Sustainable Urban Water Management: Case of Hyderabad City

KID: 20250416 | Mr Abhishek Raisinghani, Dr Maheswaran R

Introduction

Urban India is at a critical juncture when it comes to water security. Rapid urbanisation, climate variability, and growing demand have placed unprecedented pressure on existing water systems. Per-capita water availability has declined sharply, from 5.18 ML in 1951 to about 1.49 ML in 2021, and is projected to further reduce to 1.19 ML by 2050 [1], [2], [3], [4].

Hyderabad, the city historically shaped by the Musi River and its intricate network of lakes and tanks, has lost nearly 61% of its lake area since 1979 [5], reducing its natural storage, and increasing dependence on long-distance water imports. Municipal supply has remained capped at 2GL/day for a decade, even as demand crosses 2.4–2.5GL/day and is projected to exceed 3.1GL/day by 2030 [6].

Research Objectives

The question that emerges is urgent and fundamental: How can Hyderabad restore the resilience of its natural water systems while meeting the rapidly expanding demand?

The study aims to develop an integrated, city-scale water balance for GHMC by assessing current water availability and use, identifying key stress drivers, analysing future demand–supply gaps through scenarios, and proposing targeted, scalable recommendations for sustainable urban water management.

Progress and Way Forward

The natural water balance for the study integrates multiple datasets: IMD rainfall grids, land cover from ESRI, soil from FAO, groundwater recharge data from INGRES, ET and soil moisture from India-WRIS, with runoff estimated using the SCS Curve Number method. Ultimately, all data was calculated for each ward at seasonal time frame.

GHMC (~650sqkm) receives an average annual rainfall of about 970 mm, translating to roughly 678 GL of water. Most amount of which is lost naturally in the form of evapotranspiration (44%). Having more than 80% of land as built-up, 41% is converted to runoff.

Around 9% is converted into soil moisture, and remaining 6% is recharged to ground water. Seasonally, most water is lost as ET during dry month, and as ET and runoff both, during wet period.

The next steps include expanding the model from natural hydrology to the full urban water cycle—integrating imports, groundwater use, sectoral consumption, wastewater flows, and reuse. This will be followed by diagnosing system inefficiencies and conducting scenario analyses to understand future demand–supply gaps under varying growth and management strategies, ultimately informing actionable interventions.

Expected outcomes

The project is expected to produce deliver a data-driven water balance model identifying current and future supply gaps, and a scenario-based restoration strategy combining hydrological reconnection, stormwater capture, and demand-management measures. Ultimately, it aims to create a replicable model for other Indian cities facing similar challenges and reposition water bodies as an active component of a resilient, climate-adaptive urban water system.

References

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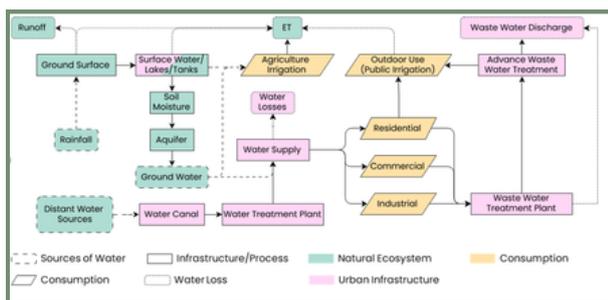

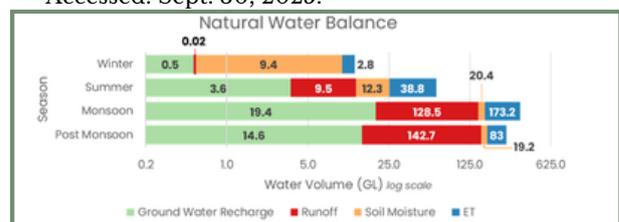Figure 1. Schematic representation of Urban Water Balance

Figure 2. Seasonal Natural Water Balance - GHMC

[1] Mr Abhishek Raisinghani
MTech, Sustainable Engineering

[2] Dr Maheswaran R
Assistant Professor, Department of Civil Engineering