HIGH CONFIDENCE GROUNDWATER RESERVE DETERMINATION STUDY IN THE BERG CATCHMENT

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PURPOSE OF THIS DOCUMENT

The purpose of this Background Information Document (BID) is to provide stakeholders with insights into an ongoing study initiated by the Department of Water and Sanitation (DWS). The study's primary objective is to establish a High Confidence Groundwater Reserve within the Berg catchment. Through a comprehensive assessment, the study aims to define the groundwater Reserve requirements, encompassing both quantity and quality, that is essential not only to meet basic human needs but also to safeguard aquatic ecosystems in priority water resources within the Berg catchment.

The detailed determinations seek to yield high-confidence results, drawing upon site-specific data gathered by specialists. These results will be important for mandatory licensing exercises and individual license applications. These applications, even if seemingly minor in impact on some catchments, could have significant consequences for ecologically important and sensitive areas.

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PROJECT WEBSITE LINKS

Study Deliverables
https://www.dws.gov.za/rdm/currentstudies/default.aspx

Background

The National Water Act (NWA, No. 36 of 1998) provides a legal framework for managing water resources in South Africa. It includes the Recourse Directed Measures (RDM) and is an important tool within this framework for achieving a balance between the protection, use, conservation, management, and control of water resources. The RDM contains three main components (refer to **Figure 1**) and includes the 1) Classification, 2) Reserve, and 3) Resource Quality Objectives (RQOs). The Reserve is the only right to water in the NWA and takes priority over other uses, as it is water set aside for Basic Human Needs (BHN) and the Ecological Water Requirements (EWR). The RQOs for priority sites in the Berg catchment is meant to cover the requirements of the Reserve and other critical water demands (including those of priority ecosystems).

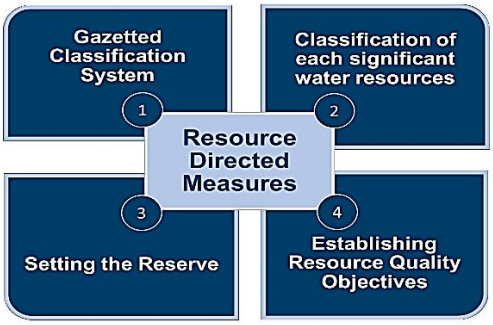


Figure 1: **The four components of the RDM as defined by Regulation 2(4) of the NWA; No. 36 of 1998.**

Although both surface water and groundwater are included in the definition of a “water resource” in the NWA, they have to be considered as unique yet interconnected systems. Therefore, determining a high-confidence groundwater Reserve requires careful consideration of the volume of groundwater that can be abstracted sustainably without affecting surface water flow.

To align with the Terms of Reference (TORs) for this study and initiate the groundwater Reserve determination process, the previously delineated Groundwater Resource Units (GRUs) in the Berg catchment underwent a thorough re-evaluation and update. This ensured the comprehensive inclusion of all groundwater resources. Subsequently, the Present Status (PS) of groundwater systems, assessing both quantity and quality, was re-evaluated for each GRU. This correlation aimed to link groundwater-related findings to the existing Water Resource Classes and RQOs outlined in the Gazette. Upon completing the PS determination, the groundwater component of the BHN and EWR Reserves was calculated, leading to the establishment of a preliminary Groundwater Reserve. Operational scenarios were then developed and evaluated, incorporating stakeholder input to assess various impacts on aquifer systems and the groundwater Reserve. The selected scenario, deemed the most likely case, was carried forward for further analysis (refer to **Figure 2**).

To evaluate potential impacts on GRUs, an Allocation Factor was developed. This factor represents the ratio of the groundwater 'still allocable' (after considering the Reserve and water use) to the total recharge for the GRU. Categorized from 'A' to 'F,' these factors reflect a spectrum from unstressed to potentially critically stressed conditions. As the ratio approaches zero, the level of stress potential increases, indicating minimal remaining “still allocable” volumes and a potential threat to the groundwater Reserve.

