

DISMAL CONDITION OF WATER BODIES IN URBAN LANDSCAPE: A CASE STUDY ON SELECTED PONDS IN BURDWAN MUNICIPALITY, WEST BENGAL

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1. Introduction

Water is most vital substance for life, up to 60% of the human body is comprise with water (The USGS Water Science School), where only 1% of the global content of fresh water and is suitable for human consumption. But the rapid growth of population providing considerable stress on this finite supply of usable water. Before going to the main discussion it should be considered whether these ponds can be consider as a pond, as the *International Ramsar Wetland Convention* define pond according to its size where the upper limit for pond size is 8 hectares (19.768 acres) , according to this concept excluding *Krishna Sayar* all four *Sayars* can be considered as Pond. **(Table 1.)**

Table 1. Area of the Ponds

Pond	Area in Acres
Krishna Sayar	27.799
Kamal Sayar	2.471
Shyam Sayar	5.868
Rani Sayar	5.559
Suli Pukur	0.962

Source: Ward Map of Burdwan Municipality, 2011 (Area Calculated by Author through Graphical Method)

2. Study Area

The study area, Burdwan Municipality, was established in the year 1865. It is situated on the banks of river Banka on the northern side of river Damodar. the administrative headquarter of Burdwan district of West Bengal, having latitudinal and longitudinal extension of 23°12'30" N to 23°15'N and 87°48'44" E to 87°52'20" E. The study has been made on the five major Sayar of municipality, among these, *Kamal Sayar* is in ward number 26, *Krishna*

Sayar and *Suli Pukur* are in ward number 28 where as *Rani* and *Shyam Sayar* are in ward number 30.

