TERMS OF REFERENCE FOR A DIRECTED WRC PROJECT

THEME **Water Availability**

TITLE **Development and pilot of a spatially differentiated (< 100m) recharge estimation method for numerical groundwater models using publicly available data**

TOR NUMBER 1010009

Rationale

Groundwater recharge estimation is a cornerstone of sustainable groundwater resource management, particularly in semi-arid regions, such as South Africa, where water scarcity is a persistent challenge. Accurate recharge estimates are essential for understanding aquifer replenishment rates, managing extraction sustainably, and informing policy decisions on water allocation and conservation. Despite its importance, current recharge estimation methods in South Africa often lack the spatial resolution needed for detailed numerical groundwater models. Many existing approaches rely on coarse-scale data or models that do not adequately capture the variability inherent in semi-arid landscapes, such as heterogeneity in soil types, vegetation, and topography. These limitations can result in inaccurate predictions of groundwater recharge, leading to inefficient management strategies and increased vulnerability to water shortages.

This project addresses the need for spatially differentiated recharge estimation methods (< 100m resolution) that leverage publicly available data, enabling more precise characterization of recharge variability. By developing and piloting these methods in semi-arid regions, the project aims to provide tools that align with international best practices while being practical and scalable for local contexts. The project is expected to deliver a validated and standardised method for spatially differentiated groundwater recharge estimation, tailored to the unique hydrogeological contexts of South Africa. By refining recharge inputs, the accuracy of numerical groundwater models will be significantly enhanced, supporting more reliable predictions and sustainable water resource management. The project will build stakeholder capacity through targeted engagement and training, ensuring that practitioners and regulators are equipped to apply and adapt the methods effectively, promoting widespread adoption and integration into national water management strategies.

Aligning this work with the Department of Water and Sanitation's (DWS) ongoing projects ensures that the developed methods integrate seamlessly into national groundwater strategies. Standardizing these techniques will foster consistency across different modelling platforms, which is critical for ensuring data comparability and reliability in decision-making processes. The

engagement of stakeholders—including groundwater practitioners, regulators, and policymakers — is another key aspect of this project. Ensuring that the methods are both scientifically robust and practically applicable increases the likelihood of adoption and long-term sustainability. Workshops and consultations will create opportunities for capacity building, enhancing technical expertise among users and promoting the integration of these techniques into day-to-day groundwater management.

Main Objectives

To develop and pilot a spatially differentiated groundwater recharge estimation method (< 100m resolution) using publicly available data, aligning with the Department of Water and Sanitation (DWS) standards to enhance the accuracy and consistency of numerical groundwater models in South Africa.

The Specific Objectives are to;

1. Develop and refine techniques to estimate spatially differentiated groundwater recharge using publicly available datasets.
2. Align the methods with existing Department of Water and Sanitation (DWS) projects to standardise recharge estimation approaches across the country.
3. Pilot these techniques in various semi-arid regions across South Africa to evaluate feasibility, accuracy, and adaptability.
4. Engage with stakeholders, including groundwater practitioners and regulators, to ensure that the methodologies developed are practically applicable and promote adoption.
5. Establish a framework for integrating the techniques into national groundwater resource management strategies.
6. Document findings and provide recommendations for scaling up the methods nationally.

Expected Deliverables

1. Comprehensive methodology report documenting the recharge estimation techniques developed, including underlying assumptions and validation results.
2. Pilot study report detailing outcomes from semi-arid region pilots, including challenges, successes, and recommendations.
3. Stakeholder engagement report summarising stakeholder workshop feedback and integration into the methodologies.
4. Final report outlining guidelines for national implementation and potential international applicability.

Total Budget: R 3 000 000.00 (Including VAT)
Year 1: R 1 500 000.00 (Including VAT)
Duration: 3 years