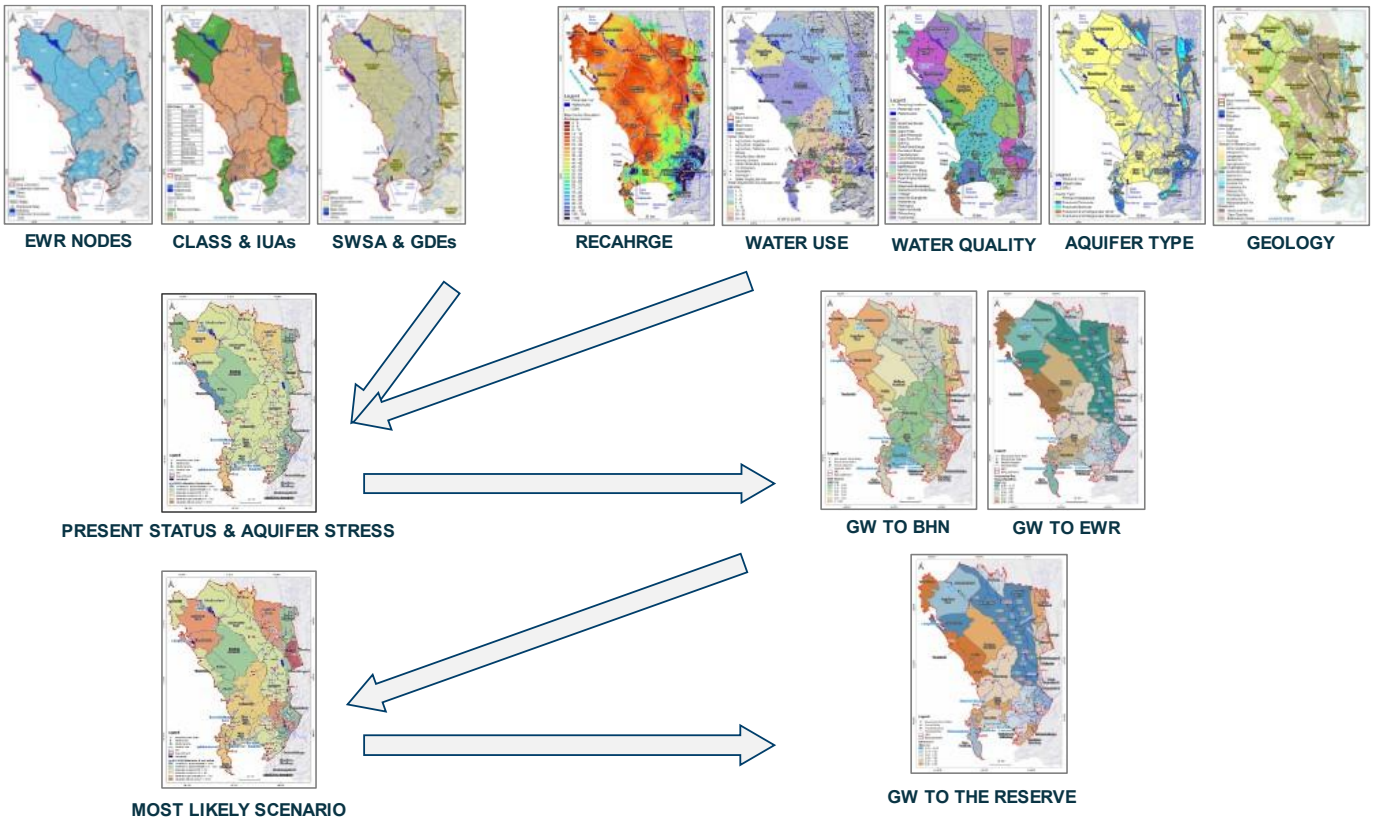


Figure 2: **A map summary of the water resource components and corresponding outcomes of the study to date.**

Aim

In adherence to Regulation 2(4) of the National Water Act (NWA, No. 36 of 1998), the Reserve determination process is mandated to hold to the eight-step Reserve determination procedure delineated in the RDM manuals. The focus of this phase of the study was to execute Step 7 of this procedure, which involves the development of a tailored monitoring program for the Berg catchment with a particular emphasis on safeguarding the contribution of groundwater to the Reserve (refer to **Figure 3**).

To achieve this, an updated monitoring program has been developed, and incorporates stakeholder input. This step involved a comprehensive review of existing monitoring programs and an assessment of the spatial distribution of monitoring networks to ensure alignment with the new monitoring objectives.

