MANAGEMENT AND CONSERVATION OF LAKES: A CASE STUDY

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ABSTRACT

Water quality reflects the composition of water as affected by natural causes and man's cultural activities, expressed in terms of measurable quantities and related to intended water use. In this study an attempt has been made to ascertain the water quality of the Dr. Salim Ali Lake at Aurangabad. The Dr. Salim Ali Lake is divided into three rows and the samples were collected from five sampling stations (fifteen samples from each row) and analyzed for 5 water quality parameters. The study revealed that there is degradation in the ecological health and biological wealth of the lake. This is due to point source inputs, such as inhabitation of new townships CIDCO and HUDCO. This paper emphasis on the management and conservation methods needs to be employed in restoring the Dr. Salim Ali Lake water quality.

INTRODUCTION

Water quality monitoring is defined as the process of sampling, measurement and subsequent recording of various water quality characteristics. An important objective of water quality monitoring is to provide authorities with appropriate information that aids the decision making process (Stout, 1993). The type of water quality information required by authorities includes information on background quality and temporal and spatial trends in physical, chemical and biological properties of the aquatic ecosystem. Probably the most important outcome authorities ask of monitoring programme is the identification of the key causes of poor water quality in a system.

The Dr. Salim Ali Lake at Aurangabad, India was used as a case study to evaluate a spatially intensive approach to water quality monitoring, which involved the collection of water quality data from a large number of sample sites over a short period of time. Despite a few potential limitations, the spatially intensive water quality monitoring methodology should allow environmental managers to rapidly and cost-effectively (in the long term) identify point and non-point source impacts on water quality.

The water quality in the Lake, due to point source inputs, was associated with inhabitation of new township CIDCO and HUDCO. Long-term management efforts in restoring the Lake water quality need to be firstly directed at reducing point source inputs, secondly at reducing non-point source inputs such as people using lake as a recreation for boating purpose and thirdly at improving the catchment water quality by reducing direct human and cattle access to lakes. Dr. Salim Ali Lake is located in the northern part of Aurangabad, and is subjected to multiple uses such as recreation, and industrial water supply. Increase in human population and urbanization in recent years resulted in gradual deterioration of water quality in the lake It

was shown that water quality deterioration was associated with increases in domestic sewage discharges as well as non-point-source pollution including agricultural chemicals and eroded soils. In this study an attempt has been made to assess the water quality of Dr. Salim Ali Lake and also emphasis on the management and conservation methods needs to be employed in restoring the Dr. Salim Ali Lake water quality.

METHODOLOGY

The task of planning an effective and optimal lake monitoring network, involving decisions on location of sites, methods, analysis and frequency of sampling is a complex phenomenon requires a heuristic approach.

Spatially intensive water quality monitoring is the collection of water quality data from large number of sites over a short time.

Location of sample sites

The surface area of lake was divided into three rows on the basis of its utility and ground truthing. Three potential sources of pollution were identified by ground truthing and inspection of existing maps and site visits.

Sample collection

Sample collection was carried out over a month. In terms of period from 1-31 March 2001 were collected by two groups. Each group was provided with a sampling kit, sample location map. Training was provided to each group to standardize sampling procedures. At each sample location, three samples were collected in three separate sampling bottles. Samples were collected at the surface, in the middle and at the bottom points in each row.

STUDY AREA

The lake pollution problems potentially exist for this area, since there is currently large flow of untreated domestic wastes are being discharged into the lake beyond its self-purifying capacity. Figure 1 shows the photographic view of Dr. Salim Ali Lake.

Fig. 1. Study Area (coloured photograph is given at the end of the book)

The study was restricted to a monitoring the fifteen (five per row) sampling sites namely; For Row1; SR11 to SR15: For Row2; SR21 to SR25: For Row3; SR31 to SR35 (see figure 2).

