water every time they clean the pools. Many of the areas around the lakes with Ghats drain the storm water and at times mixed with sullage into the lake. It is reported that there have been mass destruction of fishes due to high degree of pollution and low oxygen content at times. Eutrophication of water is in evidence as the lake is land locked on all sides and with very little inflow that is less than the amount of evaporation and seepage in the bed.

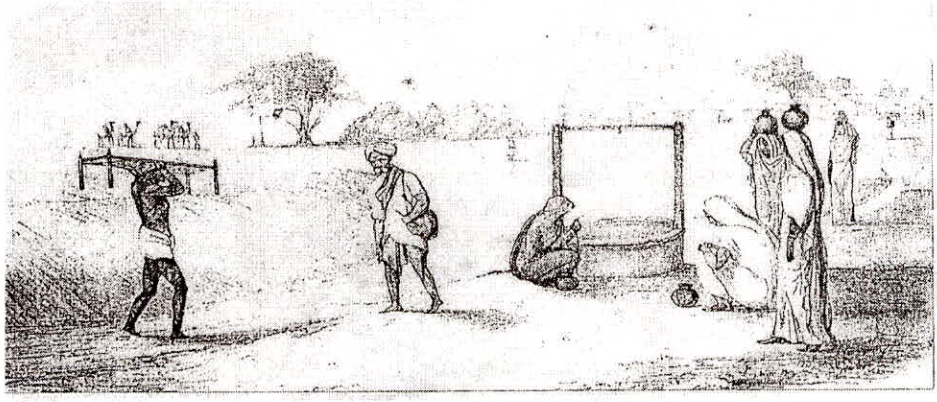
The local authorities along with N.G.Os and other institutions have a number of times attempted to desilt the lake and clean it, but it is reported that in a very short time it gets silted again and gets polluted. There efforts have not yielded any permanent solution to the recurring problem. A small portion of the lake has been segregated where tube well water is pumped in, to help bathing and to carry out other religious rituals. The pumping is meager and is not able to keep the entire lake clean and fill it with water to the required level.

Suggested measures to rejuvenate and restore the lake locating after analysis of problems

The lake which is in existence from times immemorial was sustained due to the fact that the local people had adopted traditional practices of water management for domestic purposes as well as for agriculture use. There used to be a good balance between the rainfall recharge and the consumptive use of water both from the surface and as well as the ground water use. The two big lakes Budha Pushkar and the Madhya Pushkar used to be full with water supplied by the rainfall falling on the hillsides. These lakes with water were recharging the lower Pushkar Lake due to pervious nature of the ground strata. It appears that the lower lake thus had good inflow from the bottom as in the case of an open well and also supplied by surface flows by the three streams causing some out flow as well, in the surface. Thus due to the continuous in flow and out flow, the Pushkar Lake used to be clean with potable water. Most of the water in the surrounding areas was drawn from the open wells for domestic and agricultural purposes owing to the fact that the ground water table was pretty high in those days. In the absence of piped water supply to the homes and also to the public residential places like Dharmashalas and even if some hotels that would have been there, just the required quantity of water was consumed by all. Thus a balance had been maintained between supply and demand and there was sustainability. This is evident by the writing of a British artist Pran Nevile with sketches in the year 1878 A.D. Some excerpts from this article named Pushkar as seen by a British artist's that appeared in the magazine India Perspectives December 2003 is reproduced with sketches



Pushkar Lake in the past with the Jehangiri Mahal pavilion in the middle



People taking water from open wells in the past

Presently due to the modern practices of water usage with higher consumption not within the bounds of local supply of water, the sustainability of the lake is severely affected coupled with pollution problems. The piped water supply practically in all the houses and in the numerous hotels has increased the per-capita consumption of water upsetting the balance that used to be there between supply and demand. The greed for increased production of agriculture in the surrounding land s leading to the uncontrolled tube well population has worsened the situation. Similarly for domestic purposes also, the sinking of tube wells has depressed the water table around the lake considerably. There is competition among the tube wells going deeper and deeper to meet the consumption pattern. Even the tube wells put at the foot hills where there is a deeper aquifer, have gone dry due to reduction in recharge. There are no open wells. This indicates that in order to remedy the situation recourse has to be taken to the recharge of the ground water to bring up the water table to reasonable levels at least above the bed of the Pushkar Lake such that there is a ground water inflow into the lake throughout the year.

