Managed Aquifer Recharge Using Rainwater And Treated Used Water For Domestic Water Supply For A Small Town.

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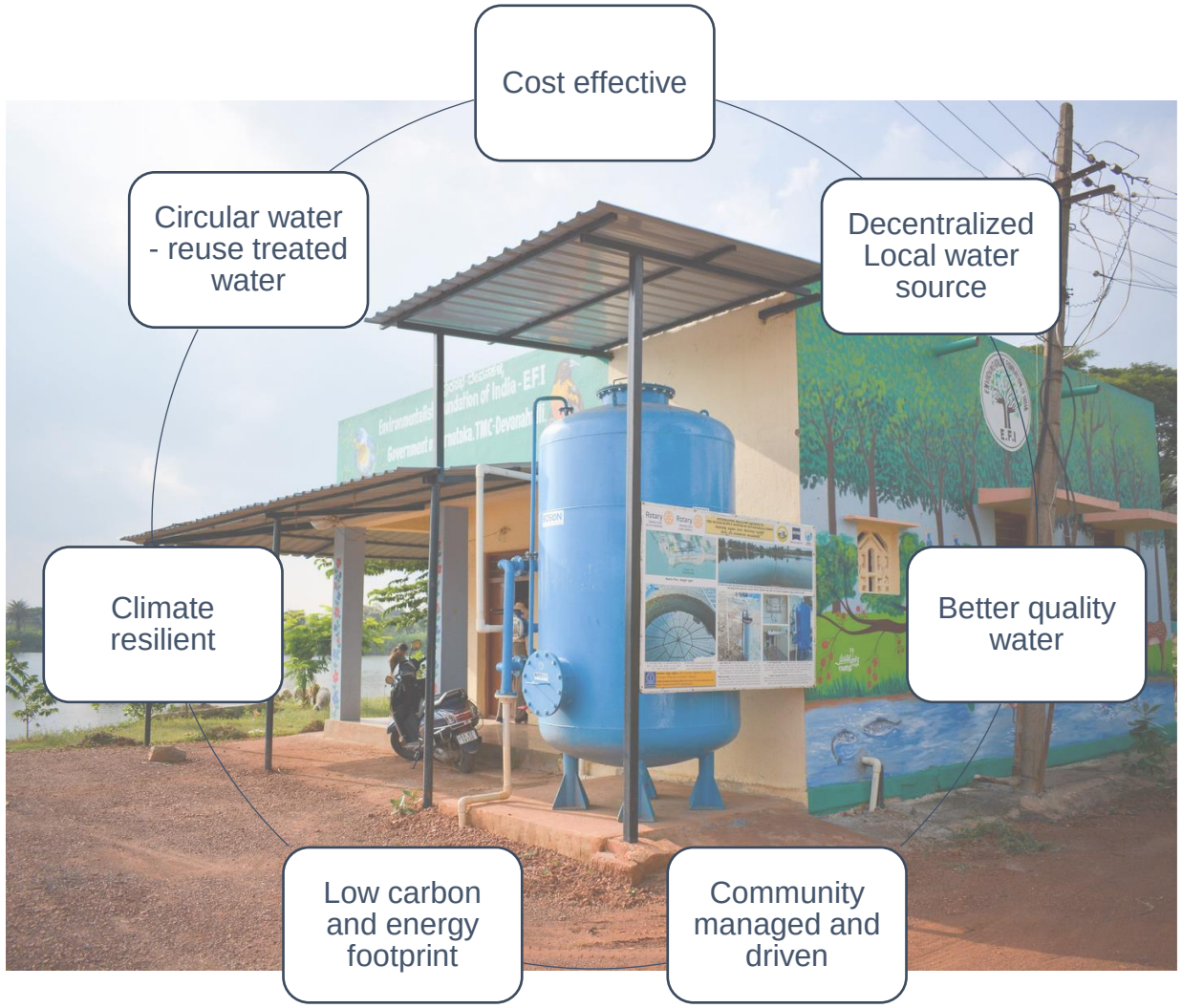
Integrating Shallow Aquifer to the Water supply system of the town using managed aquifer recharge

