CLASSIFICATION OF SIGNIFICANT WATER RESOURCES AND DETERMINATION OF RESOURCE QUALITY OBJECTIVES FOR WATER RESOURCES IN THE USUTU TO MHLATHUZE CATCHMENTS (WP11387)

GROUNDWATER RESOURCE QUALITY OBJECTIVES

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water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

NDP 2030

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Groundwater Resource Quality Objectives

- Objectives of GW RQOs
- Recharge
- Baseflow
- Stress Index
- Quality
- Reserve and Allocable groundwater
- Example for W1 RQO
- Coastal lakes RQOs

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AIMS OF GW RESOURCE QUALITY OBJECTIVES

1) Maintain the required groundwater contribution to the EWR
2) Protect groundwater resources for the direct and indirect users

- RQOs may stipulate:
  - the volume of abstraction that would cause an undesirable reduction in baseflow or undue stress on aquifer
  - specific distances from a river
  - flow at gauging stations and maximum baseflow reduction
  - water quality conditions (linked to potable use)
  - GW levels with caution
  - Why not Water levels? Because near rivers or in leaky aquifers abstraction may have large impact but water level remains stable

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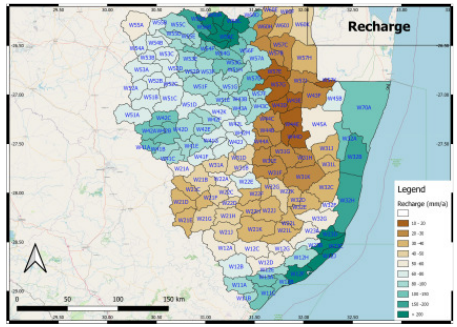
RECHARGE



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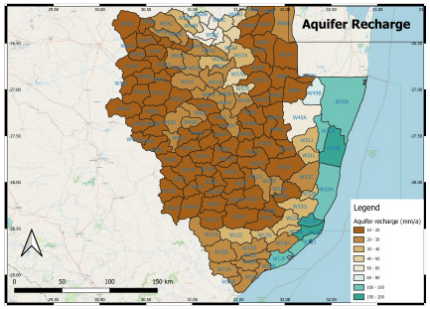
AQUIFER RECHARGE

Aquifer recharge: recharge entering the regional aquifer (aquifer recharge) after losses to interflow. Some catchments with high recharge may have limited groundwater resources



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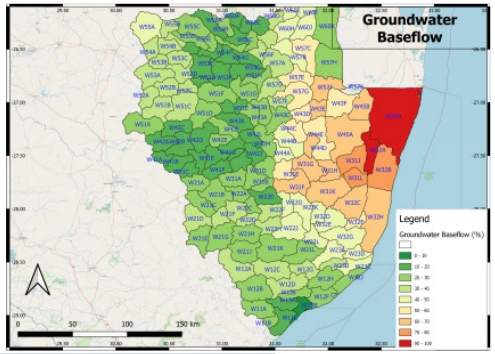
GROUNDWATER BASEFLOW



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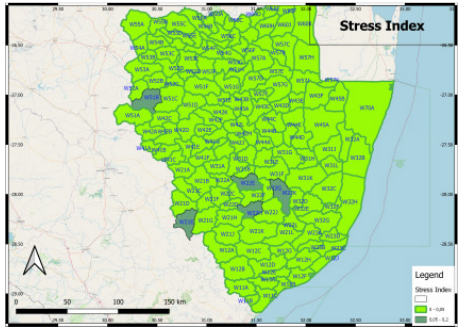
STRESS INDEX



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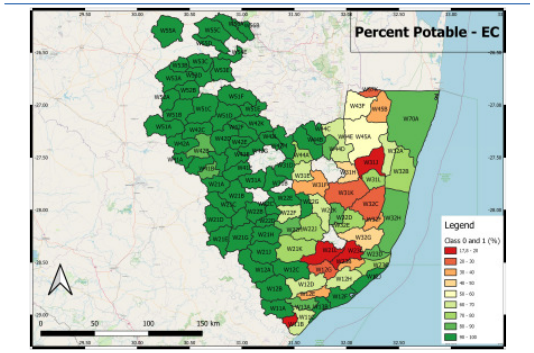
WATER QUALITY



