# Urban Surface Water Bodies Quality Mapping Using an Open Source Dataset. A Case Study of Hyderabad, Telangana, India

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**Abstract-Water bodies are the natural resources that behave as groundwater rechargers, flood disaster prevention agents, and economic resources for piscators. Urban surface water bodies in the currently prevailing situation act as drain storage, pollution barriers, and encroachments on built-up areas. This study provides the water quality of water bodies in map view using open source data published by the Telangana Pollution Control Board (TSPCB). Water quality parameters are classified on the basis of the categorization provided by the Central Pollution Control Board (CPCB), India.**

**Study area Hyderabad is well known as the City of Pearls and Lakes, as it owns numerous water bodies that once served as drinking, cultivation, and flood disaster preventers. Hyderabad city is enlarging its population and spatial extent, but its drinking water source is still dependent on two lakes, the longest distance, and three high-elevated rivers. Once, it had thousands of lakes, which now shrink to 185, out of which no lake is permitted as a drinking water source. The present study focuses on the water quality mapping of the study area to show how the water bodies are polluted.**

**Toposheets from the 1970 Survey of India were used as a base map to delineate full tank levels. The two hundred and thirty-one water bodies were digitised using various temporal toposheets and the TSPCB, which provided one hundred and eighty-five lakes with water quality data. The result shows the huge impact on health diversity of the study area, as no water bodies are used as drinking water sources and only thirteen water bodies are used for outdoor bathing. Only eight water bodies were used as drinking water sources after conventional treatment. Other water bodies are classified as disappearing, dried, and other classes.**

**Keywords – Water bodies, Telangana Pollution Control Board (TSPCB), Central Pollution Control Board (CPCB).**

## 1. INTRODUCTION

The urbanisation process in Hyderabad has altered the natural hydrological cycle, and the urban recharge component plays a vital role in urban balance (Hemanth et al., 2018). The study area endured 57.48% decadal growth, directly impacting natural resources and creating health risks and microclimate changes (Anjireddy, 2008). The lakes are getting polluted due to uncontrolled point and non-point sources of pollution due to a lack of proper sewage networks; they have lost 3245 ha of their water in the form of lakes and ponds (Sridhar Kumar et al., 2015). Groundwater in Hyderabad was contaminated as a result of urbanisation and industry. Due to insufficient sewerage systems and treatment capabilities, home and industrial effluents are being dumped straight into nalas and streams, seriously contaminating groundwater (Ravikumar Gumma, 2011). The city's wetlands have been destroyed during the last ten years, and the groundwater supply has been exploited; the depth to the water level exceeds 20m during pre- and post-monsoon periods where water scarcity will be a major problem (EPTRI, 2015). After evaluating the state of several additional water bodies using water quality parameters based on Bureau requirements for water quality, the study area's water body proved contaminated.

Water resource management is an integral aspect of the preventive management of drinking-water quality. Prevention of microbial and chemical contamination of source water is the first barrier against drinking-water contamination of public health concern (Who, 2004). Remote sensing and GIS data provide a synoptic representation of the water body, obtain the characteristics of a region rather than a spot, and may integrate many characteristics (Sanjay, 2010). Understanding spatial variations and quality indexes in lake water quality is essential for efficient lake water quality management. Spatial data predictions and statistical techniques for analysis and interpretation of complicated data sets in water quality assessment (Hema Sailaja V., 2015)

## II. METHODOLOGY

*A.Study Area*

The study geographical area, Hyderabad, is made up of lakes that are elevated 545 metres above sea level on the Deccan Plateau. Hyderabad is the capital city of the youngest southern Indian state of Telangana, separated from the state of Andhra Pradesh in 2014, and it is situated in UTM Zones 43N and 44N at 17° 22' north latitude and 78° 29' east longitude. It is India's sixth-most populated urban agglomeration and fourth-most populous city, with a metropolitan population of 7.75 million (Census of India, 2011a). The governing area is divided into the Greater Hyderabad Municipal Corporation (GHMC) area of 650 sq. km and its expansion to the Hyderabad Metropolitan Development Authority (HMDA) area of 7257 sq. km. GHMC has been chosen as the administrative boundary for this study.