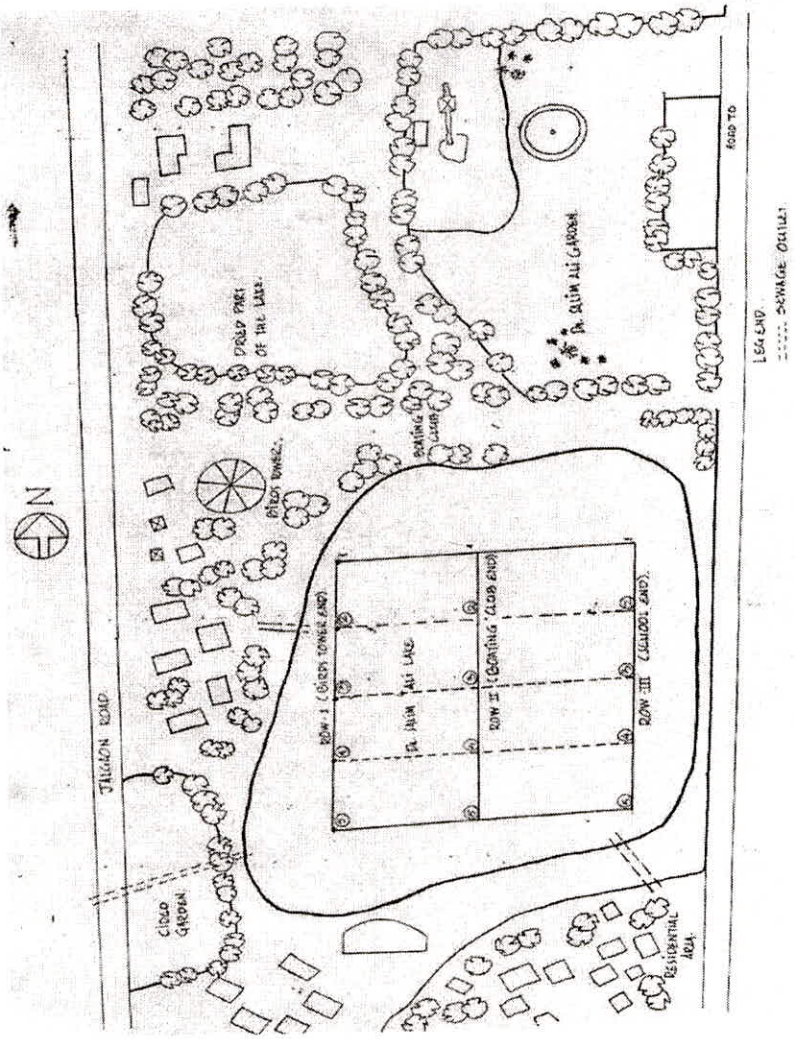

Fig. 2. Study area with monitoring stations

RESULTS AND DISCUSSIONS

Physico-chemical parameters (Temperature, pH, DO,) were measured *in situ* using a water quality analyser. Analyses of water quality parameters including Suspended Solids, DO, and BOD, followed the standard methods recommended by the American Public Health Association (APHA, 1998). The analyses of the few physico-chemical parameters are presented in Table 1, 2 and 3.

Table 1. Physico-Chemical Water Quality Parameter (For Row1: Birds Tower End)

Sampling Sites	Temp.(C)	pH	Suspended solids (mg/l)	DO (mg/l)	BOD (mg/l)
SR11	24	9.5	625	3.0	52
SR12	23	9.0	660	3.5	48
SR13	25	9.5	690	3.6	51
SR14	23	9.5	650	3.8	49
SR15	23	9.0	640	3.2	62

Table 2. Physico-Chemical Water Quality Parameter (For Row2: Boat Club End)

Sampling Sites	Temp.(C)	pH	Suspended solids(mg/l)	DO (mg/l)	BOD (mg/l)
SR21	24	9.0	635	3.0	51
SR22	23	9.5	620	3.6	46
SR23	24	9.3	634	3.4	50
SR24	23	9.1	648	3.7	47
SR25	24	9.0	655	2.7	69

Table 3. Some Physico-Chemical Water Quality Parameter (For Row3: School End)

Sampling Sites	Temp.(C)	pH	Suspended solids (mg/l)	DO (mg/l)	BOD (mg/l)
SR31	24	9.0	645	3.2	61
SR32	23	9.5	655	3.1	64
SR33	23	9.3	648	3.4	59
SR34	23	9.1	658	3.6	58
SR35	25	9.0	685	2.8	65