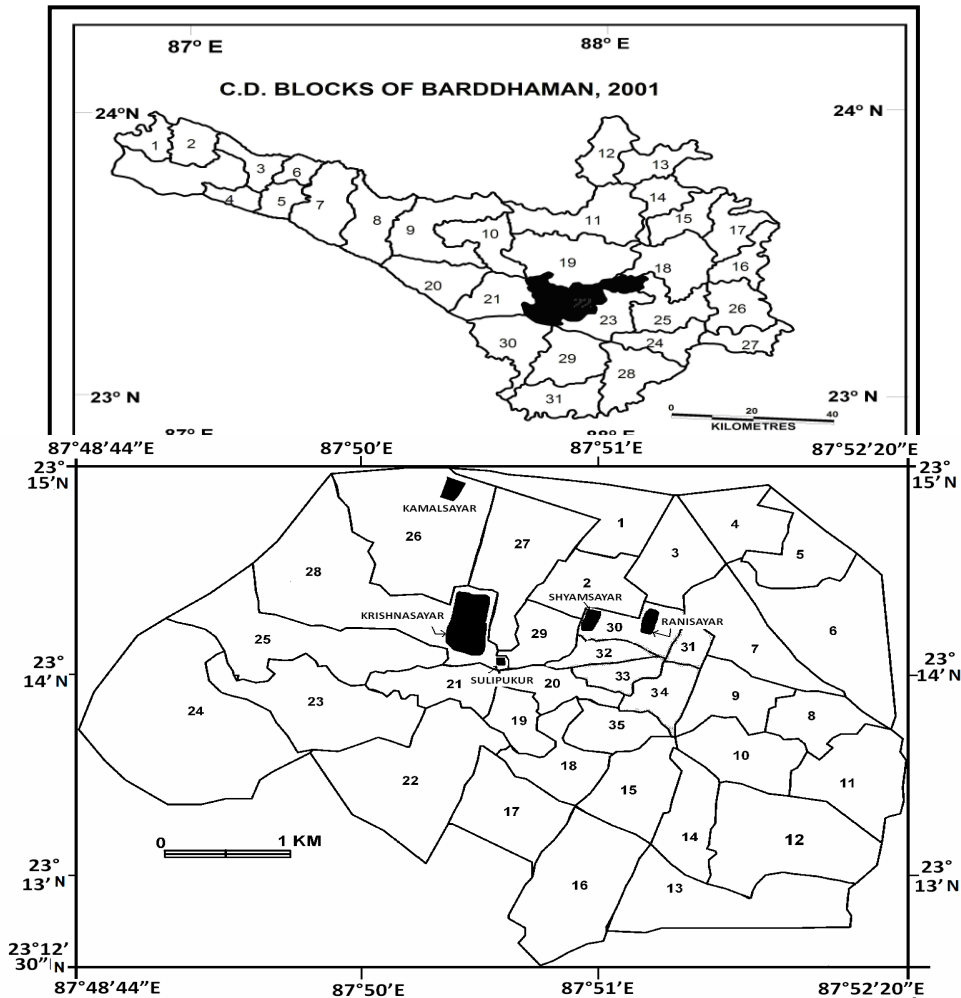


Figure 1. Location map of the Study Area in Burdwan Municipality

3. Objectives

The main goal of the study is to find out the glimpses of environmental stresses (due to solid waste disposal, haphazard urban growth, encroachment by the side of the ponds) in the study area of Burdwan Municipality. So to achieve that goal the following objectives are considered:

Knowing the utility of specific ponds in the study area;

Finding the socio-economic status of the people surrounding the pond;

Analyzing the level of man and pond interaction in the study area in respect to the quality of water, usage, and pollution scenario;

Finding the management programme taken by the government for the reclamation of these ponds and

Suggesting some measures for the purpose of management of the ponds.

4. Methodology

The whole research has been completed using empirical observations. In the pre-field session, toposheet numbers (73M/15 and 73 M/16) of Survey of India, and Map of Municipality (2011), Google Earth Imagery, Census Report (2001 and 2011), and numerous literatures related to it are collected. After geo-referencing Burdwan Ward Map the study area are plotted using Map Info Professional 5. The numbers of household taken as sample are 140 in totality. Door to door survey has conducted to measure the perception level. Stratified Sampling Technique has applied for this. In case of water testing the Conductivity is determined by Self-Contained Conductivity Instrument, temperature measured immediately after collecting the water sample by Thermophone, pH is determined by pH Metre, DO is measured by Winkler's Method and the amount of CO₂ is tested by titrated against N/100 Hydrochloric acid. Numbers of photographs has been taken to prove the ground reality. The statistical techniques are done by using Microsoft Excel 2007.

4. Historical Background of Study Area

According to the famous book named, "Bardhaman Raj Ittibritya", written by Prof. Nirod Baron Sarkar, the town having four major tanks, made by Bardhaman Raj Family, mentioned above. Ghanashyam Rai, the son of Babu Rai, dug a large pond, popularly known as Shyam Sayar in the year 1674-'75. The 6th successor of this family, Krishnaram Rai (1675-'96), had excavated the renowned Sayar, Krishna Sayar in 1691. Following the untimely death of Jagatram Rai (1699-1702), left behind his wife Brajakisory, the lady of iron-will, was responsible behind the occurrence of Rani Sayar. Tejchand, the benefactor of the people, dug a big lake called, Kamal Sayar in the name of his queen. The main purpose behind digging all these ponds is to facilitate the supply of water to the people of Burdwan District.

5. Socio-Economic Condition of the people adjacent to the ponds

In terms of socio-economic condition, the five major ponds can be generalized in to two different categories. Better socio-economic of the population can be seen surrounding *Shyam Sayar* and *Rani Sayar*, in respect to the people living surrounding *Kamal Sayar* and *Suli Pukur*. The concentration of school drop outs is in an increasing order surrounding *Kamal Sayar* and *Suli Pukur*, as most of them has finished their studies after attaining primary school, like in

Goda, Siltala, Kesobgong Choti, and Bakultala Primary School . There is no public health care centre nearby Kamal Sayar and Suli Pukur, as a result people of these areas are compelled to run to Burdwan Hospital in their crisis period, though in the eastern side of Suli Pukur a private nurshinghome, named “Adarsha Nursing Home” has been made recently, but according to the public demand it is not sufficient. On the other hand, most of the people here, basically from the lower income group suffering from “ hidden hunger”, comes from a lack of proper food and calories, it is not evident and has no visible warning signs, therefore ,people suffer from it, may not even be aware of it. The public health has been overlooked in the fire and fury by the local governing body. No of medical stores, health care center, pathological centers, chief medical office, dispensary and most importantly Burdwan Medical College Hospital, on the side of Shyam Sayar. Most of the house surrounding Kamal Sayar and Suli Pukur, are facing over crowding (figure 4), having 6 to 10 members each.