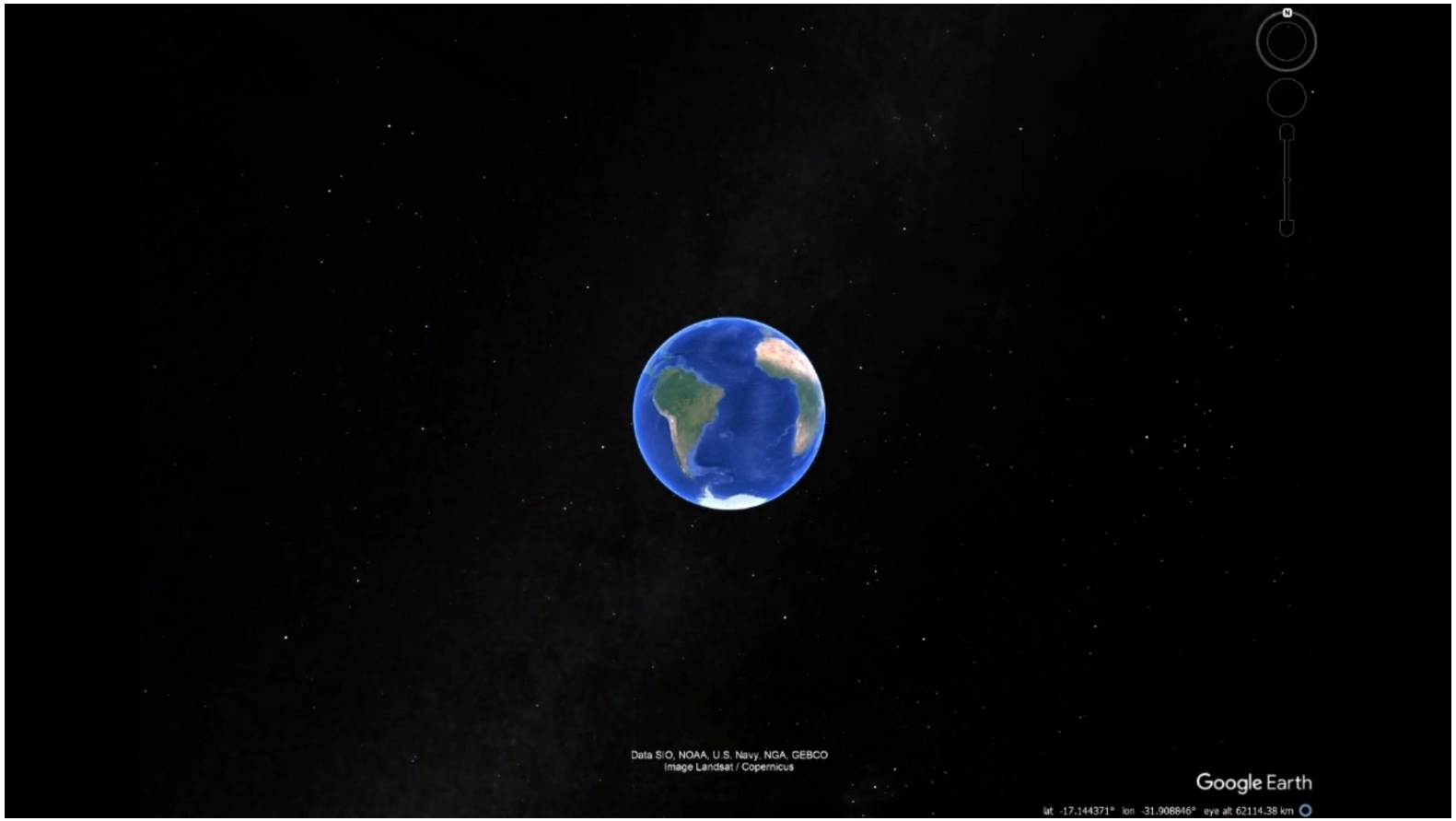
- Reuse of Diluted Treated Water
- Managed Aquifer Recharge (MAR) through existing lakes.
- Local water source and Sustainable Extraction: Water is extracted using heritage public open wells and simple, low-cost shallow filter borewells developed by the locals, integrating in the existing water supply system
- Tailored Water Treatment: A minimal yet effective treatment system designed specifically for the water quality requirements.