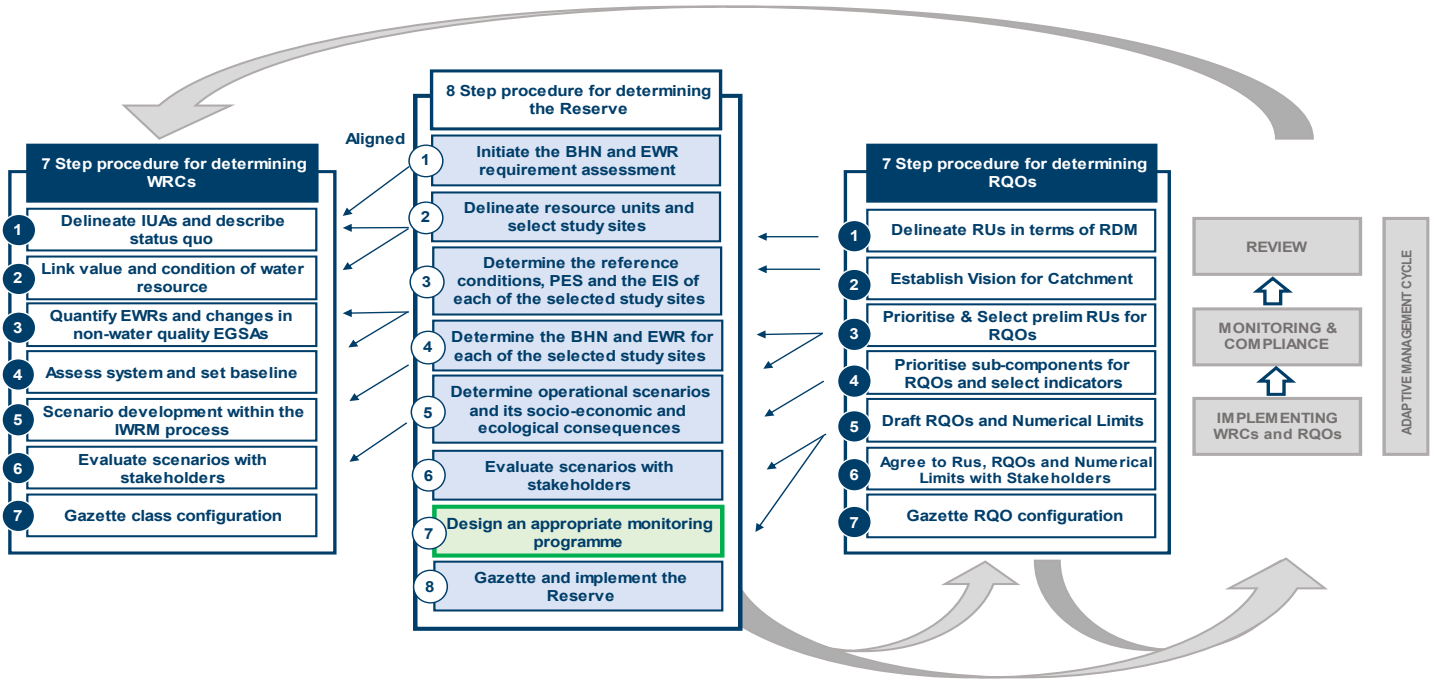


Figure 3: **The 8-step procedure for determining the groundwater Reserve and its alignment with the 7-step Water Resource Class (WRCs) and the 7-Step Resource Quality Objective (RQO) procedures as defined by Regulation 2(4) of the NWA; No. 36 of 1998. The 3 additional steps of the Adaptive Management Cycle have also been incorporated.**

In cases where existing monitoring programs were inactive or deemed ineffective, recommendations are presented to the DWS. These recommendations, if any, signify that the current measures in place for water resource protection may be insufficient to comply with WRCs, the Reserve, and RQOs, or that existing procedures may not be realistic and may require review and corrective actions. Additionally, the roles and responsibilities for all aspects of the monitoring procedure are delineated to ensure its successful implementation. Guidelines are provided regarding management criteria, resource sensitivity, monitoring locations, data collection frequency, and the type of data to be collected and evaluated for compliance.

It's important to note that the seven-step procedures related to WRCs and RQOs (refer to **Figure 3**) do not include a specific step for establishing a monitoring program. However, Steps 3 and Step 4 within these procedures, which involve prioritizing sub-components and assessing the system by setting a baseline, include the selection of "indicators" for monitoring and compliance. In this process, a separate framework known as the "Adaptive Management Cycle" was introduced, which incorporates additional steps to facilitate an ongoing process of learning and improvement. This allows for potential adjustments to be made to align the management criteria with the resource's vision.

Impact Assessment and Management Options

Integrated Water Resources Management (IWRM) played a crucial role in facilitating the coordinated development and stewardship of water, land, and other associated resources. The primary objective was to optimize economic and social well-being in an equitable manner, all while ensuring the sustainability of vital ecosystems. Steps 4, 5, & 6 of the RDM were designed to assess various operational scenarios. The IWRM framework was at the core of these evaluations, aiming to identify a subset of catchment configuration scenarios for presentation to stakeholders. This involved assessing various changes related to climate, land use, water use, etc. The outcomes of Step 7 of the GRDM process, the current step in this phase of the study, involves the design of an appropriate monitoring program. This step will establish management criteria for groundwater's contribution to both the ERW and BHN Reserve requirements.

