

March 2025

The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.



Groundwater Resource Directed Measures (GRDM) methodology update, software enhancements and training

The recently completed Groundwater Resource Directed Measures (GRDM) project aimed to improve methodologies and software for groundwater protection and management in South Africa. Initially developed in 2007 and updated in 2013, the GRDM methodology and software have faced challenges in implementation, including issues with data integration, groundwater-surface water interactions, and usability. The 2024 revision addresses these gaps by updating the methodology for classification, Reserve determination, and resource quality objectives. Enhancements include a more user-friendly software interface, improved recharge and baseflow assessments, and refined groundwater-dependent population estimations. Training programs and workshops were conducted as part of the project, funded by the Water Research Commission, to ensure effective adoption by the Department of Water and Sanitation officials and stakeholders. Recommendations emphasise the need for updated geological data, national database improvements, and sustained training initiatives for GRDM users.

Background

Groundwater plays a crucial role in South Africa's water security, supporting ecosystems, agriculture, and human consumption. To ensure the sustainable management of groundwater resources, the Department of Water and Sanitation (DWS) initiated a research study in 2007 to develop methods for assessing the groundwater component of Resource Directed Measures (RDM). This project, funded by the DWS and implemented by the Water Research Commission (WRC), resulted in the first version of the Groundwater Resource Directed Measures (GRDM) methodology and software.

Subsequent applications of the methodology identified critical gaps, such as challenges in scaling assessments from regional to local levels, issues with quaternary catchment delineation, and limitations in addressing groundwater-surface water interactions. To address these gaps, a follow-up project was launched in 2011, leading to a revised GRDM methodology and updated software, which was completed in 2013.

Despite improvements, continued use of the 2013 GRDM methodology and software highlighted further shortcomings, including difficulties in updating data, baseflow estimation issues, and challenges with user-friendliness. Additionally, various expert reviews identified

the need for methodological refinements to enhance the accuracy and effectiveness of groundwater resource assessments.

The latest GRDM Project, completed in 2024, looked at updating the methodology and software to improve groundwater classification, reserve determination, and resource quality objectives (RQOs). It also sought to standardise assessment approaches and provide training for DWS officials to ensure consistent and effective groundwater management nationwide.

Objectives and method

The GRDM project is designed to enhance the assessment and management of groundwater resources in South Africa. The project builds on previous iterations of the GRDM methodology and software, addressing identified gaps and improving the accuracy, usability, and applicability of groundwater resource assessments.

The key objectives of the project included updating the GRDM Methodology; improving data integration; refining baseflow estimation; enhancing groundwater-surface water interaction analysis; developing user-friendly software; conducting training sessions for DWS officials and stakeholders to ensure effective implementation and long-term sustainability of the methodology; and standardising assessment approaches.

The project employed a multi-disciplinary approach, incorporating:

- **Hydrogeological and hydrological modelling:** Utilising numerical and analytical models to simulate groundwater flow, recharge, and interactions with surface water.
- **Field investigations and data collection:** Conducting site-specific assessments, including borehole testing, geophysical surveys, and water quality sampling.
- **Stakeholder engagement:** Collaborating with experts, policymakers, and water resource managers to ensure practical applicability of the revised methodology.
- **Software development and testing:** Updating the GRDM tool to improve accessibility, functionality, and integration with national water resource databases.
- **Pilot implementation and case studies:** Testing the revised methodology in selected catchments to validate its effectiveness before nationwide adoption.

This project is a critical step toward strengthening the country's groundwater management framework, ensuring that South Africa's water resources are effectively protected and sustainably utilised.

Main results

The GRDM project has delivered on key milestones in advancing groundwater resource assessment and management. The key outcomes include:

- **Refined GRDM methodology:** The project successfully updated the methodology for groundwater resource classification, reserve determination, and resource quality objectives (RQOs), improving the accuracy and consistency of assessments.
- **Enhanced baseflow estimation:** A more robust approach was developed to estimate baseflow contributions to surface water systems, addressing inconsistencies in previous methodologies and ensuring more reliable water balance calculations.
- **Improved groundwater-surface water interaction analysis:** The methodology now includes better integration of groundwater and surface water interactions, enhancing the ability to assess the impacts of groundwater abstraction on rivers, wetlands, and

ecosystems.

- **Upgraded GRDM software:** The new version of the GRDM tool offers a more user-friendly interface, improved data handling capabilities, and seamless integration with national hydrological and geological datasets.
- **Stronger data integration:** The project incorporated updated hydrological, geological, and hydrogeological datasets, allowing for more comprehensive groundwater assessments at various spatial scales.
- **Standardised assessment protocols:** Clear guidelines and protocols were developed to ensure uniformity in groundwater assessments across different regions, supporting consistent decision-making and policy implementation.
- **Capacity building and stakeholder training:** Training sessions were conducted for DWS officials and other stakeholders, enhancing their technical expertise and ensuring effective implementation of the updated GRDM framework.
- **Successful pilot case studies:** The revised methodology was tested in selected catchments, demonstrating its effectiveness and applicability in real-world groundwater management scenarios.

Recommendations

The findings of the GRDM project highlight the need for institutionalising an updated methodology for groundwater classification, Reserve determination, and resource quality objectives. Regulatory frameworks should be strengthened to reflect improved understanding of groundwater-surface water interactions, while monitoring networks must be expanded to provide real-time data for better decision-making.

Integrating the GRDM approach into national water resource planning, alongside capacity-building initiatives for water managers and policymakers, will enhance groundwater governance. Stakeholder engagement, data sharing, and scaling up successful pilot studies should be prioritised to ensure sustainable groundwater management and long-term water security.

Accompanying report:

Groundwater resource directed measures (GRDM) methodology update, software enhancements and training (WRC report no. 3188/1/24). For content-related queries please contact Yazeed van Wyk, yazeedv@wrc.org.za.