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Assessment of Physico-Chemical Parameters of Perumal ERI

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ABSTRACT: Tamilnadu is deficit in Water Resources. It is a major fresh water lake in the cuddalore district of tamilnadu. It is located almost 7 kilometers (4.3 mi) from Alapakkam, The rainfall is seasonal and often erratic in timing and geographical distribution, resulting in frequent droughts and occasional floods. To mitigate the adverse effects, serious attention is required to rehabilitate the existing irrigation structures, canal systems, anicuts and tanks to make them functionally more effective, conserve and utilize the water for optimum use. This paper deals with an assessment of water quality parameters of Perumal eri (lake) situated at Alapakkam in Cuddalore district. Samples have collected at five different locations in Perumal eri during pre-monsoon period. Then laboratory analysis has done and the results are compared with BIS and WHO drinking water standards. Then by using "Inverse Distance Weighting" (IDW) method geostatistical analysis has done. Based on the results obtained mapping of contaminants in lake has done by using ArcGIS software. According to the results suitable solution will be given to treat the water in the lake.

I. INTRODUCION

1.1 GENERAL

Lakes are one of the important ecosystem in our earth. India has a large number of beautiful lakes and water bodies. It provides important habitat and food resources to the diverse aquatic life. But these lakes are subjected to a range of physical, chemical and biological problems due to human activities, climate change is of major concern as it can diminish their aesthetic beauty, recreational value, water quality and habitat suitability of the lakes, especially near residential areas are polluted because of anthropogenic activities. The deterioration of lake water affects the aquatic life and causes hindrance in its traditional uses.

In our India many of the villages depends on lake water for both domestic and agriculture. Similarly, it is located on highway NH 45A, en route to Chidambaram town. It is 19 km from cuddalore and 29 km from Chidambaram town. Perumal lake is located near the villages. The village consists of more than 1000 acres (4.0 km²) of arable land and about 1000 homes. It had been drawing water for supply to wards till it was polluted around 1990. Huge volume of plastic waste is found choking supply channels from them, by virtue of its location close to shops, hospitals and restaurants, has taken the brunt of pollution. Some quantity of sewage get mixed to the lake. This changes the water quality parameter widely and make it unfit for various purposes. This study aims to assess the water quality of lake on pre-monsoon and post-monsoon period and also to provide remedial measures to restore the lake and to meet the water demand.

1.2 NEED TO ASSESS THE PARAMETERS

Water is an essential component for living and it is used for various purposes. But this water in Perumaleri get polluted due to the discharge entire municipal sewage into this tank. Since this tank is located in the Alapakkam town, solid wastes such as polythene, medical waste, other wastages from nearby commercial establishments, sewage collected from septic tank are also spilled into this tank. This tank is fully polluted and bad smell is emanated around this locality. Due to discharge of Municipal sewer and other solid waste into the tank, the BOD and COD have gone to level where the water from the tank could not be used for irrigation. Also the quality of ground water around the locality has also got affected which included irrigation wells. Hence, it is necessary to treat the Municipal sewage with suitable treatment process and allowed into the tank.

1.3 OBJECTIVES

1. To measure the water quality in pre-monsoon and post-monsoon period
2. To analyse the measured data and mapping the contaminants using ArcGIS
3. To bring remedial measures for restoration of lake

II. LITERATURE REVIEW

2.1 GENERAL

Water pollution is caused by many reasons such as improper sewage disposal, poor sanitation, dumping of solid waste, etc. This pollution can be reduced by taking many measures. Hence, before starting to use particular water, its parameter needs to be analyzed and a suitable solution can be adopted. These water quality parameters can be analyzed easily by using Inverse Distance Weighting (IDW) method in ArcGIS and the contaminants also mapped.

2.2 WATER QUALITY ANALYSIS USING GIS

Rebecca R. Murphy et al., (2010) Compared spatial interpolation methods for Water Quality Evaluation in the Chesapeake Bay. Spatial interpolation methods are frequently used to estimate values of physical or chemical constituents in locations where they are not measured. Very little research has been conducted, however, to investigate the relative performance of different interpolation methods in surface waters. The study reported here uses archived water quality data from the Chesapeake Bay to compare three spatial interpolation methods: inverse distance weighting, ordinary kriging, and a universal kriging method that incorporates output from a process-based water quality model. Interpolations were performed on salinity, water temperature, and dissolved oxygen “snap shots” cruise-based data sets taken between 1985 and 1994 at 21 different depths for multiple locations in the mainstem Bay, using data compiled by the prototypical Chesapeake Bay Environmental Observatory. The kriging methods generally outperform inverse distance weighting for all parameters and depths. Incorporating output from the water quality model through universal kriging appears to improve some of the interpolations by specifically accounting for some physical and biogeochemical features of the estuary. Such integration of process-based information with statistical interpolation warrants further study.