The tables 1, 2, 3 and Figure 3 reveal that the average D.O. level is about 3.2 mg/l. So the lake can be classified as highly polluted one. In order to improve this condition three aeration systems have been suggested namely, Floating fountain, Ozonizer and Floating fountain cum ozonizer. Floating fountain cum ozonizer device is highly effective in increasing D.O. at both surface and middle zone so installation of this device is suggested in highly polluted zone of lake. Table 1 shows the analysis of water sample collected form the bird's tower end. Deficiency of D.O. is observed in the both surface and bottom zone. Therefore the floating fountain cum ozonizer has been suggested to install at birds tower end. Ozonizer is effective at the places which have deficiency D.O. at the bottom zone. Table 2 shows that at boating club end has very low D.O. level. i.e. the ozonizer has been suggested to install at boat club end. The device floating fountain is effective in improving the D.O. level of the surface zone of the lake. The deficiency of D.O. has been observed at boating club end and School end. The floating fountain and ozonizer can be relatively moved from one place to another place to improve the D.O. level of these areas. The location points of these aeration systems have been shown in figure 4.

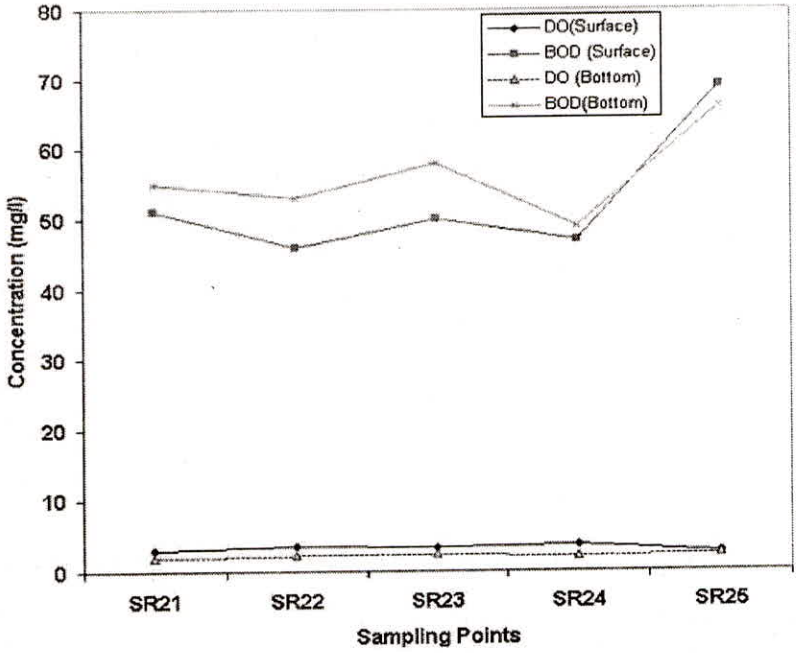

Fig. 3. DO and BOD Values at different cross sections of the lake

MANAGEMENT AND CONSERVATION METHODS

Ascending of the Sources of Pollution

Pollution and contamination of the lakes are attributed to various sources. It is necessary to investigate all possible sources of pollution including rainwater, agricultural wastes, fertilizer, pesticides, sewage and other waste effluents, solid wastes, disposed weeds etc., along with the pollution load of each source (Sharma et al 2001).

Strengthening of Environment Awareness Campaigns

Although some campaigns and programs on environment awareness are undertaken by the various environmental conscious groups and MIT [(Sharma et al., 2001) this need to be further strengthened and continued.

Prevention of Pollution (Sewerage) Schemes

Until a separate system for storm water and sewage is developed the excess discharge has to be allowed to overflow into the lake when the sewage pumping facilities are overloaded particularly during the rains. It is recommended to provide temporary retention ponds by deepening the sewage outlets of the lake and enclosing them with short bunds so that suspended matter in the sewage could settle and later be removed without entering the lake.