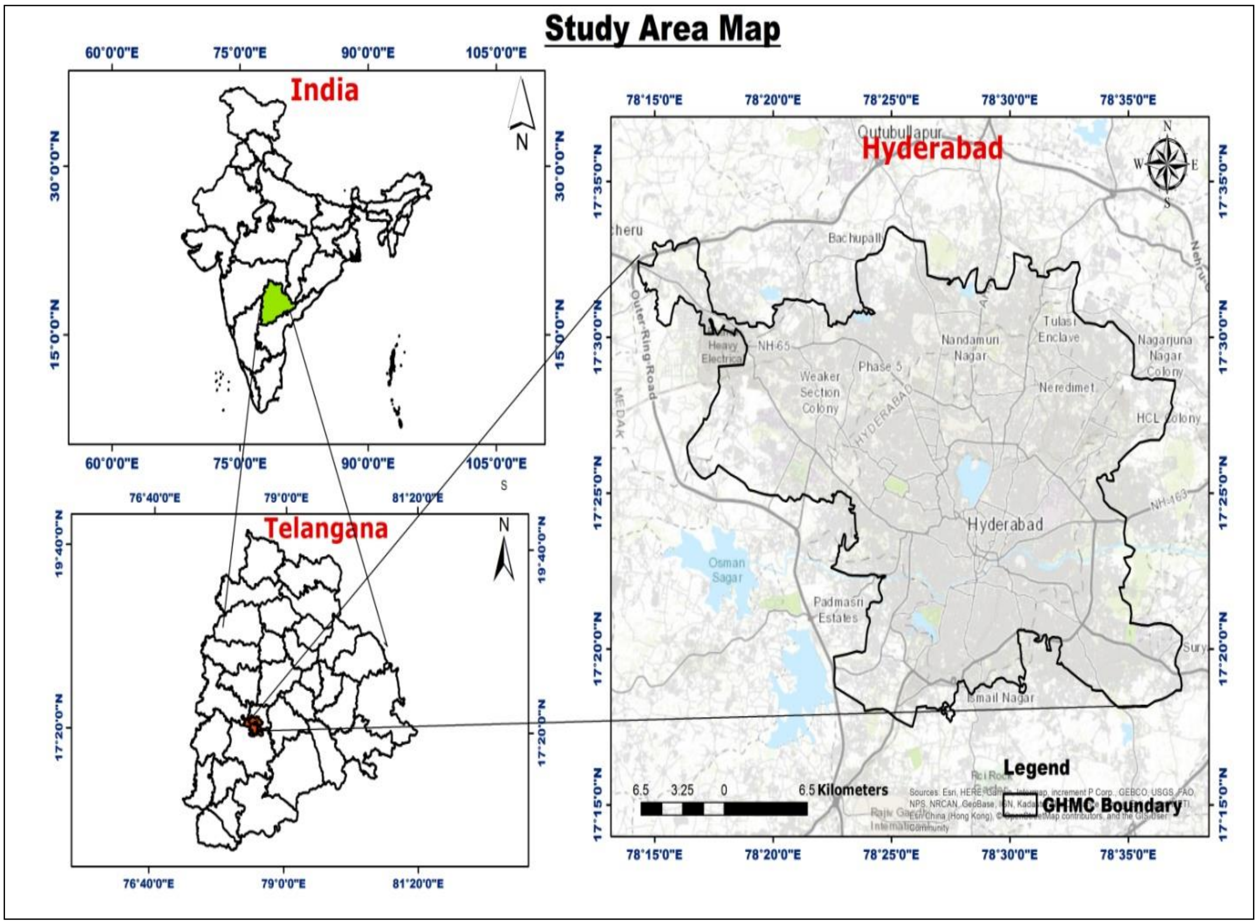


Figure.1.Study Area Map

*B.Need for Study*

Study Area ground water is deplicated as its utilization is 12099ha.m and availability is 1400 ha.m (Ravikumar Gumma,2011). Hyderabad water source depending to five various water sources with far distance .In Five water resource two of them are with gravity and other water source are through pumping stage.