Heritage Town of Devanahalli

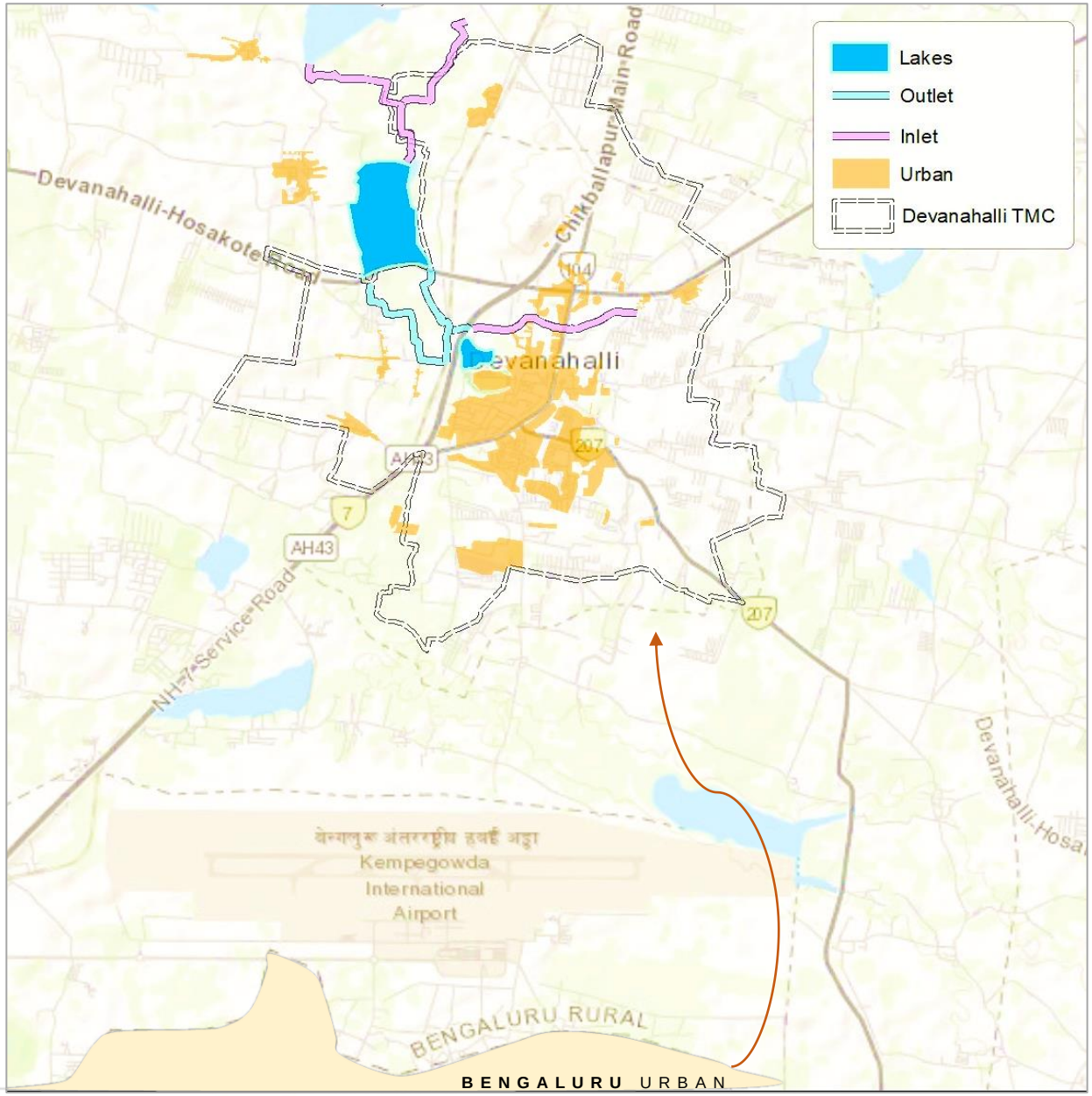
Devanahalli Overview

- Located in Bengaluru rural district, Karnataka
- Distance: 35 km from Bengaluru city, Kempegowda International Airport: 10 km away
- Area: 16.63 sq. km, Wards: 23
- Population: ~40,000 (2024)



Town's challenges:

- **No Perennial Water Source**: Town lacks a reliable, sustainable water source.
- **Reliance on Deep Borewells:** Sole dependency on borewell water. Non-yielding, with depths of 1000–1800 feet.
- **Irregular Water Supply:** Certain wards receive water only once a week to every 15 days.
- **Water Quality Issues:** High TDS levels exceeding 1200+ (above permissible water quality limits).
- Drinking water needs met by 17 public and remaining private RO plants.