The groundwater Reserve is presented at a GRU scale, comprising the BHN and EWR Reserves, each influenced by distinct yet interconnected factors. The criteria for defining a "groundwater management option" at the GRU level should be viewed separately for groundwater's contribution to the EWR (Allocation Factor vs. Baseflow Contribution to EWR Sites) and groundwater's contribution to BHN (Groundwater's contribution to the BHN Reserve vs. Population Density).

It's important to note that the monitoring program was designed on a regional scale, rather than for individual users. As a result, the Reserve's 'limits' and the associated RQOs do not serve as a substitute for other monitoring programs. Additional programs are necessary to address parameters not covered in existing initiatives, and the data collected should be integrated into the DWS databases.

Figure 4: **Management Matrix for groundwater's contribution to the EWR (left) and groundwater's contribution to the BHN (right).**

Management Matrix: GW EWR

GW Contribution to Baseflow (Mm^3/a) \ Allocation Factor (Still Allocable / Recharge)	A	B	C	D	E	F
0.00 - 0.18	1					
0.18 - 0.87	2					
0.87 - 1.62	3					
1.62 - 3.01	4					
3.01 - 6.00	5					
6.00 - 11.15	6					

Management Matrix: GW BHN

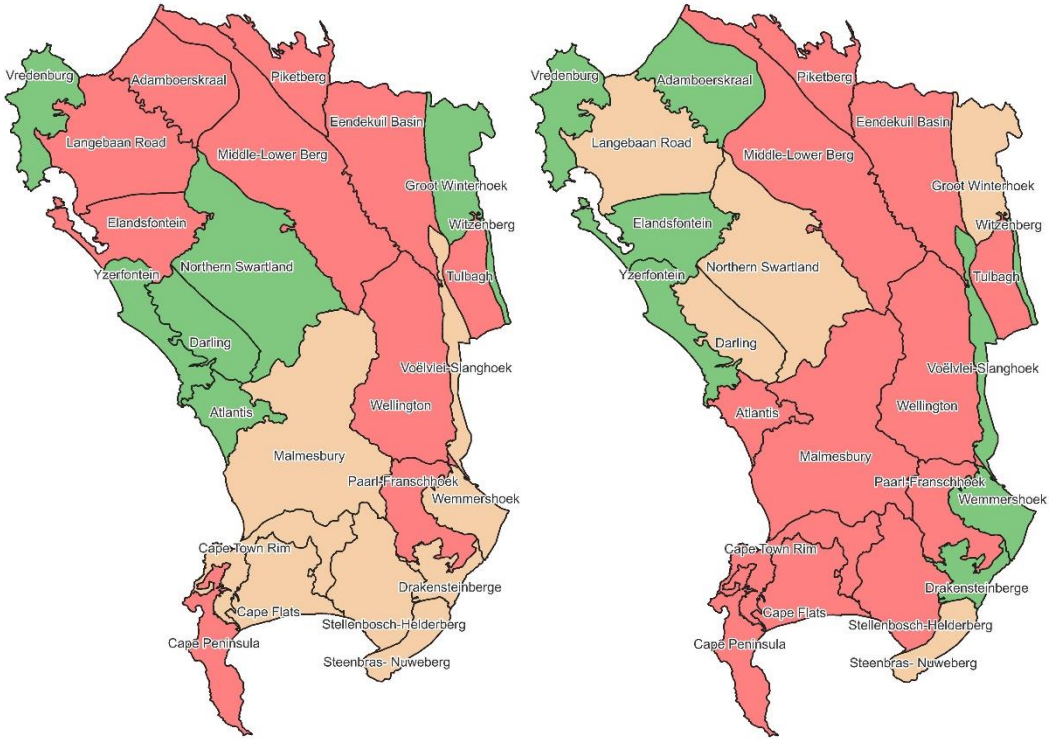
Population Density (pop/km^2) \ GW contribution to BHN (Mm^3/a)	A	B	C	D	E	F
1.26 - 3.99	1					
3.99 - 7.68	2					
7.68 - 11.81	3					
11.81 - 18.16	4					
18.16 - 56.43	5					
56.48 - 330.30	6					

Management Options	Monitoring Description
1	Low Priority, Limited Selection of Monitoring Sites, Infrequent Monitoring
2	Moderate Priority, Moderate Selection of Monitoring Sites, Increased Monitoring Frequency
3	High Priority, Numerous Selection of Monitoring Sites, High-Frequency Monitoring