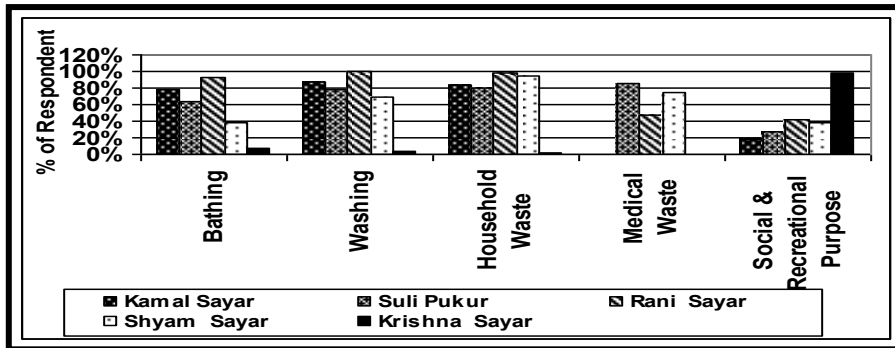
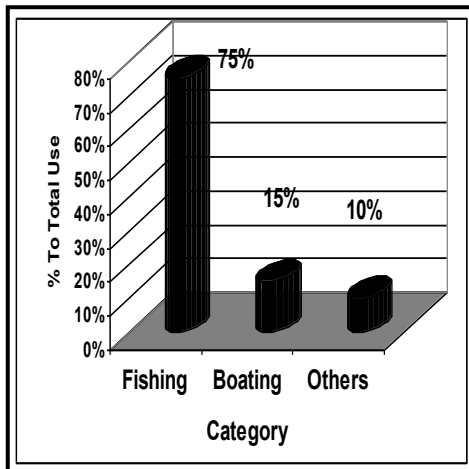


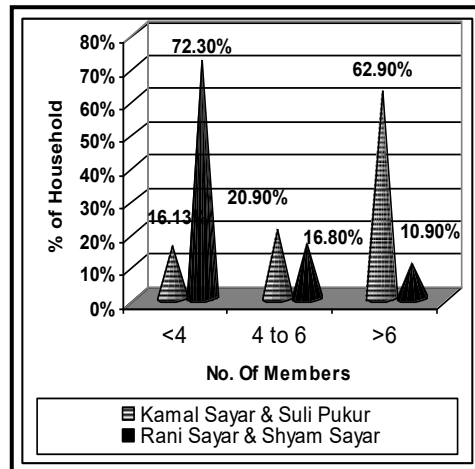
Figure 2 . Using Purposes of the Ponds by people (Source: Field Survey, 2011)

Figure 3. Use of These Water Bodies



(Source: Field Survey, 2011)

Figure 4. Household Size



(Source: Field Survey, 2011)

6. Present State of Study Area

With increase of population, the condition of these ponds, along with other ponds of Burdwan Municipality are deteriorating, destroying the self-purification capacity. These problems are as follows;

- The field survey portraying a picture about the Encroachment by the side of the ponds in the study area, mainly because of the residential purposes (70%), shopping purposes (20%) and others (10%), like in *Kamal Sayar* accept the eastern part, the other parts are occupied by settlement. In *Suli Pukur* the southern and western part are covered by settlement, whereas *Rani Sayar* is completely surrounded by households. As a result different factors are arising which are responsible for the deterioration of the water quality of the study area .

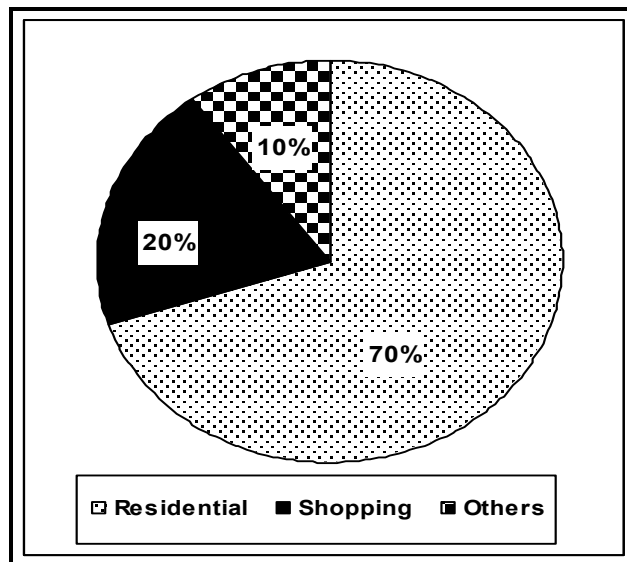


Figure 5. Encroachment by the Side of Ponds (Source: Field Survey, 2011)
(Figure 5 & 10)

- Heavy population density within a small area is the common feature in all the surrounding of the four ponds accepts Krishna Sayar ,where piles of garbage at a regular distance and overflowing bins give pigs, donkeys and cows free invitation to feed on the garbage split on the road.

