GIS BASED MAPPING AND STATUS OF WATER QUALITY IN LAKES FOR SUSTAINABLE RESTORATION

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Introduction:
Water is one of the most essential natural resources that sustains life on Earth. Lakes and other surface water bodies play a vital role in maintaining ecological balance, supporting biodiversity, recharging groundwater, and providing water for domestic, agricultural, and industrial purposes. However, with the rapid pace of urbanization, population growth, and unregulated land-use activities, the quality of freshwater bodies has been severely degraded in recent years. Pollution from domestic sewage, solid waste dumping, agricultural runoff, and industrial discharges has led to the deterioration of lake ecosystems, making them unsuitable for their intended use. Lakes act as natural storage and self-purification systems, but when the rate of pollution exceeds the lake's natural cleaning capacity, their water quality declines drastically. The assessment of water quality is therefore an essential step in understanding the health status of a lake. It provides valuable insight into the physical, chemical, and biological characteristics of the water, indicating whether the lake is fit for drinking, irrigation, or aquatic life. The Water Quality Index (WQI) is a scientific tool that simplifies complex water data into a single value that expresses the overall quality of water, making it easier to understand and compare between different sites. In this study, an attempt has been made to assess the water quality of selected lakes in Nanjangud Taluk, Mysuru District, by determining key physicochemical parameters such as pH, Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Turbidity, Hardness, and Chloride. The obtained results were compared with the standard permissible limits prescribed by BIS IS 10500:2012 and CPCB surface water quality criteria to determine the suitability of water for various purposes. To visualize spatial variation in lake water quality, Geographic Information System (GIS) techniques were used to generate thematic maps showing parameter distribution and pollution intensity zones. This integration of laboratory analysis with GIS-based mapping helps identify critical polluted regions and supports decision-making for future lake restoration measures. The study ultimately aims to promote sustainable lake management by providing scientific data and visual tools that can help authorities and communities

implement effective restoration and conservation strategies. By understanding the current water quality status, preventive actions can be taken to protect and restore these valuable freshwater ecosystems for future generations.

Lake name	WQI	Water quality	Possible usages
Kalale	58.4	Fair	Irrigation and Industrial
Gonathagala	82.7	Poor	Irrigation
Halepura	69.2	Fair	Irrigation and Industrial
Yennehole	76.5	Poor	Irrigation
Shettykere	73.9	Fair	Irrigation and Industrial
Dalvoy	78.1	poor	Irrigation

Figure 1: Water quality index

Objectives:

1. To identify the polluted lakes in and around Nanjangud rural areas.
2. To analyze the physical, chemical and bacteriological parameters of the lakes in Nanjangud rural areas.
3. To determine the Water Quality Index (WQI) to know suitability for drinking purpose.
4. To use the GIS software for mapping water quality status and restoration plan of lakes.

Methodology:

1. Literature review
2. Study Area Selection
3. Water Sample Collection (Multiple Rural Sources)
4. Laboratory Testing
5. Physical Chemical Bacteriological
6. Data Tabulation & Water Quality Index (WQI)
7. Data Tabulation & Water Quality Index (WQI)
8. GIS Mapping & Hotspot Identification (IDW)
9. Sustainable Recommendations

Result and Conclusion:

The study conducted on six selected lakes Kalale, Gonathagala, Halepura, Yennehole, Shetty kere, and Dalvoy through bi-weekly sampling has helped us understand the present condition of these surface water bodies. Analysis of key parameters such as pH, alkalinity, turbidity, chlorides, hardness, dissolved oxygen, TDS, conductivity, and E-coli showed that certain lakes fall under moderately polluted and poor-quality categories based on the Water Quality Index (WQI). Yennehole and Shetty kere lakes exhibited higher levels of turbidity, chlorides, total hardness, and microbial contamination, indicating direct discharge of domestic wastewater and agricultural runoff.

The variations observed between sampling weeks reflect continuous external influence on lake water quality due to urbanization, unregulated waste disposal, and reduced natural inflow. Lakes such as Kalale and Halepura showed relatively better water quality but still

displayed early signs of eutrophication and declining dissolved oxygen levels. Overall, the results highlight that none of the lakes are suitable for direct consumption, and long-term degradation may lead to ecological imbalance, loss of biodiversity, and reduced groundwater recharge.

References:

1. Gupta, R., & Agarwal, S. (2015). Assessment of Urban Drainage Systems in Delhi.
2. Bansal, A., Singh, R., & Chauhan, K. (2017). Comparative Evaluation of Stormwater Network Efficiency in Chandigarh.
3. Patil, S., & Jadhav, P. (2018). Field-Based Evaluation of Stormwater Infrastructure in Pune City.
4. Kumar, V., & Tiwari, M. (2016). GIS-Based Urban Drainage Information System for Bhopal City.
5. Pradhan, S., & Sahoo, B. (2019). GIS Mapping of Urban Drainage Conditions in Cuttack, Odisha.
6. Nagarajan, R., & Reddy, K. (2020). Flood Vulnerability Assessment Using GIS in Chennai.
7. Rahman, M., Ahmed, S., & Hasan, M. (2018). Land Use Impact on Urban Flooding in Dhaka Using Remote Sensing and GIS.
8. Shekhar, S., & Pandey, A. (2021). Slope and Runoff Analysis for Drainage Planning in Indore.
9. Singh, P., & Sharma, D. (2018). Application of Sustainable Urban Drainage Systems (SUDS) in Indian Conditions.
10. Kavitha, R., Nair, S., & Menon, P. (2020). GIS-Based Integration of SUDS and Drainage Networks for Urban Resilience.
11. QGIS (Open-Source Geographic Information System).
12. SWMM (Storm Water Management Model – USEPA).
13. Google Earth (Satellite imagery).
14. OpenStreetMap (Base maps).
15. Indian Meteorological Department (IMD) – Rainfall data.

Future Scope:

The future scope of this project includes:

1. Include seasonal water quality analysis for better accuracy.
2. Analyze advanced parameters like heavy metals and nutrients.
3. Use remote sensing with GIS for large-scale monitoring.
4. Implement real-time monitoring using IoT sensors.
5. Extend study to more lakes for regional analysis.
6. Apply hydrological models (SWMM) for pollution prediction.
7. Conduct economic feasibility of restoration methods.
8. Promote community participation and policy implementation.
9. Evaluate long-term effectiveness of restoration measures.