Somvanshi. S et al., (2012) Analysed water quality of Gomti river, Uttar Pradesh using Integrated remote sensing and GIS. This paper deals with development of decision making tool for mapping of water quality parameters of Gomti River in parts of Lucknow, Sitapur and Barabanki districts of Uttar Pradesh, India. Mapping was done using IRS LISS III data combined with measurement of selected sample points. Water quality data was collected for both pre-monsoon and post-monsoon seasons. Radiance value of each band of IRS LISS III data has been calculated and observed radiance value on those sample points of each band along with band ratios and principal components were compared with in situ measurements of water quality parameters. The water quality parameters included, TS, DS, SS, pH, BOD, DO, Chloride and TH. Using radiance data of pre-monsoon images and in situ measurement data of water quality parameters correlation and multiple linear regression models were developed and selected most appropriate band combinations which were having highest R² value. With the help of these multiple linear regression water quality parameters were predicted which were then compared with the values obtained through laboratory analysis of water quality. These appropriate band combinations and principal components of pre-monsoon satellite data were used in estimation of water quality parameters. The all these water quality parameters were significantly correlated with LISS III radiance data except SS. The same band combinations of post-monsoon satellite data were also used for estimation of water quality parameters in post-monsoon. Subsequently, multiple linear regression equations models were used in estimation of water quality parameters and preparation of digital cartographic maps depicting the water quality over the entire study area for both the seasons respectively.

Adebayo Olubukola Oke et al., (2013) Sustainable management of water resources involves inventory, conservation, efficient utilization, and quality management. Although, activities relating to quantity assessment and management in terms of river discharge and water resources planning are given attention at the basin level, water quality assessment are still being done at specific locations of major concern. The use of Geographical Information System (GIS) based water quality information system and spatial analysis with Inverse Distance Weighted interpolation enabled the mapping of water quality indicators in Ogun and Ona catchment of Ogun-Osun River Basin, Nigeria. Using 27 established gauging stations as sampling locations, water quality indicators were monitored over 12 months covering full hydrological season. Maps of seasonal variations in 10 water quality indicators as impacted by land-use types were produced. This ensured that trends of specific water quality indicator and diffuse pollution characteristics across the basin were better presented with the variations shown along the river courses than the traditional line graphs. The production of water quality maps will improve monitoring, enforcement of standards and regulations towards better pollution management and control. This strategy holds great potential for real time monitoring of water quality in the basin with adequate instrumentation.



III. STUDY AREA

Perumal eri is situated in kurijipadi taluk of cuddalore district.it is located at 24.9 km east of neyveli and 16.7 km south of cuddalore. The recharge source of lake is from the Gadilam river and Walaja tank and it is also get water from Neyveli aquifers. According to 2011 sensus Kurijipadi had a population of 32,439 with a sex-ratio of 1,032 females for every 1,000 males, much above the national average of 929. A total of 2,936 were under the age of six, constituting 1,493 males and 1,443 females.The geographical coordinates are 11.10° N, 79.37° E.