- Solid waste poses crisis in many of the world’s large urban areas due to explosive population growth and massive shift of population towards urban. According to Indian MSW Rules 2000, “Municipal Solid Waste” includes commercial and residential waste generated in a municipal or notified area in either solid or semi-solid form. Items which are no longer need or do not have any further use fall in the category of wastes and we tend to throw them away. Municipal solid waste also called “Urban Solid Waste”.

Amongst these, ward number 30, side of Rani Sayar and Shyam Sayar generate maximum amount of solid waste. Burdwan Medical College and Hospital is mainly responsible for the bio-medical waste near the Sayar, as well as major share of these solid wastes is come from a number of nursing homes, pathological laboratories and doctor's private chambers. (Figure 11)

In the eastern part of Suli Pukur a vast amount of bio-medical waste are deposited from the Adarsha Nursing Home.

Surrounding area of Shyam Sayar has been occupied by a number of shops fast food, which is great contributors of the solid and liquid waste in the ponds. According to the local people, 7 years ago, these shops were completely eradicated by the Burdwan Municipality.

The quality of water in Krishna Sayar is affected badly due to solid waste disposal, mainly during the time of Basanta Utsab and Fool Mela, because of the disposal of plastic, bottles, polythene, plastic containers, straw, paper, fruits and vegetables etc.

All of these ponds are greatly practiced by pisciculture, for these purposes different types of pesticides, herbicides, and sometimes toxic chemicals, weeds and poisons are added to the pond water which plays a very harmful roll for the aquatic life.

Excreta of dog and other animal entering to the pond through the surface; can be a possible source of bacteria, causing illness to the people bathing in it.

6.1 People's Opinion on the Condition of the Study Area

- No provision has yet been taken to differentiate the bio-degradable waste (such as green waste) and non- biodegradable waste at the source of disposal.
- Only few conscious families collect their own household waste and dispose them to the roadside community dustbin. Majority of the household dumps their daily waste in the personal dustbin and at the next morning they release it to the Municipality garbage van (**Figure 6.**). This figure is mostly practiced in the ward no 30, surrounds *Rani Sayar* and *Shyam Sayar*. But in the less develop area, like in the interior part of *Kamal Sayar* and even in the *Suli Pukur* surroundings the door to door collection of the waste has been stopped due to the negligence of the local governing authority. As a result, they dumped their daily waste in the nearby unused place or to the side of the.

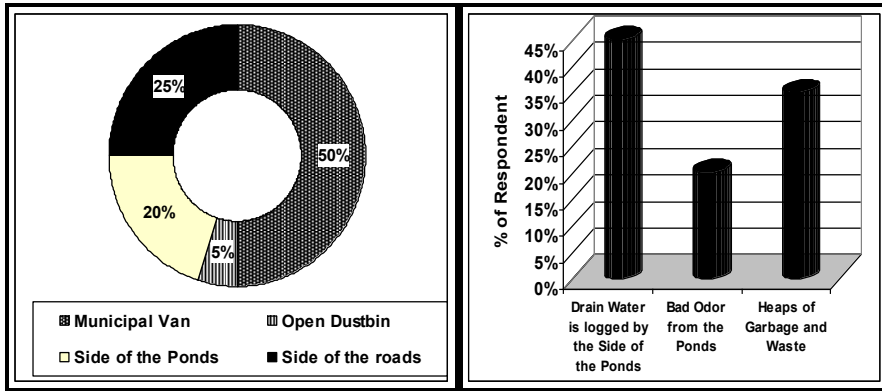


Figure 6. Places for Disposal of Household Waste (Source: Field Survey, 2011)

Figure7. Problems from these Water Bodies (Source: Field Survey, 2011)

6.2 Problems Resulting from Solid Waste Disposal

Unconscious habit of the residence and poor management for the waste disposal system has given birth to a number of environmental problems to the study area, which are given below.