HN Valley Project - Karnataka's large-scale tank-filling lift-irrigation initiative - 2020

Water channel bring treated water and Rainfall runoff from the lake's catchment into the lake.

Lake filled with rainfall runoff and treated water.

Transfer of domestic treated sewage water from the Bengaluru city - pumping it to neighboring arid – drought prone districts – Chikkaballapur, Anekal, and Kolar (Video depicts the pumping to Chikkaballapur)

Instrumentation and Monitoring

- Automatic Rain gauge to measure Rainfall
- Staff Gauge to measure lake level
- Pan Evaporimeter to measure evaporation rates
- Water level sensor to measure water level fluctuation in open well
  - Automatic Pressure sensor
  - Manual sensor
- Flow meters to monitor pumping and extraction data from Open wells, Shallow borewells and deep borewells
- Estimate Lake's capacity/Volume

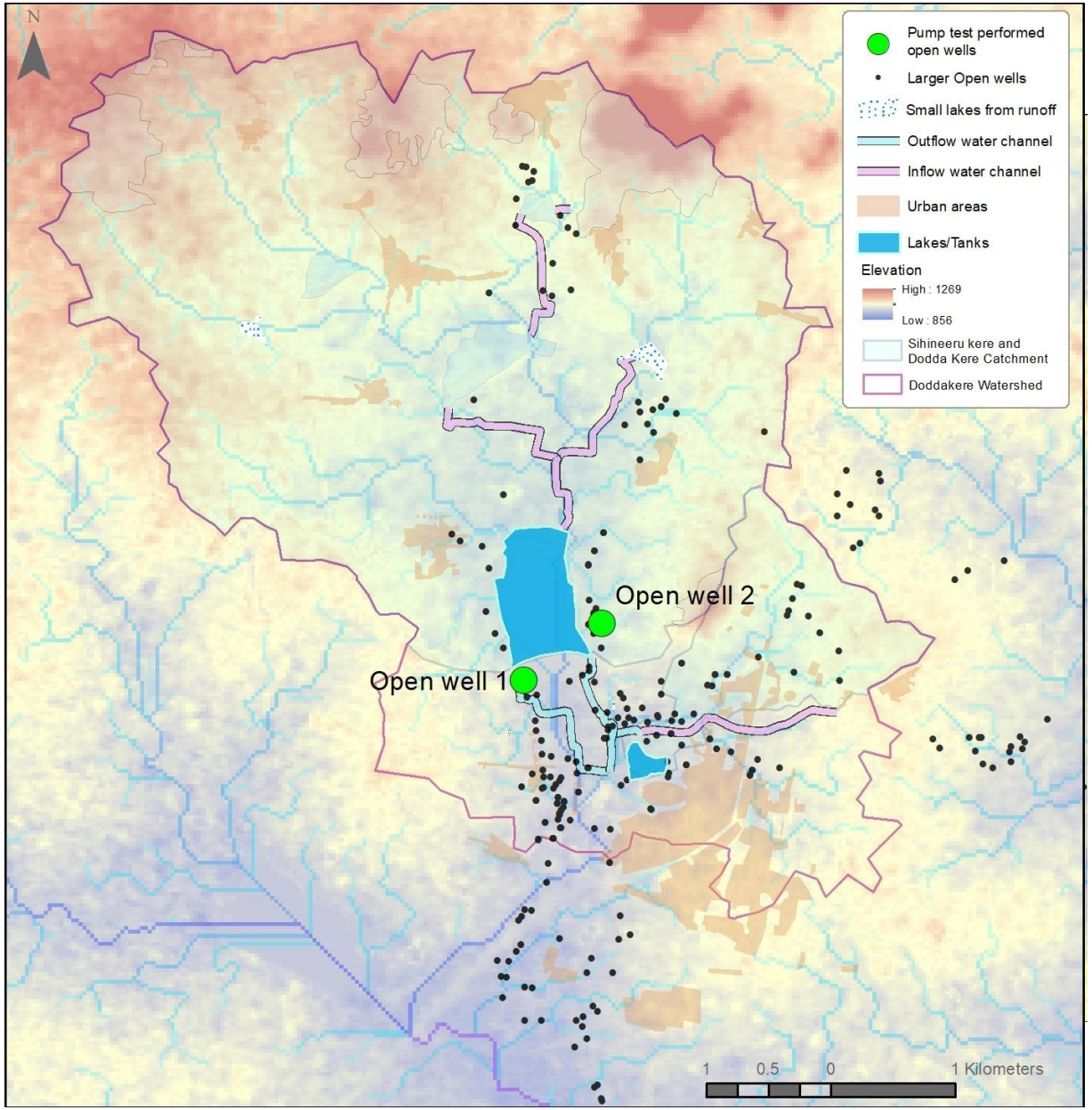
Rain Gauge

Pan Evaporimeter

Staff Gauge

Watershed Characterization

- Land Use Land Cover Mapping (Landsat/Sentinal)
  - Built up Area,
  - Irrigated area, Crops Grown and water requirements
- Natural drainage mapping (ASTER/SRTM data)
- Current drainage mapping (On ground survey)
  - Treated water inlets, Outlets and their catchment.
- Catchment Mapping for both lakes
- Mapping the spatial extent of the shallow aquifer
- Well inventory – Open Wells and Deep Borewells
- Shallow Aquifer's Thickness/Depth distribution for Volume of shallow aquifer



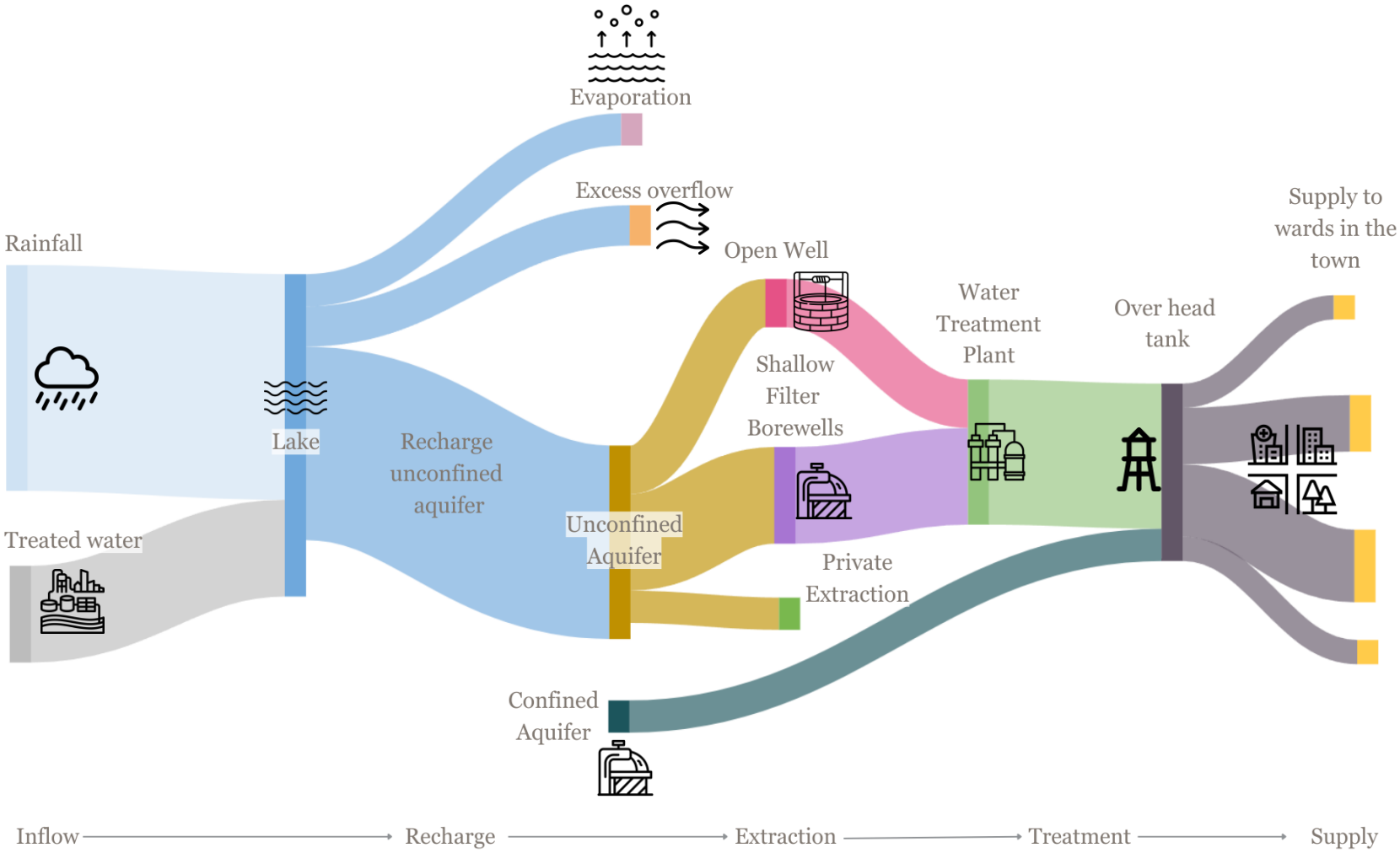
Watershed mapping of the two lakes in Devanahalli Town