In addition there should be a regulation on the tube wells and no further tube wells should be allowed to be sunk in the Pushkar catchment area. Further control on the existing tube wells must be exercised to reduce consumption both for agriculture and domestic use. Change of cropping pattern in agriculture and automatic stop cocks for the taps in the houses and in the public places will help in reducing the consumption considerably. The existing posh hotels with swimming pools should recycle the water of the pool when ever they clean it. Smaller hotels should drain the waste water to recharging pits in their areas so has to increase the ground water recharge to the lake. This will help in increasing the ground water flow to the lake.

The measures that the Government and the local authorities can take to improve the ground water flow are suggested as below.

Prepare a topographic survey of the entire catchment from ridges downwards towards the lake, in case survey of India topo-sheets to a large scale or not available. In case such maps are available only local details such as the streams and valleys are identified clearly that can add to the surface flow to all the three lakes may be got done through field work. This need not be elaborate but a general indication is enough. Simultaneously, some geophysical studies may be done to delineate the extent and depth of aquifer zones in the catchment area, that will help the ground water recharge to all the three lakes and in particular to the Pushkar Lake.

Since the hills are comprised with sand stone formations, starting from the ridge downwards towards the foothills, as well as in the foothills and wherever possible, long trenches at least 5mts length and 2mts depth and about 1.5mts wide may be dug into the stratified formation in staggered rows along the contours. This will help to increase the recharge into the ground as much as possible whenever there is rainfall. The sand will get trapped into these trenches and will not move towards the lakes on the surface. Even if the trenches are filled with sand gradually being pervious the recharge rate will not get affected.

The pumping to the railway facilities in Ajmer must be stopped altogether so that the Budha Pushkar Lake gets filled up with water over the years and would become a permanent recharging source to the Pushkar Lake along with similar phenomenon by the Madhya Pushkar Lake.

The three streams as mentioned earlier should be properly channelized to carry the surface flows straight into the Pushkar Lake. Wherever there is pervious zone causing deep percolation such reaches of the channel should be lined to prevent deep percolation.

Afforestation of the hills should be taken up as a campaign so that there is change in the micro climate towards cooler side to increase precipitation of rain bearing clouds. Cattle grazing of the hills side should be prevented so that the forest is not denuded. Stall feeding of the cattle/ livestock should be resorted to by whoever that maintains such animals.

The Municipality should install Electric Crematorium or preferably C.N.G Fired Crematoriums in Pushkar so that use of large quantity of fuel that results in ash along with the body burning is minimized. This will prevent the large quantity of ash getting into the Lake causing siltation as well as pollution. This will of course need the co-operation of the large number of priest class that abound in the holy Pushkar town. The authorities need to persuade and win over the

head priests through awareness and education. Similarly the Ghats should be demarcated distinctly for different purposes such as bathing, immersion ceremonies and feeding the fishes minimally so that the pollution is controlled and within the natural rejuvenation capacity of the water body in the lake.

Throwing of the flowers and other pooja materials should be minimized and localized. Similarly the immersion of ashes also should be reduced to the least. Till such time the priests are enrolled and aligned to adopt these measures, coir mats can be laid at some depth below the surface of water to collect them and removed at periodical intervals preventing the settling of these undesirable and deteriorating organic materials that will lead to Eutrophication. The priest class should be clearly warned that if the present trend continues there will be no lake and their will be no livelihood for them in future.

