THE DURBAN BROCHURE

Intermittent droughts in KwaZulu-Natal in the 1980's and 1990's have changed the perception of a province considered to be well-watered with surface water supplies. Groundwater progressively became more important and major drilling programmes have since been undertaken to tap into groundwater resources.

The Durban Hydrogeological map (DHM) , printed in 1998, forms part of a country-wide map series that will eventually comprise of 21 map sheets, the legend of which is founded on the 1983 UNESCO legend. The primary aim of the DHM is to produce a synoptic overview of the hydrogeological character of the map area. The main features shown on the map are lithology, borehole yields, aquifer types, groundwater use and groundwater quality. A conceptual profile was drawn to illustrate the regional; hydrogeology in terms of geology, and to evince target areas for groundwater development.

The basis of the map is the lithology, which dictates the occurrence of groundwater. Different hydrogeological areas were defined on which borehole records were overlain in order to draw yield boundaries. The same methodology was used for the compilation of the groundwater quality map.

The map area's topography rises fairly steeply from the coast to the Drakensberg at about 3000 masl. Rainfall is strongly orographically related, especially towards the interior, and varies between 700 and 1300 mm/a. Mean annual evaporation ranges between <1200 and about 1400 mm. All the large rivers have their sources in the Drakensberg escarpment, intermediate rivers rise in the highlands of the interior and smaller rivers have their sources in the coastal hinterland.

The geology of the map area consists of pre-Karoo age crystalline rocks of the Mokolian age Natal Metamorphic Province (wrongly coded "Nmp"), and sandstone of the Natal Group and Msikaba Formation. The Karoo Supergroup is represented by the basal diamictite of the Dwyka Group, the shale and sandstone of the Ecca Group, shale, mudstone and siltstone of the Beaufort Group and shale, mudstone and sandstone of the Molteno, Elliot and Clarens Formations. All these units have been intruded by Jurassic age dolerite. The Karoo Supergroup is capped in the west by basaltic lava of the Drakensberg Group. Tertiary-Quaternary coastal deposits are represented by the Maputoland Group. The most outstanding structural features of the map area are the numerous faults of the coastal and coastal hinterland portions, which form part of the rifted eastern margin of the sub-continent. These faults are thus related to the breakup of Gondwana.

The following four modes of groundwater occurrence are depicted on the map :

- An **intergranular aquifer occurs in** unconsolidated coastal deposits of the Maputoland Group. Borehole yields in excess of 50 l/s, hydraulic conductivities of 5 m^2/day, storativity values of 0.18 and electrical conductivities averaging 100 mS/m have been reported for this unit.
- **Fractured aquifers** describe aquifers associated with fractures, fissures and joints in hard rocks. Sandstone of the Msikaba Formation and Natal Group and diamictite of the Dwyka Group portray this mode of groundwater occurrence. Median yields varying between 0.5 and 2 l/s, hydraulic conductivities ranging between 0.4 and 7.7 m^2/day and storativity of between 0.0005 and 0.005 can be expected.
- A **karstic aquifer** depicted by a small occurrence of carbonate rocks occurs in the Natal Metamorphic Province and displays groundwater enhancing solution weathering in which median borehole yields range between 0.5 and 2 l/s.
- **Intergranular and fractured aquifers** are represented by Karoo Supergroup rocks, including dolerite and lava of the Drakensberg Group as well as crystalline rocks of the Natal Metamorphic Province. Groundwater in these rock units is contained in intergranular interstices in the saturated weathered zone as well as in joints and fractures in the hard rocks. Median borehole yields vary between 0.5 and 2 l/s in the Karoo rocks and between 0.1 and 0.5 l/s in the rocks of the Natal Metamorphic Province. Hydraulic conductivities in the Karoo rocks range between 0.05 and 0.5 m^2/day and storativity vary between 0.0001 and 0.001. Groundwater quality in this groundwater regime is variable and values of up to 300 mS/m can be expected.

The depth to groundwater level is strongly influenced by local topographical conditions. Groundwater levels are generally in the 12 to 25 m range, averaging 18 m below ground level. Artesian boreholes are uncommon but do occasionally occur in the natal Group. Springs occur widely, with an average yield of 0.05 l/s. Yields of springs fluctuate seasonally with some of them drying up in the winter. Two thermal springs with temperatures of 41.1 and 29.3 °C respectively, are fault related.

The main potential sources of pollution are industrial facilities, solid waste disposal sites and industrial and urban landfills in urban areas, and bacteriological pollution in rural areas. All the aquifers within the map area can be considered vulnerable to pollution - the unconfined intergranular aquifers being the most vulnerable.

Many rural areas within the map area are dependent on groundwater, as are many farms. In the major urban areas a few industries exploit groundwater, notably in the Pinetown, Durban and Stanger areas. The total groundwater usage in the map area is estimated at about 120 million m^3/a. The groundwater development potential of the map area is considerable. The overall groundwater resource potential is about 37 000 cub m^3/km^2/a. Regional variations of between 15 000 and 50 000 m^3/km^2 occur.

Recommendations for further studies are :

1. The long term monitoring of groundwater level behavior and quality in representative locations to establish recharge estimates.
2. Investigations of the effect of intensive afforestation, especially Eucalyptus, on the groundwater regime.
3. The effects on groundwater quality underlying areas of intensive urban or peri-urban informal settlements

4. Exploratory hydrogeological and stratigraphic borehole drilling, including deep boreholes (300 m), in specific target sites suggested by regional structural analysis, particularly extensional features, or other lithological indications such as Karoo dolerite contact zones, faults and joints, and inland areas of deep alluvium such as Cedarville Flats.
5. The investigation of the role of fracture density and orientation on groundwater occurrence and borehole yields.
6. The investigation of Karoo dolerite intrusions as targets for siting of boreholes, and
7. The investigation of the groundwater production potential of springs and their usefulness as sources of rural domestic water supply.