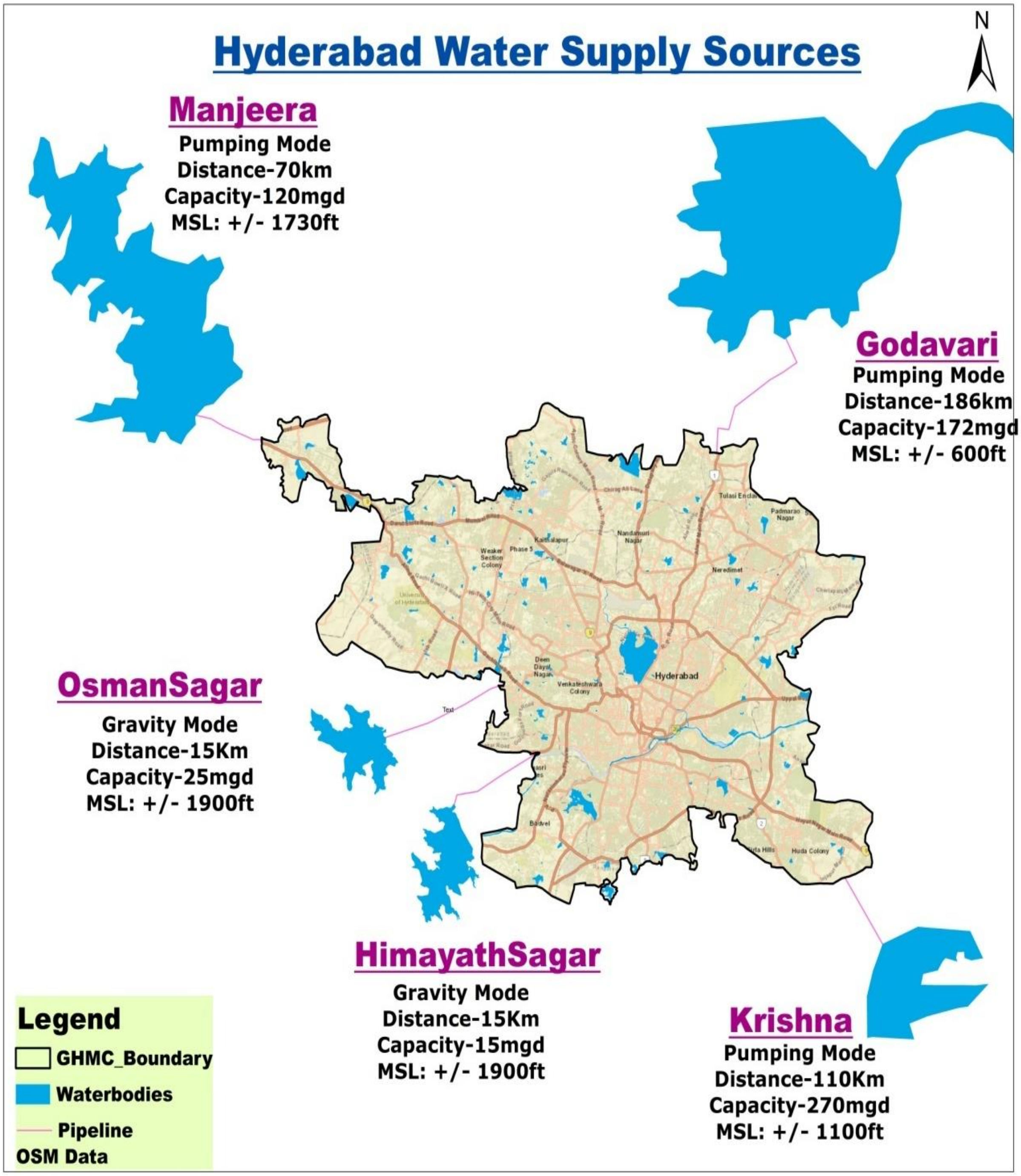


Fig.2.Hyderabad Water Supply System (Source-HMWSSB)

The below table no.1 shows the drinking water source in Million Gallons per Day where study area per day demand supply and deficit(HMWSSB,2020).

