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Restoration and Feasibility Study for Development of Sunkalpalya Lake

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Abstract: *Water is the main source for the survival of the fittest. But nowadays due to urban sprawl, the availability of fresh water is decreasing both qualitatively and quantitatively. The reason behind it may be discharge of effluent into lakes, invasion of lake area etc. These problems were also seen in Sunkalpalya lake, Bengaluru south, Karnataka. As a citizen we need to restore the lake to its original state. In this process we need to analyse various water quality parameters, socio-economic characteristics, topography sources of pollution etc. the results are interpreted and found the lake water is polluted in small amount and it can be rectified by use of vetiver grass wetland system.*

Keywords: Lake restoration, sewers, topography, vetiver grass, water quality.

I. INTRODUCTION

Water needs to be protected inorder to avail it. Due to rapid expansion of the city, enormous amount of sewage is generated. According to BWSSB's conservative estimates nearly 1400 MLD (Million Litres per Day) waste water is generated in Bengaluru. But available sewage treatment capacity is only 721 MLD. More development activities are taking place without proper sewerage infrastructure and sewage treatment plants. As a result of it sewage is fed into lakes and they have been contaminated to a great extent, affecting aquatic life and posing threat to use of lake water to future population. Due to disinclination of people towards restoration of lakes, its defilement has increased day by day. Similar problems were encountered in Sunkalpalya lake, Bengaluru south, Karnataka. Physical, chemical, biological parameters of lake water was analysed. Other information regarding hydrological conditions, toposheet details were collected and suitable remedies were provided to rejuvenate the lake.

Figure 1: View of Sunkalpalya Lake

II. LITERATURE SURVEY

According to Harini Nagendra in [1],Kaikondarahalli lake in Bengaluru was deteriorated due to lack of maintenance from local people and government bodies as well. In order to rejuvenate it by analysis of satellite remote sensing data sets and maps, personal observations and discussion with local residentswas done. They then prepared a DPR (Detailed Project Report) and approached BBMP to take up restoration works. The main challenges were fund raising, constant commitment of time and energy of the people for proper maintenance of the lake.

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According to Ranjana Siva et al. [2],lakes have been reduced drastically due to illegal encroachment, sewage toxic waste apart from dumping of domestic waste, human and animal defection. Few of the lakes have permanent froth, consisting of harmful bubbles on the surface that occasionally catch fire due to the presence of oils and chemicals (e.g. Bellandur lake). Samples from five lakes were tested for pH, value, TDS (Total Dissolved Solids) value wasassessed for change in area over a span of seventeen years (2000 to 2017). Based on the sources a TRIZ- based Morphological analysis was carried out to propose various technological and bio inspired solutions for betterment of lakes and its ecosystem.

According to Ramachandra T. V et al. [3], have assessed the efficacy of the restoration endeavor in Bengaluru lakes, Karnataka, India. Rapid urbanization coupled with industrialization in urban areas has greatly stressed the available water resources qualitatively and quantitatively. This has also resulted in generation enormous sewage and wastewater. The monitored forty lakes distributed across the three major watersheds namely Koramangala and Challaghatta valley, Vrishabhavathi valley and Hebbal valley were grouped under three different WQI (Water Quality Index) status like good water quality (10%), poor water quality (37%) and very poor water quality (53%). Majority of these restored lakes has become polluted which indicates improper decontamination and poor maintenance of restored lakes. According to Anul Haq et al. [4], Sahibi river is ephemeral, seasonal river flowing through Rajasthan, Haryana and ends in Najafgarh drain in Delhi. Due to climate change, the Sahibi river is drought. Scarcity starts and increases the demand. To solve this problem, construction of water structures can be helpful to trap the rainfall and increase the water table. Different parameters such as GPS, mosaic dataset helps to combine different information to easily find the scarcity and also help the study of geographic information. This is the most valuable tool to increase the water source which will lead to the restoration.

III. METHODOLOGY

- **Recognition and Fixing Study Area:** With the help of satellite image and topo sheet (57H/5, 57H/9) obtained the details of area of the lake, location and accessibility, pattern of the drainage, catchment area and its slope.

