BASIC STUDIES ON RECLAMATION OF BELLANDUR LAKE

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ABSTRACT

Lakes and bodies of water, also known as wetlands, are among the most productive ecosystems that contribute to ecological sustainability, thus providing the necessary links between land and water resources. The quality and hydrology of these lakes and wetlands depend directly on the integrity of the basin. In recent decades, rapid urbanization coupled with unplanned human activities has dramatically altered wetland ecosystems globally. Changes in land use and land cover (LULC) in wetland watersheds affect water production and water quality in lakes. In addition to the LULC changes, the influx of untreated domestic wastewater, industrial wastewater, solid waste dumping and rampant basin encroachment have threatened the livelihoods of urban wetlands. This is evident from the nutrient enrichment and consequent proliferation of macrophages, which degrade the functional capacities of wetlands. The reduced treatment capacity of wetlands has resulted in loss of native biodiversity, widespread unsanitary conditions with the threat of mosquitoes, pollution of groundwater levels, impacts on biodiversity and environmental degradation of people who depend on wetlands. The decline of services and goods by wetland ecosystems has affected social, cultural and ecological spaces as well as water management. This paper observes the negative and harmful effects of lake water pollution on the environment and the surrounding community as well as the quality of water after its treatment. The most common form of water pollution has been waste disposal via human activities. The study conducts tests on water samples from the Bellandur Lake. Recorded values of pH, turbidity, hardness, lead (Pb), Cadmium (Cd), chloride (Cl), total phosphate (Po_4^{-2}),total acidity, total alkalinity, the temperature measured during the time of sampling varied from 26 – 28 °C and presence of heavy metals such as lead and cadmium for before and after the water treatment have thus compared to analyze the extent of water hygiene delivered.

Keyword: – *Bellandur Lake, Environmental pollution, lake water restoration, heavy metals*

1. INTRODUCTION

Lake Bellandur (at 12.9464° to 12.9277°N and 77,6420° to 77.6807°E) located in Agaram and Bellandur Ward is the largest lake (366.89 ha; 906 acres 25 guntas) of the City Bangalore (BBMP) and span six villages. Lake Bellandur has a watershed area of nearly 279 square kilometers with 46 interconnected lakes in layers. The Bellandur Lake Basin has a population of 34.8 thousand (2011) with a population density of 138 persons per square kilometer. Lake Bellandur has a watershed area of about 148 square kilometers (37,000 acres) spread across central, south, east and southeastern Bangalore.

Lake Bellandur is under increasing anthropogenic stress due to the constant flow of untreated domestic and industrial wastewater, solid waste dumps, wetland encroachment, and connected drainage systems. Lake Bellandur

belongs to category E under the CPCB classification of inland surface waters. Polluted populations of phytoplankton and zooplankton were present in the water of Lake Bellandur, indicating pollution as well as eutrophication conditions. Post-urbanization development activities around Lake Bellandur have degraded its water quality and increased foam formation, becoming a threat to public health and its water completely non-existent. Not Suitable for human use. In addition, there is a decrease in biodiversity in the lake.