Table.1.Showing Water Supply data to the Study Area

| Sl. No | Horizon Year | Demand (MGD) | Supply (MGD) | Deficit (MGD) |
|---|---|---|---|---|
| 1 | 2020 | 609.28 | 564 | **45.28** |
| 2 | 2035 | 821.05 | 564 | **257.05** |
| 3 | 2050 | 1014.02 | 564 | **450.02** |

*C.Data Set Used*

Waterbodies in the study area were digitised using Survey of India toposheets from year 1977 to 2011. The total of 230 waterbodies and one river were delineated using historical toposheets. Delineated surface waterbodies were quality mapped using Telangana State Pollution Control Board (TSPCB) website data published monthly in Excel format. A total of 185 water bodies and one Musi River were published in the below-given format.

Table.2. Showing Water Parameters published in TSPCB.

| S.No | Name of Lake | DO | pH | Conductivity (mS/cm) | BOD (mg/L) | Total coliform (MPN/100ml) | Free Ammonia | Boron (mg/L) | SAR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 186 | | | | | | | | | |

Source – Data used from TSPCB website of date July 2022.

From the above table, no -01 water quality data were taken out of 185 water bodies in July 2022; they have sampled 140 water bodies. Rest other water bodies: few of them were dried, and other samples were not able to be collected due to lack of access. According to the Central Pollution Control Board (CPCB, 2021), water quality parameters are classified according to their water quality criteria. It has been classified into five categories; the table is shown below.

Table .3. Water Quality Classification data using CPCB.

Source: Central Pollution Control Board, Government of India, 2021.

| Class of Water | Designated-Best-Use | Criteria |
|---|---|---|
| A | Drinking Water Source without conventional treatment but after disinfection | • Total Coliforms Organism MPN/100ml shall be 50 or less<br>• pH between 6.5 and 8.5<br>• Dissolved Oxygen 6mg/l or more<br>• Biochemical Oxygen Demand 5 days 20C 2mg/l or less |
| B | Outdoor bathing (Organised) | • Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5<br>• Dissolved Oxygen 5mg/l or more<br>• Biochemical Oxygen Demand 5 days 20C 3mg/l or less |
| C | Drinking water source after conventional treatment and disinfection | • Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more<br>• Biochemical Oxygen Demand 5 days 20C 3mg/l or less |
| D | Propagation of Wild life and Fisheries | • pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more<br>• Free Ammonia (as N) 1.2 mg/l or less |
| E | Irrigation, Industrial Cooling, Controlled Waste disposal | • pH between 6.0 to 8.5<br>• Electrical Conductivity at 25C micro mhos/cm Max.2250<br>• Sodium absorption Ratio Max. 26<br>• Boron Max. 2mg/l |

## III. RESULTS & DISCUSSION

From the delineated 231 water bodies, only 141 with water quality data were mapped using ArcGIS 10.2 Software. The other water bodies water quality data were not available, as few of them were dried, some were built up, and others were not accessible to collect samples. Water bodies were classified using classification Table No. 3 in the spatial analyst tool. Classified water bodies are given colour coding according to their category, as shown in the below figure.