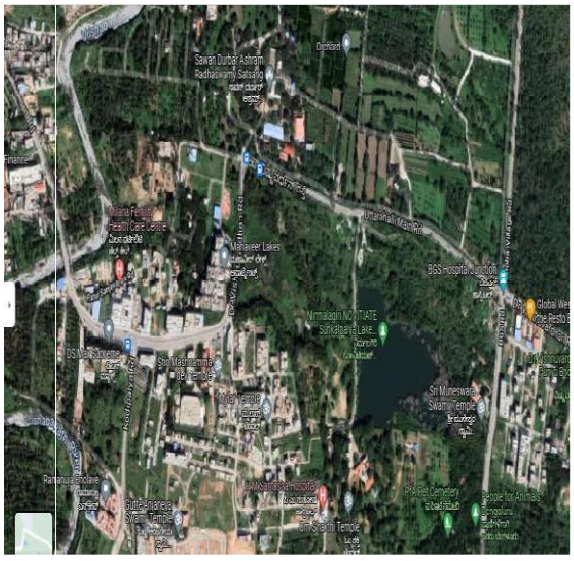

Figure 2: Satellite image showing the location of Sunkalpalya lake

- **Assessment of Current Population and Rainfall of Mylasandra Area**: With the help of census India-2011, the population of Mylasandra area was determined. Rainfall data was obtained from Directorate of statistical and economic department GOK, Bengaluru.
- **Forecasting Future Population and Rainfall details of Mylasandra Area**: Arithmetic mean method and geometric mean method were used to determine the population of 2031 and further rainfall from the year 2001 to 2020 was analysed. Average and annual rainfall was determined.
- **Analysis of Lake Water**: Various parameters of water such as pH, turbidity, nitarates was tested to check the extent of pollution in it. Samples were collected at the inlet of the lake and at the center of the lake.

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Figure 3: Map showing Drainage network of Sunkalpalya lake

- **Design of Sewers**: Storm water and sewage water drain was done to avoid mixing of storm water and sewage water. Proper disposal of storm water into the lake and diverting sewage away from entering lake, with thorough inspection with the help of manholes was done. With the help of rational formula method and mannings formula, storm water and sewage water drains of circular cross sections diameter were determined.
- **Use of Vetiver Grass Wetland Plantation System**: It is a type of restoration technique wherein vetiver grass is grown as wetlands in the lake and its root absorbs the enriched contaminants of the lake water such as nitrates and phosphates. Since it is a perineal plant, it can be used in more effective manner, low cost and when it is dried up it can be used as fertilizer for plants as well.

Figure 4: Vetiver grass wetland plantation system

IV. RESULTS

Once the analysis of various water quality parameters was done, it was found that the water is polluted in small extent. So vetiver grass was used to reduce the level of pollution. Diameter of 200mm and 150mm circular cross sections for storm water and sewage water drain were used respectively. Below table shows the water quality parameters before and after the use of vetiver grass in center lake water.

Table. 1 represents the parameters which have been exceeded the limits according to IS 10500:2012 before using vetiver grass wetland plantation system for center lake water for sample of onelitre.

Table. 1: Values before installation of vetiver grass system

Sl. No	Parameters	Limits	Results
1	Iron (mg/L)	0.10	**0.14**
2	Nitrate(mg/L)	45.0	**48.20**

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3	Chemical OxygenDemand(mg/L)	50.00	**51.20**
4	Turbidity(NTU)	2.00	**2.50**

Table 2 represents the parameters which have been exceeded the limits according to IS 10500:2012 after using vetiver grass wetland plantation system for center lake water for sample of one litre.

Table. 2: Values after installation of vetiver grass system

Sl. No	Parameters	Limits	Results
1	Iron(mg/L)	0.10	**0.12**
2	Nitrate(mg/L)	45.0	44.10
3	Chemical Oxygen Demand(mg/L)	50.00	49.00
4	Turbidity(NTU)	2.00	1.50

V. CONCLUSION

Implementing hydraulic structures and other infrastructure such as channels, drains will reestablish connection between catchment, lakes and the river. Securing the lake from solid waste, construction debris dumping, encroachment and antisocial activities will prevent the lake pollution. Reduction of pollution is done using vetiver grass wetland system, which is a low-cost methodology. Some of the recreational activities such as boating, children play area, proper walkways and fencing can be provided at outer edge and inner edge of the bund line. Creation of island would attract various species of birds to lake. More importance should be given to the protection of plant species around the lake area. Creating awareness on importance of lake amongst the people will help attract them, which in turn can be used as a mean of revenue collection. This fund can be used for maintenance of lake.

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