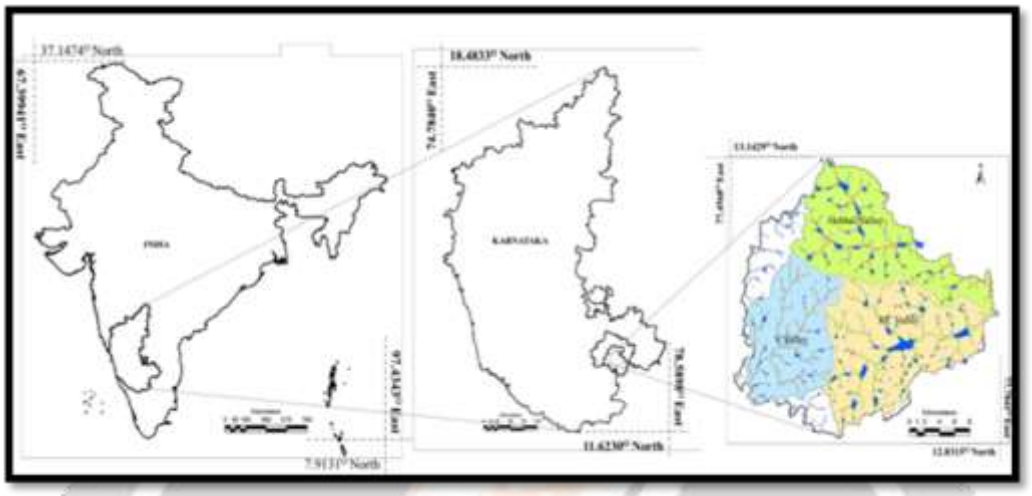

Figure1 study area showing the Bangalore catchment with drainage network

2. LITERATURE REVIEW

Rapid urban growth has many negative effects, including the loss of valuable agricultural and ecological land (e.g. wetlands, forests), increased energy consumption, and greenhouse gas emissions due to it. the use of the private car (Ramachandra and Shwetmala, 2009). Vegetation decreased by 32% (from 1973 to 1992), 38% (from 1992 to 2002) and 63% (from 2002 to 2010). The emergence of water bodies or the sharp decrease in the number of water bodies in Bangalore is mainly due to intense urbanization and urban sprawl. Many lakes (54%) are encroached on for illegal construction. The field survey of all lakes (2007) showed that almost 66% of the lakes were supplied with wastewater, 14% were surrounded by slums and 72% indicated a loss of watershed. In addition, the lake basin is also used as a landfill for municipal solid waste or construction debris (Ramachandra, 2009a; 2012a). Around these lakes there are illegal constructions and most of the time, the inhabitants of the slums occupy the adjacent areas. In many places, water used for washing and household activities and even fishing has been observed at one of these sites. The multi-storey buildings that were raised on some lake beds completely disrupted the natural flow of the watershed, causing severe deterioration and deterioration in the quality of the water bodies. This correlates with the increase in built-up area of the Bangalore-centric growth model adopted by the state apparatus, severely affecting open spaces and especially water bodies. Several lakes have recently been restored by the city and the agencies concerned.

3. LABORATORY WORK & ANALYSIS

3.1 Preliminary Analysis of Wastewater Sample

The collected water samples, tested initially to know its concentration, was found to be highly turbid and alkaline, also showing the presence of heavy metals like lead, cadmium…etc. in it. Preliminary water sample testing helps in determining the type and extent of treatment to be given to the wastewater, in order to make it consumable for domestic purposes. The below table shows the results of the water sample collected from the lake discharge.

Table 1: Result chart of the conducted laboratory analysis.

Parameters	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	Test Method
pH value	**6.75**	**6.8**	**7.2**	**7.5**	**6.5**	**IS :3025/Part-11**
Turbidity,NTU	**247.5**	**210**	**300**	**260**	**330**	**IS :3025/Part-10**
Total Hardness as Caco3,mg/L	**500**	**440**	**360**	**520**	**460**	**IS :3025/Part-21**
Chloride as Cl,mg/L	**350**	**260**	**320**	**450**	**350**	**IS :3025/Part-32**
Total Alkalinity as Caco3,mg/L	**430**	**310**	**280**	**260**	**320**	**IS :3025/Part-23**
Sulphate as So4,mg/L	**63.5**	**50.1**	**25.1**	**30.6**	**28.6**	**IS :3025/Part-24**
Lead as Pb,mg/L	**0.03**	**0.006**	**0.05**	**0.001**	**0.002**	**IS :3025/Part-47**
Cadmium,mg/L	**0.008**	**0.001**	**0.003**	**0.001**	**0.004**	**IS :3025/Part-41**
Dissolved Oxygen,mg/L	**Nil**	**0.5**	**0.3**	**nil**	**0.1**	**IS :3025/Part-39**
BOD (3 days @27c),mg/L	**320**	**430**	**610**	**290**	**280**	**IS :3025/Part-44**
Chemical Oxygen Demand,mg/L	**568**	**536**	**318**	**630**	**548**	**IS :3025/Part-58**
Phoosphate as PO4,mg/L	**8.9**	**6.8**	**7.4**	**8.5**	**6.1**	**IS :3025/Part-31**
Faecal Coliform, MPN/100ml	**Greater than 1600**	**Greater than 1600**	**Greater than 1600**	**Greater than 1600**	**Greater than 1600**	**IS1622-1981**

Table 1 shows that our waste water cannot be directly disposed without conducting treatment.