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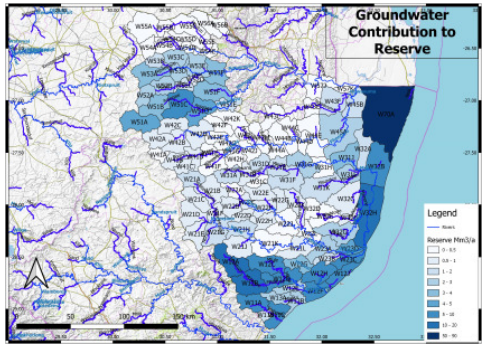
RESERVE



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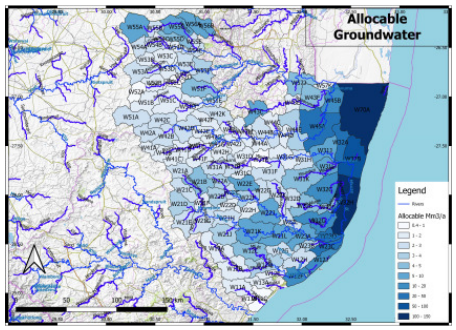
ALLOCABLE GROUNDWATER



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RQOs

Quat	Groundwater narrative RQO				Groundwater numerical RQO
	Abstraction	Baseflow	Water Level	Water Quality	
W11A	All existing users to comply with existing allocation schedules, including GA* and Schedule 1, and individual licence conditions. Allocations for new users is to remain within the allocable groundwater volume.	Due to the low groundwater use, monitoring not a high priority for RQO compliance purposes until numerical RQO is reached.	Due to the low groundwater use and low aquifer contribution to baseflow, monitoring not a high priority for RQO compliance purposes. Local monitoring of wellfields and background monitoring is necessary	Water quality to stay within the limits of Water Quality Class I	The remaining Allocable groundwater is 1.44 Mm³/a.
W11B				Many boreholes have natural elevated salinity, so water quality needs to be tested for domestic boreholes.	The remaining Allocable groundwater is 0.43 Mm³/a.
W11C				Many boreholes have natural elevated salinity and nitrates, so water quality needs to be tested for domestic boreholes.	The remaining Allocable groundwater is 0.91 Mm³/a.
W12A				Water quality to stay within the limits of Water Quality Class I	The remaining Allocable groundwater is 1.88 Mm³/a.
W12B				Water quality to stay within the limits of Water Quality Class I	The remaining Allocable groundwater is 1.49 Mm³/a.
W12C				Many boreholes have natural elevated salinity, so water quality needs to be tested for domestic boreholes.	The remaining Allocable groundwater is 4.82 Mm³/a.

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RQOs

Quat	Groundwater narrative RQO				Groundwater numerical RQO
	Abstraction	Baseflow	Water Level	Water Quality	
W51A	All existing users to comply with existing allocation schedules, including GA* and Schedule 1, and individual licence conditions. Allocations for new users is to remain within the allocable groundwater volume.	Due to the low groundwater use, monitoring not a high priority for RQO compliance purposes until numerical RQO is reached.	Due to the low groundwater use and low aquifer contribution to baseflow, monitoring not a high priority for RQO compliance purposes. Local monitoring of wellfields and background monitoring is necessary	Water quality to stay within the limits of Water Quality Class I	The remaining Allocable groundwater is 2.40 Mm³/a.
W51B				Water quality to stay within the limits of Water Quality Class I	The remaining Allocable groundwater is 1.13 Mm³/a.
W51C				Water quality to stay within the limits of Water Quality Class I	The remaining Allocable groundwater is 1.24 Mm³/a.

