

Master Thesis

“Managed Aquifer Recharge in Africa - a comprehensive literature review”

About us

The Chair of Urban Water Systems Engineering is involved in the education of students (Bachelor and Master) in environmental and civil engineering. Our research covers all aspects of the urban water cycle: urban water supply, wastewater treatment and energy recovery, water recycling, drainage systems, industrial wastewater treatment, and the urban water-food-energy nexus.



Topic

Groundwater resources are essential for drinking water and for industrial and agricultural use. However, groundwater is threatened by overuse and contamination. Managed Aquifer Recharge (MAR) is an approach for the sustainable management of groundwater by increasing the available amount of water and improving water quality. For MAR a variety of water sources such as surface water, reclaimed wastewater or stormwater can be used. The water is infiltrated into the subsurface where filtration, biodegradation and adsorption of contaminants take place. Water is then procured from the aquifer by pumping it back to the surface.

MAR is used worldwide, however, Africa's diverse hydrogeological and socio-economic contexts present unique challenges and opportunities for the adoption and scaling of MAR approaches. To date, many African countries have initiated MAR pilot projects or integrated recharge techniques into water management plans, yet a systematic and comprehensive review of these efforts is lacking. Understanding the current state of MAR implementation, its successes, limitations, and contextual drivers is essential for guiding future research, and supporting sustainable groundwater management across the continent.

This Master's thesis aims to fill this knowledge gap by conducting a comprehensive review of MAR initiatives in Africa, compiling and analyzing existing literature, project reports, and case studies. The

study will explore the variety of MAR techniques applied, their hydrogeological and environmental settings, operational performance, effluent use and socio-economic and institutional frameworks, including possible integration with the Water-Energy-Food-Ecosystems (WEFE) Nexus approach. One focus will be the review of low-cost monitoring methods to ensure MAR operation. It will also identify key challenges hindering wider adoption of MAR, such as technical constraints, governance issues, funding limitations, and community acceptance.

Tasks

- Literature review of applications of MAR in Africa, possibly with a focus on the countries that are part of the ongoing EU project “TRANS-SAHARA” (e.g., Ghana, Tunisia, Kenya)
- Focus on water availability and water quality improvement with MAR
- Evaluate the performance, benefits, limitations and challenges of MAR
- Review low-cost monitoring methods for ensuring MAR operation

Preferred Background

- Hydrology, Hydrogeology, Environmental Engineering, Water Resources Management
- Strong literature review and writing skills
- Interest in sustainable water management in developing contexts

Time Range

The work is designed for a period of 6 months and should be started soon (June/July 2025).

Please send an email to felicia.linke@tum.de with a short cover letter, your transcript of record and your CV.

The Master Thesis will be co-supervised by **Dr. Daphne Gondhalekar**, head of the Urban Water-Energy-Food-Ecosystems (WEFE) Nexus research group at the Chair of Urban Water Systems Engineering.

Contact

Felicia Linke
felicia.linke@tum.de
089 289 13704
Chair of Urban Water Systems Engineering
Am Coulombwall 3
85748 Garching
www.cee.ed.tum.de/sww
www.tum.de