- The discharge of the household waste and the sludge from the septic tank of the surrounding household, creating serious problem by putting the ground and the surface water at a great risk of being polluted by pathogens, hazardous chemical sand nutrient such as phosphorus, nitrate and organic wastes, resulting eutrophication.
- In some area the garbage are thrown indiscriminately at the side pond near the drinking water source, as a result ground water is also gets polluted through the leaching of the pollutant from the dumping source.
- These garbage points are the breeding point of the mosquitoes, flies, and various insects, causing serious diseases. During the rainy season the garbage from the Municipal garbage point washed out to the nearby pond and degrades the water quality of the pond, causes skin disease to the human body.

6.3 Threats to the Ponds in the Recent Days:

The main problems facing by the ponds now days are as follows:

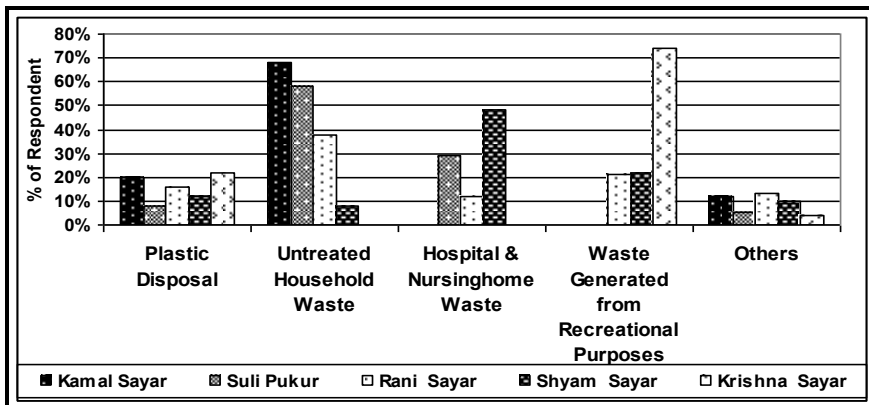


Figure8.

Factors Deteriorating the Quality of Water (Source: Field Survey, 2011)

▪ Drainage problems are the most common. The surrounding household having their drain outlet mostly in the ponds; like in the western and northern part of *Kamal Sayar*, 26 and 12 household allowing their household drain to open to the pond, the same scenario has been seen in *Suli Pukur* and *Rani Sayar*

▪ The side of *Shyam Sayar* has been occupied by different temporary shops and so as northern part of *Kamal Sayar*, in the eastern part of this pond there is University Institute of Technology (UIT) College campus and the hostel. According to the public opinion there was a drain about 20ft, going parallel to *Golapbag*, to the *Lahar*, which has been covered for the construction of this building. As a result the water of drain is logged by the side of the pond, causing overflow, during rainy season, as the sewage system gets hampered. In many areas there is lack of adequate drain to dispose off the storm and waste water. The outfalls of the drains are not proper either. Still there are some *kuccha* drains which create problems.

▪ The socioeconomic condition of the people surrounding *Kamal Sayar* and *Suli Pukur* is low that, most of them don't even have the sanitation facilities within premises and compelled to use the community latrine, at the same time many of them have the tendency of open defecation (Figure 10). The most important arising problems which needs to be discussed, is the improper management scenario of the governing body. The constructed eastern side of *Suli Pukur* is now in a destructive condition just because of lack of management.

▪ Special attention should be given to *Suli Pukur*, where the process of Eutrophication has been started because of mixing of nitrogen and phosphorus beyond the limit. The colour of the pond is blackish to gray. According to the public opinion, bad smell is coming from the pond, mainly during the wet season. The water of the pond creates skin diseases and rashes on the human bodies, and the constructed side is now in a distressed condition because surrounding ponds of improper management.