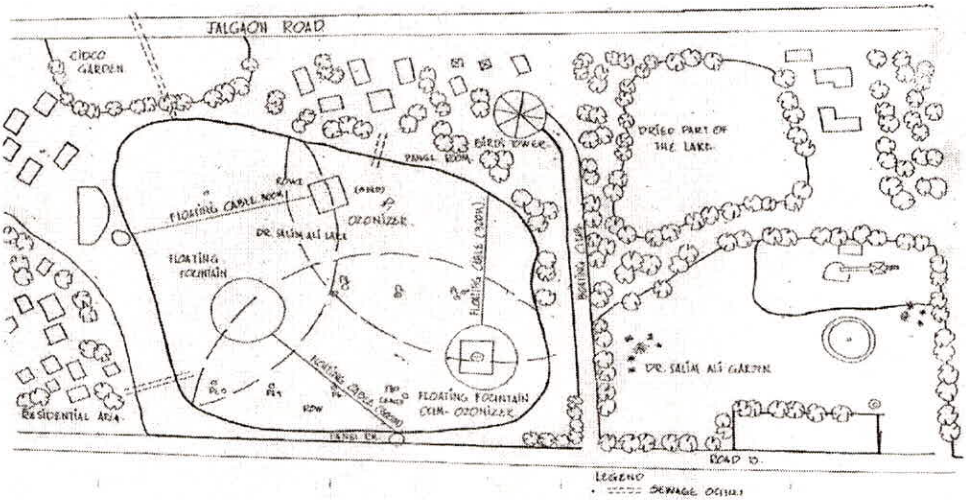

Fig. 4: Location of aeration systems in Dr. Salim Ali Lake

Developing the Lakes

Biological control of pollutants through planned and controlled cultivation of suitable plants, such as water hyacinth, is recommended and therefore experimental studies must be conducted to asses the effectiveness of biological control through weeds. The methods of disposal of weeds including (drying) treatment, end uses, such as in biogas generation, composting, manufacturing of pulp etc., and the sites for disposal etc., need to be properly planned. By introducing appropriate technology for such end uses, the burden of disposal costs on the state could be minimized through commercial participation. Cultivation of lotus may be allowed in specified area of the Lake provided that the dead plants and roots are removed regularly together with any silt trapped. However, such cultivation shall be well planned and controlled to avoid adverse human intervention.

Environmental Monitoring and Management

Catchment Area Treatment

At present though harmful chemical fertilizers are not widely used in the catchment area, in order to prevent their excessive use, it is suggested that a survey be done on the types and amount of fertilizers that are presently used and suitable control measures must be taken as per the Pollution Control Act and any other regulations prohibiting use of substances that may directly or indirectly be harmful to public health. A major source of pollution is the human and animal feces that are openly disposed on land. It is definitely necessary to resettle elsewhere any encroachers who have now found habitation within the catchment area or to relocate them after providing adequate sanitary facilities and suitable arrangements for the disposal of both solid and liquid wastes so that these will not enter the lakes. Preliminary studies conducted on water quality monitoring of lake indicates possible relationships between certain plants and some minerals and heavy metals present in the lake. It is recommended that further studies be conducted to clarify this point, also with a

view to exploit through biological control the possible abilities of specific plant species to absorb pollutants and contaminations.

Monitoring of Water Quality

Once the water quality monitoring program is commenced, the locations (and depth) of sampling and the timing of sampling should be maintained every year based on a fixed schedule. Arbitrary alterations should be avoided as comparison of data become difficult or impossible. When such abnormalities are discovered in water quality analyses, reasons must be investigated immediately and if necessary, the analyses must be repeated. As it is important to assess precisely the prevailing pollution condition in the lake, it is recommended to carry out a primary survey for all major pollution parameters and for different water layers. Such analyses should be repeated at least once in each season.

CONCLUSIONS

To augment the natural process of aeration, it is suggested to install artificial aeration systems in order to restore the lake water quality. The roadside open drains are likely to collect trash thrown by the passers by and clog the screens provided. It is therefore necessary not only to clean the drains, but also to create public awareness to control scattered disposal of wastes. The role of manual labour especially in the maintenance part of the program, for example in the annual deweeding works, shall not be neglected on account of the employment generation and creation of awareness. An environmental awareness campaign should be carried out to enlighten the public about the importance of environmental conservation and management.

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