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DEPARTMENT OF WATER AFFAIRS AND FORESTRY

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This map was approved by the Director-General of the Department: Water Affairs and Forestry. Precipitation and elevation data were obtained from the Computing Centre for Water Research, University of Natal, and completed by H. Mullis. Information on roads, rivers and towns were obtained from the Chief Directorate: Surveys and Mapping, Department: Land Affairs, and edited by the Department: Water Affairs and Forestry. Permission from these respective institutions to make use of their information is gratefully acknowledged. Borehole data were obtained from the National Groundwater Data Base (NGDB). T. Chetty was responsible for the compilation of the borehole distribution map.

**Principal groundwater occurrence**

Aquifer type	Borehole yield class (median l/s) (including 50% boreholes)					
	0.0 - 0.1	0.1 - 0.5	0.5 - 2.0	2.0 - 5.0	> 5.0	
Intergranular	x	x	x	x	x	
Fractured	d1	d2	d3	d4		
Karst	x	x	d3	d4		
Intergranular and fractured	d1	d2	d3	d4		

Borehole yield boundary (main map only)

Note: Groundwater occurrence depicts the aquifer types with the highest borehole yield, and does not always correlate with surface lithology.

**Surface / Sub-surface lithology**  
(Unconsolidated sediments which are unsaturated, have been omitted from the map)

Pre-dominantly argillaceous rocks (shale) and subordinate arenaceous rocks (sandstone)	Intermediate extrusive rocks (andesite)
Argillaceous and arenaceous rocks (approximately equal proportion)	Pre-dominantly meta-arenaceous rocks (quartzite, gneiss) and migmatite
Pre-dominantly carbonate rocks (dolomite) and subordinate limestone	Pre-dominantly meta-calcareous rocks (calc-silicate)
Pre-dominantly diamictic (siltite)	Various lithologies:
Pre-dominantly iron formation (banded ironstone and jaspilite)	Sedimentary rocks: Va
Basic intrusive rocks (dolerite)	Metamorphic rocks: Ma, Mp, Ms and Mo
Add intrusive rocks (various granitoids)	Metamorphic and extrusive rocks: Vv and Vz
	Lithological / stratigraphical boundary
	Fault
	Inferred fault
	Dolerite / diabase intruded

**Large scale groundwater abstraction**

- 0.1 - 1 million m<sup>3</sup>/a
- Municipal

**Chonostratigraphy**

Period	Stage	Group	Formation
Cenozoic	Quaternary	O	
	Tertiary	T	
	Cretaceous	K	
Mesozoic	Jurassic	J	Du Toit G. (J1)
	Triassic	Tr	
	Non-perennial river		
	Permian	P	Saunders G. (P1-10), Dwyka G. (P1-10)
	Carboniferous	C	
Palaeozoic	Devonian	D	
	Silurian	S	
	Ordovician	O	
	Cambrian	E	
	Namibian	N	
Proterozoic	Mokkian	M	Kleinsee S. (M1), Janssensfontein F. (M2), Soutpans G. (M3), Sny G. (M4), Sny G. (M5), Sny G. (M6), Sny G. (M7), Sny G. (M8), Sny G. (M9), Sny G. (M10)
	Vaalian	V	Vaal G. (V1), Vaal G. (V2), Vaal G. (V3), Vaal G. (V4), Vaal G. (V5), Vaal G. (V6), Vaal G. (V7), Vaal G. (V8), Vaal G. (V9), Vaal G. (V10)
	Randan	R	Randfontein F. (R1), Randfontein F. (R2), Randfontein F. (R3), Randfontein F. (R4), Randfontein F. (R5), Randfontein F. (R6), Randfontein F. (R7), Randfontein F. (R8), Randfontein F. (R9), Randfontein F. (R10)
Archaean	Saalian	Z	Mayday G. (Z1)

**Schematic cross-sections to illustrate typical groundwater occurrence**

Not to scale

**AREA NORTH-EAST OF NIEKERKHOOP**

1 Borehole yields of generally less than 0.1 l/s can be anticipated in jointed dolomite of the Dwyka (D1) and Ecca (E1) Groups, away from dolomite intrusions. Electrical conductivity (EC) often exceeds 700 mS/m in the dolomite of the Dwyka Group, and vary between 300 and 700 mS/m in the shale and subordinate sandstone of the Ecca Group.

2 Jointed and fractured contact zones between Karoo sedimentary rocks (Dwyka (D1-D10) and Ecca (E1-E10) Groups) and dolomite dykes (d1-d10) are proven targets for groundwater development.

3 Various groundwater conditions are associated with dolerite sills (d1-d10). Groundwater can be secured from fractures by penetrating dolerite sills where they are not unduly thick (d1-d10). Groundwater can be found in weathered and underlying transitional contact zones.

4 Groundwater is unlikely to be found in solid dolerite, or where dolerite bodies are too thick to penetrate, or the depth to lower contact of dolerite with host rocks precludes the existence of water-bearing joints.

5 Contacts of different lithological and stratigraphical horizons, such as the Dwyka Group (D1-D10) rocks and sub-Dwyka basaltic, or between dolerite of the Dwyka Group and shale of the Ecca Group (E1-E10), or horizons within the Ecca Group (E1-E10) can be targeted when siting boreholes.

6 Groundwater occurs in zones of weathering and in fractures, or in the contact zones between different lithologies, such as granodiorite, granite, gneiss and quartzite of the Gwalior Group (G1-G10). The calc-silicates have no known karstic aquifer properties, and are not likely to facilitate groundwater occurrence.

7 Groundwater can be exploited from joints and fractures in calc-silicates and subordinate quartzites of the Gwalior Group (G1-G10). The calc-silicates have no known karstic aquifer properties, and are not likely to facilitate groundwater occurrence.

8 Groundwater occurs in karstic cavities and joints in dolomite of the Gwalior Group (G1-G10), mainly in association with faults, diabase intrusions and interlayered chert bands.

9 Joints and weathered zones in the argillaceous or the Prieska Group (P1-P10) and in the older Seaboard Formation (R1-R10) can be targeted for groundwater development.

10 Groundwater occurrence in the iron formations of the Adelaide Hills Subgroup of the Gwalior Group (G1-G10) is usually in high and yields of less than 0.1 l/s. These formations are generally highly impermeable, and dolerite intrusions and faults are common features in this unit. Weathered and fractured zones are generally not targeted for groundwater development.

11 Groundwater with yields between 0.5 and 2.0 l/s can be obtained on the contacts of mixed lithologies of the Karoo, Permian and Karoo Formations of the Gwalior Group (G1-G10), in particular where it is intruded by diabase and kimberlite.

12 Weathered zone

13 Groundwater level

Note: For additional information concerning groundwater occurrence refer to accompanying brochure.