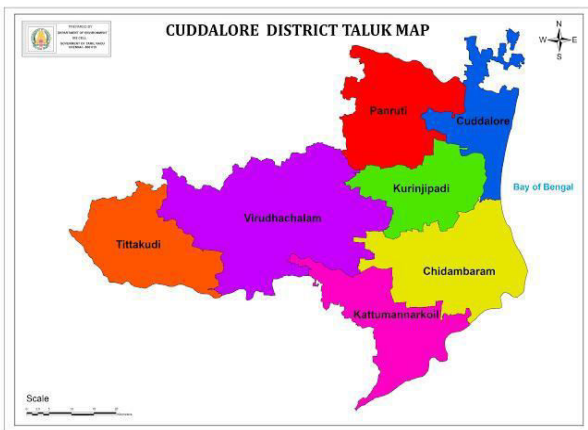


Figure 1.1 Cuddalore taluk map



Figure 1.2 Tamil Nadu district map

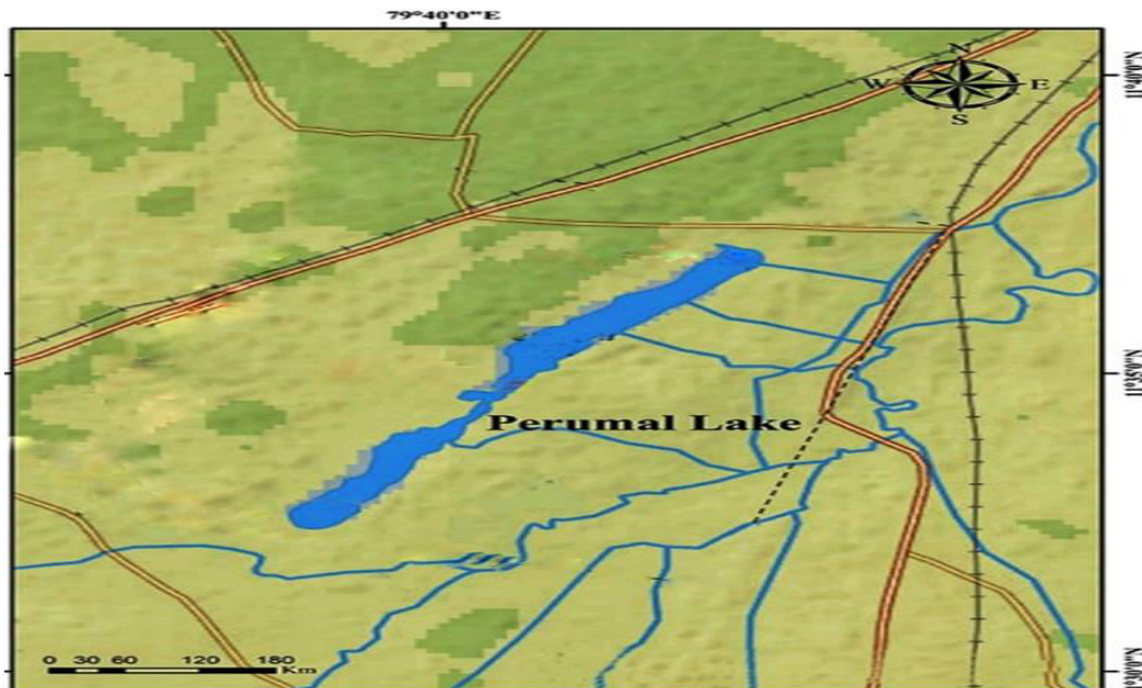
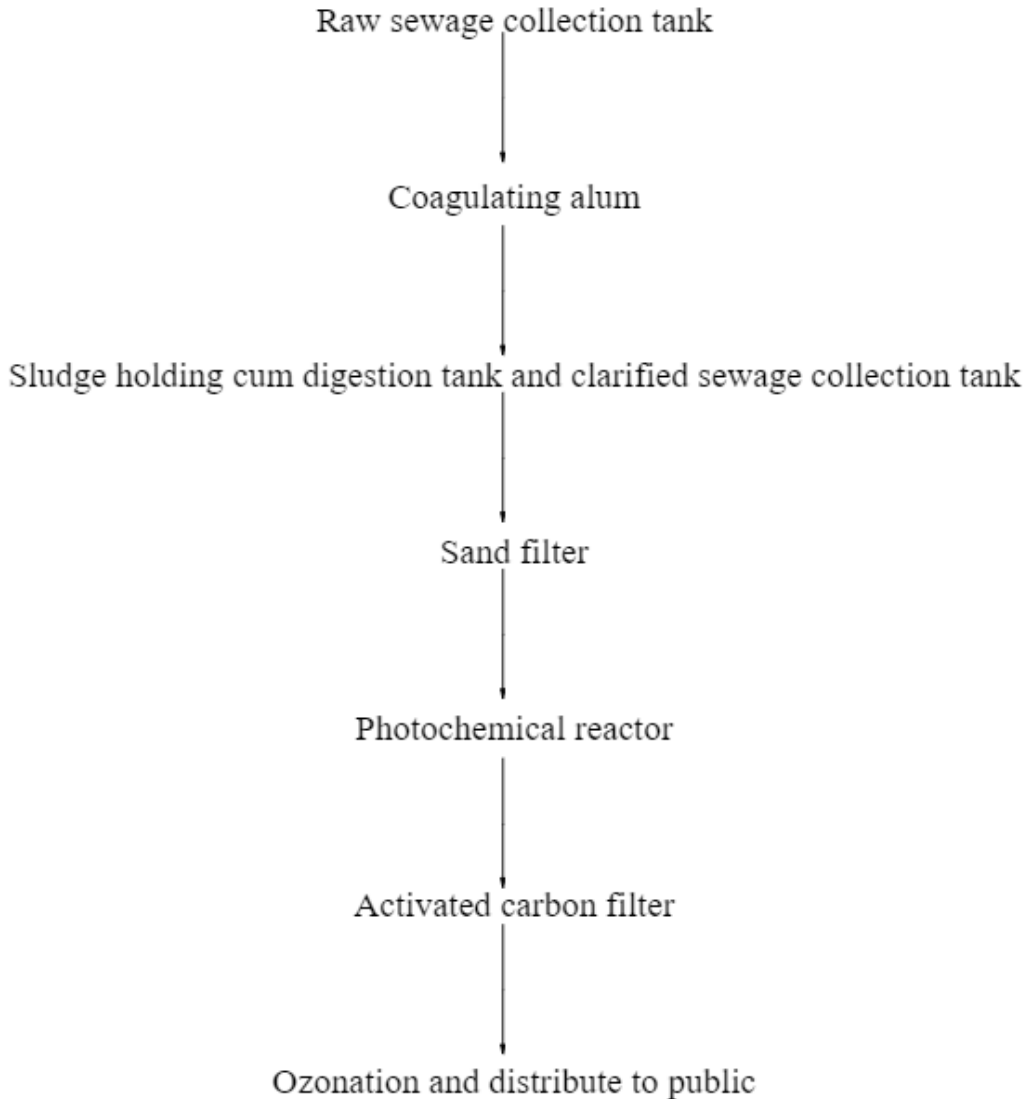