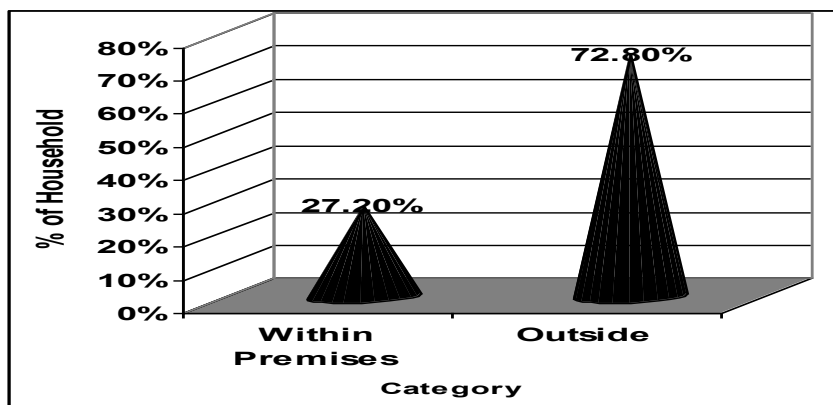


Figure 10. Sanitation Facilities of the Households (Source: Field Survey,2011)

6.4 Quality of Pond Water: Results and Discussion

After going through the chemical test of the samples of the pond water in the laboratory, the points which reveal the water quality are as follows:

Parameters & Permissible Limit Ponds	DO(mg/litre)	Combined CO ₂ (mg/litre)	pH	Temperature (°C)	Conductivity (µmoh/mg/litre)
KrishnaSayar	8.3868	39.335	6.90	34	86.6
ShyamSayar	5.7332	41.3335	7.50	33	148.8
RaniSayar	11.615	39.665	7.10	32	97.15
KamalSayar	5.5068	58.000	7.05	33	65.5
SuliPukur	4.2732	58.6665	5.50	33	68.1

Table 2. Variation in Physicochemical Factors in Ponds (Source: Water Tested by Author in laboratory, dated: 29-05-2011)

The ponds are holding about 10 to 12 mg/L of oxygen, which is the stander of dissolved oxygen and good for fish and other aquatic life. The amount of conductivity is high (148.8 µs/cm²) mainly in *Shyam Sayar*; it is because of high detergent influx in the water as the clothes of the patients of Burdwan Medical College Hospital are being washed here. Its value depends upon presence of total concentration of ionized substances. The amount of Combined CO₂ is maximum in *Suli Pukur* (58.6665 mg/litre), creating a harmful environment for the fishes. In general most fishes can do better in ponds with a pH near 7.0. So here it could be said that all of them are suitable for pisciculture except *Suli Pukur* (pH 5.5), though during study the variation of pH showed no reasonable significance. According to WHO (World Health Organization) the permissible limit of pH in drinking water is 6.5-8.5.

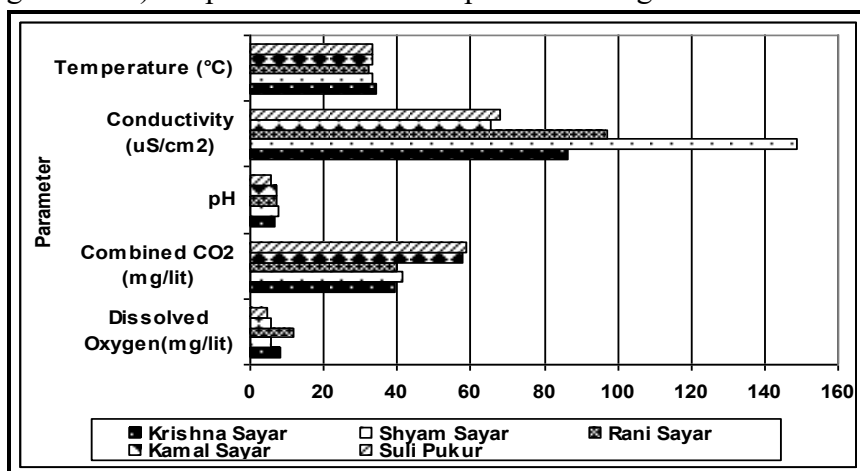


Figure 9.

Quality of Water Tested in Laboratory

The conductance shows the measures of concentration of mineral constituents in the water. The value depends upon the total concentration of ionized substances in the water shows that the conductivity is highest amongst the five in *Shyam Sayar*, as the total dissolved solid is high in this pond, which is the contribution of nearby Burdwan Medical College and Hospital and the various pathological centers. The permissible limit of Dissolved oxygen in average 35°C temperature is 6mg/litre, less than 6mg/litre can have detrimental effect on aquatic life, whereas in case of pH, the range is between 7.0 to 8.5 . Temperature is not as that much important factor to be considered in this situation but the aquatic herbicides are most effective when temperatures are between 15.5°C to 23.8°C. The total concentration of CO₂ changes periodically, but the concentration of CO₂ >20 mg/litre can have adverse effect on the water quality.