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SETTING RQOs – LAKES

Mzingazi: Dry season flows suggest little change in the groundwater regime, with droughts being caused by reduced surface water inflow

Nhlabane: Dry season flows have remained consistent with groundwater contributions exceeding surface water only in very dry years. The lower groundwater contribution relative to lake Mzingazi means the lake is more vulnerable to drought.

Cubhu: Simulated dry season flows for the month of July for surface water, and for groundwater have remained consistent with surface water contributions exceeding groundwater by a large margin except only in severe drought years.

Sibaya: 2000 to 2019 is an extended dry period, with rainfall well below the mean.

- **After significant afforestation commences in 1970 until 2000, lake levels rise despite afforestation and abstraction due to the wet conditions**
- **Observed, naturalised and simulated lake water levels show that due to the low rainfall after 2000, lake levels would have dropped naturally, and the impact of afforestation and abstraction is to increase the drop in lake level by about 1m.**
- **Under natural conditions, the lake would have dropped to 16 mamsl during the 1930s and the present day. Therefore, afforestation and abstraction alone cannot be the sole cause of low lake levels and the removal of afforestation would not maintain lake levels.**
- **Reducing afforestation by 50% and stopping the lake abstraction and transferring the water use to groundwater would keep water levels within 0.4 m of natural conditions and drop levels to 15.5 mamsl during the present drought.**

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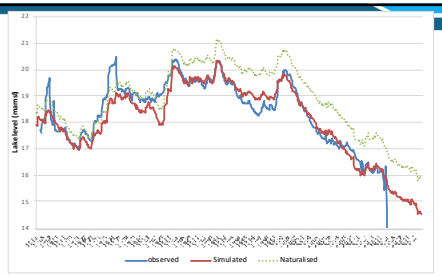

Lake	Quinary	Inflows				
		Abstraction (million m^3/a)	Groundwater inflow (net) (million m^3/a)	MAR Surface portion (million m^3/a)	Total MAR (million m^3/a)	Historic Firm Yield (million m^3/a)
Mzingazi	W12J1	14.0	12.45	39.98	52.43	10.5
Nhlabane	W12J2	18.0	4.69	25.71	30.40	7.9 without support from Mfolozi
Cubhu	W12J3	6.0	3.49	18.09	21.58	0.4
Sibaya	W70A1	3.22 and 2.8 from SPR	31.67	11.98	43.11	2.9

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SETTING RQOs – LAKES

Lake	Groundwater narrative RQO			Groundwater numerical RQO	
	Abstraction	Surface Inflow	Groundwater Level	Lake level	Abstraction
Sibaya	The preferred scenario is to reduce direct lake abstraction as much as possible and transfer existing water use to groundwater.	Due to land use changes, monitoring of surface water inflows is required and lake levels need to be monitored to remain above the minimum drought level	Due to the low groundwater use relative to recharge, monitoring presently not required for RQO compliance. Due to the low groundwater use and low aquifer contribution to baseflow, monitoring not a high priority for RQO compliance purposes. Local monitoring of wellfields and background monitoring is necessary	The minimum drought lake level is to be maintained above 15.5 mams for Category C	Total water allocations by SFR activities and direct abstraction from the lake should not exceed 1.4 Mm^3/a
				The minimum drought lake level is to be maintained above 16 mamsl for Category B/C	No afforestation is possible and groundwater abstraction of 3.0 Mm^3/a
Mzingazi	All existing users to comply with existing allocation schedules, including GA* and Schedule 1, and individual licence conditions. Allocations for new large scale abstraction requires an assessment of impact on lake level			The minimum drought lake level is to be maintained above 0.1 mamsl	Total water allocations from the lake should not exceed 10.5 Mm^3/a
Nhlabane				The minimum drought lake level is to be maintained above 3.5 mamsl	Total water allocations from the lake should not exceed 7.9 Mm^3/a without any support from the Mfolozi river
Cubhu				The minimum drought lake level is to be maintained above 1.2 mamsl	Total water allocations from the lake should not exceed 0.4 Mm^3/a

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