3.2 Graphs representing the quality of Wastewater Sample

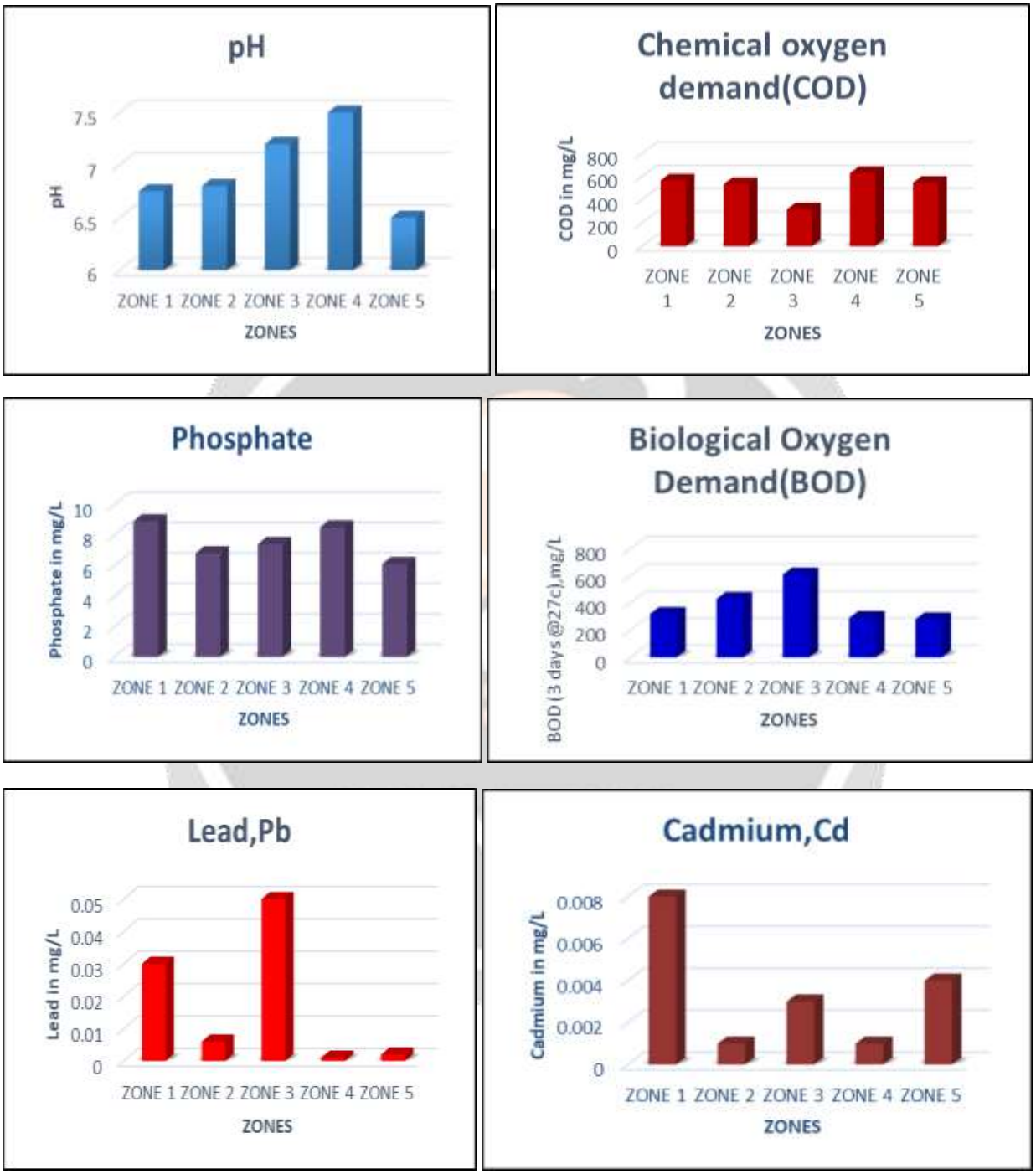

Figure 2: shows the graphical representation of the parameters of the lake

4. DISSCUSSION

The Water temperature was taken as a routine measure and varied 23.5 to 28.6^{0}C depending on the time of sampling. Temperature influences the process behavior in lakes and its measurement was necessary to get overall view of temperature regime during the sampling period.
Table 1 Summarizes the range of values determined for 6 important parameters and compares this against the most stringent drinking water standards available. The factors of concern here were the pH, Heavy metals like Lead, cadmium, COD, BOD, phosphate.
The pH measurements were done during the day. The photosynthesis and respiration of algae in eutrophic waters are known to influence the pH. Heavy metals like Zn, Cu, Pb, Ni, Cd, Hg, etc. contributes various environmental problems based on their toxicity. These toxic metals are exposed to human and environment, the accumulation of ions takes place which causes serious health and environmental hazards. Hence, it is a major concern in the environment. Due to this concern, the significance of developing technology for removing heavy metals has been increased. Consequences of lake pollution are Fish mortality, Decline in groundwater table and quality, Increased GHG (Greenhouse gas) footprint, Frothing, Fire.

Table 2 shows the standards for water quality parameters

Parameters	**Standards(limits)**	**Source**
pH	**6.5-8.5**	**IS 10500:2012**
BOD	**10 mg/l**	**CPCB Effluent standard**
COD	**50 mg/l**	**CPCB Effluent standard**

Table 3 Drinking water standards for trace and toxic metals (BIS-10500-2012)

Toxic metal	**Requirement (acceptable limit)**		**Permissible limit in the absence of alternative source**	
	(mg/L)	**(µg/L)**	**(mg/L)**	**(µg/L)**
Total arsenic (as As)	**0.01**	**10**	**0.05**	**50**
Cadmium (as Cd)	**0.003**	**3**	**No relaxation**	
Total chromium (as Cr)	**0.05**	**50**	**No relaxation**	
Lead (as Pb)	**0.01**	**10**	**No relaxation**	
Mercury (as Hg)	**0.001**	**1**	**No relaxation**	

5. CONCLUSION

The pH level were within limits prescribed by all drinking water standards.
Toxic metals can remain in chemical or mixed form, making them difficult to remove from wastewater. Certain heavy metals form essential components that we need in small amounts for metabolic activities and these metals can cause incurable human health toxicity in large amounts. Heavy metals in open water lead to the end of aquatic life, oxygen starvation and algae blooms.

Recommendation:
No more unprocessed conversions in the city. Decentralized wastewater, application of the rules". Make sure not to be rejected by efficient processing plants. Phosphorus panels used in detergents or modified detergents with phosphorus on the market.

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