Table 1: **Summary of Preliminary Management Options per GRU for groundwaters contribution to EWR and groundwaters to BHN, and their associated Management Matrix components.**

GRU	Allocable Factor per GRU	Groundwaters Contribution to Baseflow per GRU (M m3/a)	Groundwaters Contribution to EWR Management Option	Groundwaters Contribution to the BHN Reserve (M m3/a)	Population Density per GRU (pop/km2)	Groundwaters Contribution to BHN Management Option
Adamboerskraal	0.53	6.00	3	0.01	2.50	1
Atlantis	0.84	0.08	1	0.05	20.09	3
Cape Flats	0.36	0.51	2	1.29	329.43	3
Cape Peninsula	0.38	5.43	3	0.16	56.44	3
Cape Town Rim	0.39	0.87	2	0.36	100.31	3
Darling	0.82	0.03	1	0.03	7.72	2
Drakensteinberge	0.85	2.88	2	0.01	3.94	1
Eendekuil Basin	0.21	6.95	3	0.16	18.16	3
Elandsfontein	0.31	6.39	3	0.01	1.97	1
Groot Winterhoek	0.80	0.77	1	0.03	7.68	2
Langebaan Road	0.18	5.52	3	0.03	4.00	2
Malmesbury	0.39	1.18	2	0.64	43.46	3
Middle-Lower Berg	0.56	11.15	3	0.16	11.82	3
Northern Swartland	0.88	0.20	1	0.09	7.90	2
Paarl-Franschhoek	0.24	3.01	3	0.21	62.68	3
Piketberg	0.37	2.07	3	0.06	17.57	3
Steenbras- Nuweberg	0.56	1.16	2	0.02	13.11	2
Stellenbosch-Helderberg	0.63	2.34	2	0.46	87.79	3
Tulbagh	0.14	1.28	3	0.05	17.74	3
Voëlvlei-Slanghoek	0.85	1.62	2	0.01	6.11	1
Vredenburg	0.70	0.00	1	0.02	6.24	1
Wellington	0.52	6.75	3	0.39	39.70	3
Wemmershoek	0.80	3.59	2	0.00	1.27	1
Witzenberg	0.87	0.18	1	0.00	11.22	1
Yzerfontein	0.70	0.02	1	0.02	5.84	1
TOTAL		**69.98**		**4.27**		

Figure 5: **Summary Map of Preliminary Management Options per GRU for groundwaters contribution to EWR (left) and groundwaters to BHN (right).**



Project Plan and Progress

PHASE 1	**STEP**		**OUTCOME**	**STATUS**
	Inception		• Scope of work • Capacity building programme • Expenditure schedule & projections • Stakeholder engagement planning	**Complete**
PHASE 2				
	Data collection and collation		• Collate, review and analyse all available, relevant data and literature pertaining to the project area in the form of a desktop assessment.	**Complete**
PHASE 3				
	Step 1	Initiate Groundwater Reserve Study	• Complete a review of available information and data to determine the process and detail of the assessment and determination. • Identify relevant stakeholders to be included in the project.	**Complete**
	Step 2	Water RU Delineation	• Determine eco-regions, delineate aquifer specific groundwater related RUs (GRUs), select study sites.	**Complete**
	Step 3	Ecological Status and Reference Conditions per RU	• Determine the reference conditions, Present Ecological Status (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) of each of the selected study sites.	**Complete**
	Step 4	Determine BHN and EWR	• Determine the groundwater component of the BHN and EWR for all GRUs delineated in the study area, supported by the ecological findings of the gazetted Water Resource Classes and RQOs.	**Complete**
	Step 5	Operational Scenarios & Socio-economic	• Review current and future operational scenarios and its socio-economic and ecological consequences.	**Complete**
	Step 6	Evaluate scenarios with Stakeholders	• Evaluate the scenarios with stakeholders where the outcome of Step 3 – Step 5 will be presented, evaluated, adjusted and agreed upon.	**Complete**
	Step 7	Monitoring Programme	• Design an appropriate monitoring programme by taking into account the hydraulic characteristics and the status of identified water resources.	**Underway**
	Step 8	Gazette & implement Reserve	• Gazetting template will be drafted, based on the results of the study	**Not Started**

Public Meetings

Six PSC meetings will be held during the study, with the fifth scheduled for the 22 November 2023. The PSC is representative of all major sectors and interests within the study area and stakeholders are encouraged to provide strategic advice and guidance. Comments can be sent to the Stakeholder Engagement Office, DWS Study Managers or the PSP team for Technical Enquiries.