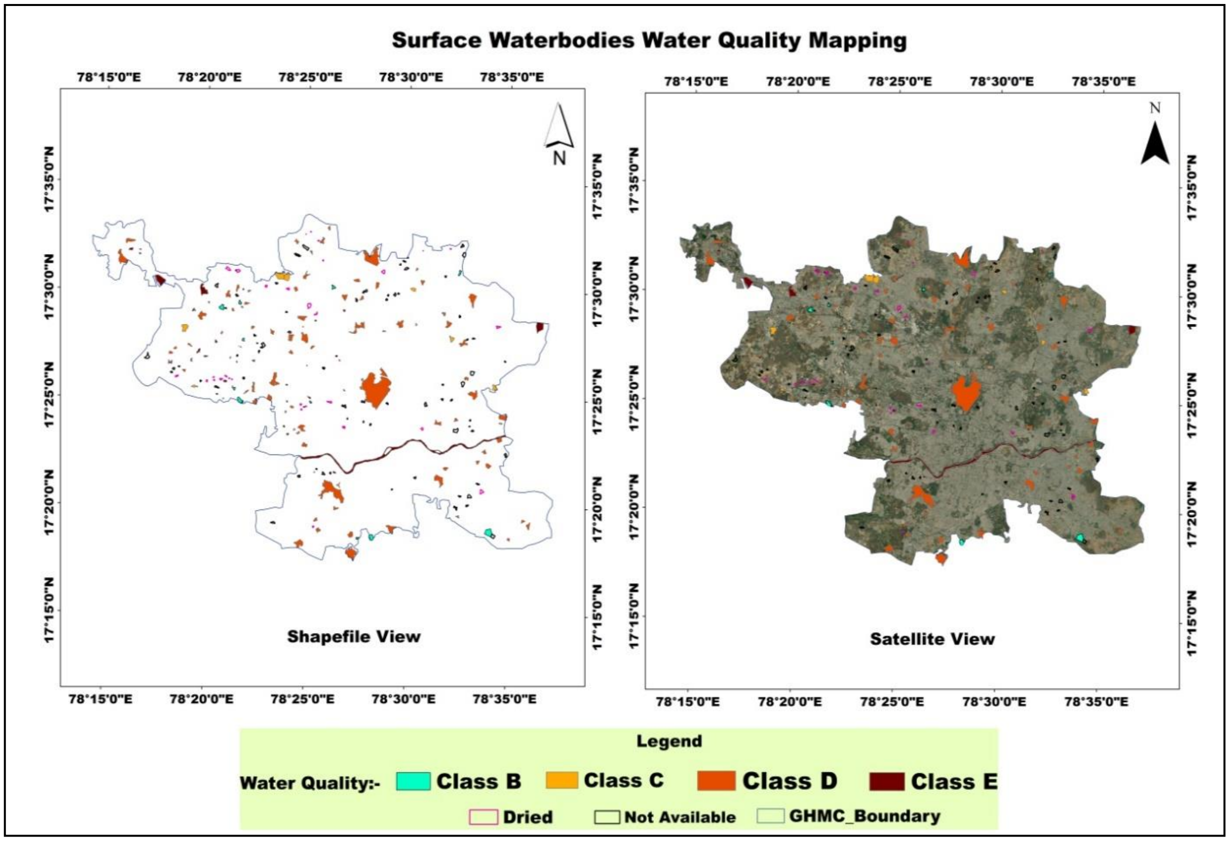


Figure 3. Water Quality Mapping of the Study Area

Table .4.Showing Results of Water Quality Class

| S.No | Water Quality Class | Count |
|---|---|---|
| 1 | B | 13 |
| 2 | C | 8 |
| 3 | D | 86 |
| 4 | E | 24 |
| 5 | Dried | 25 |
| 6 | NA | 75 |
| Total | | 231 |

The above table shows Class B, which is designated for only organising outdoor baths as it is in the initial pollution stage. A total of thirteen waterbodies were classified as being in class B. The other stage is Class C, which is a Drinking water source after conventional treatment and can be considered a less polluted stage. This class categorises eight different types of waterbodies. The Second polluted stage, which is about to be considered a dangerous stage to be classified, is the designation of wildlife and fisheries as Class D. It is designated to use water only for fishery or wildlife drinking purposes, which the study area falls under, but the urban area is not engaged in it. The total number of Class D-classified water bodies is eighty-six. The last class that is hazardous to human health is designated for industrial cooling in Class E. This class counts twenty-four waterbodies, which are likely to increase in the future.

## IV. CONCLUSION

The results reveal that even while the study region is growing in terms of area, population, and economic influence, the waterbodies are being adversely impacted. Lakes are certainly endangered by artificial growth demonstrated through their shrinkage or disappearance. Twenty-five of the two hundred thirty one water bodies are dry, and seventy-five were either inaccessible or were not accessible during the wet season for collecting the data. No water body has been detected in the present investigation as a source for drinking water, which is a glaring indication that all waterbodies were contaminated. The need for water is expected to increase by 2050. The scenario study area is dependent on pumping water from rivers at the present time. Protecting the study area's waterbodies from pollution in physical, chemical, and biological terms is likely good for groundwater, surface waterbodies, and public health.

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