The pumping of tube well water as is being done now will not help the fishes as such water will not contain dissolved oxygen. As the evaporation is higher, compared to the inflow due to ground water recharge, increased pumping will lower the water table further and enhance deeper percolation. The action should be so done to do increase the ground water recharge, reduce the water consumption pattern overall as per the suggested measures, such that the ground water table is raised up gradually. This will help the water influx into the lake from the bed and the sides during the non-monsoon season and in-turn also will increase the surface flow during the monsoon period. A combination of all these actions will increase the influx into the lake and most probably an out flow channel will be required to maintain the level of the lake constant for a long period in a year. The out flow can be led out near the sand dunes that has blocked the out flow channel which appears to have been existence in the past as observed at the site at one end of the Ghats. The outflow should lead to the natural channel towards the lower village which is visible in the valley below.

The sanitation and sewage disposal needs immediate improvement in the town and the capacity of the existing sewage treatment plan should be expanded. The draining of the storm water and sullage water into the lake must be diverted to flow outside the lake or pumped out to the lower levels where it can be treated by separating the sullage water and the storm water for recharging. Solid waste must be suitably treated and used as manure.

Use of plastic waste must be banned in the town and collection of solid waste must be done systematically to prevent getting into the lake. The drainage on the roads must be planned properly so that the excess water is collected and let towards recharging zones specially selected around the lake area to increase the recharge.

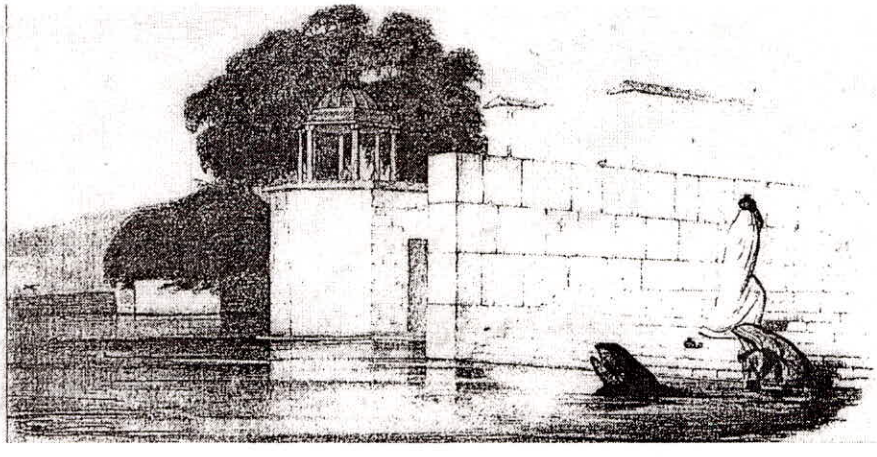
To prevent the wind blown sand particles getting into the lake, plantations of special species such as Vetiver grass and such varieties that are not eaten by cattle and sheep should be planted in rows across the gap in the mountains that bring the wind blown particles. In alternate rows, trees that grow tall should be planted close by to act as a screen. The movement of the sand dune formation should be arrested by these vegetative barriers. The forest department should be involved in this work to be taken up under their own funding arrangements.

De-siltation of the tank shall not be taken up until recharging measures are put in place and water table raised up. Otherwise whatever water that is in the lake may go down to deep percolation if done without recharging measures in place.

It is desirable to have some fountains in the centre of the lake and some bottom aerators to increase the oxygen content in the water to hasten self purification and keep the fish population alive and healthy

CONCLUSION

An integrated and a holistically prepared project report should be got up incorporating in the above suggestions. The implementation of the project must be taken up in stages, starting with priority items taken up first as per availability of funds and convenience. The report shall be prepared by the local persons who are familiar with all the problems and supplemented by external experts in various disciplines. Such a project shall be prepared to international standards to attract external assistance for funding to take up the project. There are many donors within the country as well as abroad. Further, effort should be made to get the Pushkar Lake in the list of Ramsar convention for restoration of lakes. This will help in getting funds from international organization like UNEP, UNSECO, World Bank, ADB etc as the lake has all the qualifications to get into the list. It has cultural heritage, ethnic back ground due to the camel fair where colorful Rajasthanis assemble, deep religious significance for all the Hindus due to the one and only Brahma temple in the whole country and the irresistible attraction of the foreign tourists who throng all the year round and in particular during the Pushkar fair



Pushkar in the glorious past