7. Planning and Management Programme taken by Burdwan Municipality

Some planning and management programme has been taken by Burdwan Municipality for the betterment of the society, amongst them some has direct influence upon these water bodies, like, the developmental objectives set by ULB (Urban Local Body) in a meeting for Intra-Municipal Infrastructural facilities to achieve the specific goal and targets are noted below to provide safe and hygienic sewage; sanitation facilities and eliminate unsanitary practice, such as open defecation; to provide effective area drainage system so as to avoid single day of water logging and to strengthen segregation waste from all the households and adopted scientific and sustainable ways for disposal of municipal solid waste.

The ongoing schemes of different intra-structures taken up by the ULB in the selected wards of Burdwan Municipality, having a direct influence on the study area, are as follows:

Table 3. Planning and Management Schemes of the local Government

Ward No.	Different Schemes taken up by ULB
26	<ul style="list-style-type: none"> ▪Construction of drains ▪Improvement of water supply
28	<ul style="list-style-type: none"> ▪Construction of community latrine ▪Community latrine for ladies only ▪Construction of drains ▪Improvement of water supply
30	<ul style="list-style-type: none"> ▪Construction of drains ▪Improvement of water supply

(Source: Burdwan Municipality, 2011)

There are number of scheme taken by Burdwan Municipality for the beautification of *Shyam Sayar* and surroundings, like: M.P.'s Local Area Developmental Scheme,(2001-2002), under Burdwan Municipality-

In the year 2005-2006 (dated -13.06.'05)-"Beautification of Shyam Sayar in W/No-30"(6,00,000/-), proposed by Sri Nikhilananda Sar(M.P);

"Beautification of Shyam Sayar in W/No-30" was reintroduced in 7.10.'05, by Sri.Nikhilananda Sar;

In the year 2006-'07(dated-13.11.'06),a new scheme was proposed by Sri Nirupam Sen (M.L.A)named, "Development and Plantation of Shyam Sayar Park in W/No-30(phase-1)".

For *Krishna Sayar* some management technique has been taken by the trusty, these are- (i) fencing surrounding the park; (ii) ring road development.

These managements can be sustainable with the initiation of government authority as well as positive cooperation of the inhabitants of the study area.

8. Suggestions & Conclusions

Depending on the above study some conclusion can be drawn, these are,

- Burdwan Municipality is taking much care of *Rani Sayar* and *Shyam Sayar* in comparison to *Kamal Sayar* and *Suli Pukur*.
- Haphazard growth of settlement and infrastructure has blocked the natural drainage course.

Water quality of ponds can be prevented with some proper management technique, like:

1. Strictly limit polluting activities near the ponds or in areas that drain into ponds;
2. Checking the hidden sources such as septic system or drainage sources;
3. Use of ditches and grading technique to divert polluted surface water away from the pond;
4. Reduce nutrient loading to pond;
5. Keep landscape disturbance to a minimum in the surroundings of the ponds;
6. Avoid soil erosion;
7. Do not connect ponds to storm drains;
8. Divert local runoff away from ponds with beams and ditches;
9. Keep a buffer strip of vegetation around the pond as much as possible, so as to intercept local runoff;
10. Construction of a settling pond or a wetland adjoining to the pond would be better to receive runoff and drainage before it reaches the pond;

9. Acknowledgments

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Figure 10. Encroachment by the side of Shyam Sayar (left side photo) and side of Rani Sayar (right side photo) due to rapid urbanization



Figure11 . Deterioration of water quality due to solid waste disposal like floating plastics and bottles (left side photo) and other household and bio-medical wastes (right side photo)

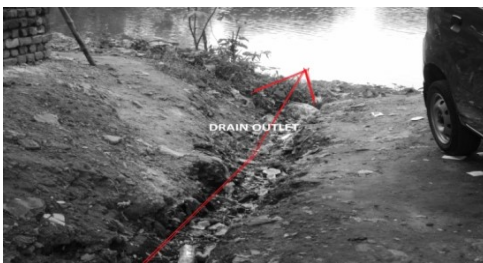


Figure 12 . The discharge of the household waste and the sludge from the septic tank of the surrounding household as the Household and roadside drain are opening to the pond