Figure: It denotes the location of samples collected in Perumal eri.



TREATMENT PROCESS:



Step - I Recycling Plant employs a purely physio-chemical process. It incorporates processes like the addition of oxidizing chemicals, mixing/agitation and the photochemical oxidation, which is the heart of this treatment process.

Step - II The raw sewage entering the system will be fluctuating in terms of flow characteristics, BOD, COD, solid concentration etc. The efficiency of all the processes thereafter depends heavily on the characteristics of the raw sewage water. So, in order to achieve the maximum possible efficiency, a good retention time is provided in the “**Raw sewage collection tank**” to equalize the system.

Step - III Coagulating Alum is pumped in the raw sewage collection tank & is mixed homogeneously with the recirculation pump. The sewage from raw sewage collection tank is pumped to a flash mixer. A flocculent (Polymer) are dosed online at the inlet of flash mixer, where a thorough mixing is carried out by blower in the flash mixer.

Step - IV The overflow from flash mixture is fed to a hopper bottom-settling tank lying above ground. A retention time is provided for the coagulated particles to settle down. The settled underflow sludge will be sent to the “**Sludge**



holding cum digester tank” tank by gravity. The overflow from the settling tank will be collected in the “Clarified sewage collection tank”. The clarified sewage collection tank will be in RCC tank, positioned above ground level.

Step - V The sewage from clarified collection tank is passed on through a sand filter by a horizontal centrifugal pump to strain out the flocs and the finely suspended particles. After a period of use, the sand filter will be completely clogged with flocs, and is backwashed to remove the flocs.

Step - VI The outlet of the sand filter is given to a bag filter to remove turbidity which absorbs UV rays thereby reducing the efficiency of the photochemical reaction. Then it is passed on to a reactor in which ozone is purged and is recirculated with ozone recirculation pump.

Step - VII The effluent with the oxidant is passed through the photochemical reactor. Photochemical oxidation is a rapid process that enhances the oxidation of organic pollutants.

Step - VIII The outlet from the photochemical reactor is passed to an Activated carbon filter to remove odor and color from treated sewage. The simple organic molecules formed after photochemical oxidation will be absorbed in carbon filter.

Step - IX The outlet from carbon filter is collected in Treated collection tank above ground in which some of the flow of ozone is purged through aeration grid. Also the treated sewage is recirculated through pump to inhibit the microbial growth.

IV. CONCLUSION

In this report I have collected the samples during pre-monsoon period and analyzed in the laboratory. The above values have obtained. Then the samples were collected during post-monsoon period and laboratory analysis had done in the phase II. Based on both values geospatial analysis will be done for zoning of contaminants and mapping has done using ArcGIS 10.5. Then the suitable solution has given to restore the lake and to make the water fit for drinking.

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