Aquifer Characteristics

- Four pump tests at different locations across the aquifer to evaluate parameters such as transmissivity and specific yield (storativity).
- Assess and map the spatial distribution of variations in aquifer properties within the watershed.

Water Balance

- Total rainfall: 794 mm, August & October as peak months. Average daily rainfall: 5.2 mm/day – Last 6 months
- Lake storage volume: 94 Million Litres
- Evaporation rate: 2.8 – 3 mm/day
- Shallow aquifer storativity: 8% – 11%
- Current pumping from shallow aquifer: 1 million liters per day – 20% of town's requirement
- Cost: Shallow aquifer pumping: INR 0.54/kL, Deep aquifer pumping: INR 9.30/kL



- Working on refining and add more data to better understand the system.

Water treatment plant – Design

Disk Filter: Removes physical impurities larger than 130 microns. Multimedia Filters: Multi-layer filtration with activated charcoal. UV Radiation and Chlorine Dosage: Eliminate biological contamination.

- The water system was designed, with water quality extensively tested by IISc and third-party labs for various parameters, including heavy metals.
- Based on the specific characteristics of the shallow aquifer, a tailored treatment process was developed, making it a highly context-specific and thoughtful design rather than a one-size-fits-all solution.

Water Quality Monitoring - Dashboard

- Living Lab and IISc Monitoring and Assessment:
  - Monthly and Quarterly water quality tests
  - Focus on microbiological and physical parameters.
- Comprehensive Water quality evaluation of 90 parameters:
  - Microbiological, Organoleptic, and Physical parameters, Toxic substances and pesticide residues.
- Quality tests for Antibiotic residues and Antimicrobial resistant – Dr. Varsha Sridhran, Molecular Solutions Care Health

Collaboration, Support and Partnerships

- The Devanahalli (TMC) Town Municipal Council and the Community, Well Diggers, Pump and valve Operators, Waterman and others on ground.

- Indian Institute of Science – Upcoming project under Department of Science and technology on Soil Aquifer treatment and Water quality
- IIIT Hyderabad – Water level and water quality sensors

- Replication in other Gram Panchayat – Received Grant under Karnataka Rural Development and Panchayat Raj Department
- Formulating DPR with the Karnataka Urban Water Supply and Drainage Board for its water treatment plant in Devanahalli
- Jal Jeevan Mission & Atal Bhujal Yojana to exchange insights, integrate local knowledge, and inform on treated water & system changes – by leveraging Devanahalli's existing status as a beneficiary under AMRUT scheme.

Thank You

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