

ABSTRACT OF THE KROONSTAD BROCHURE

The Kroonstad Hydrogeological Map and the accompanying explanatory brochure introduce the current state of the groundwater knowledge and the basic geohydrological characteristics of the map area. It needs to be explained that within the map's confines, dissimilar and divergent conditions occur which, to various degrees, may impact on groundwater. Under these circumstances various groundwater distinctives and characteristics can be expected, most of which have been referred to in this brochure.

The scarcity of available data in some parts of the Kroonstad map area, did not allow the map authors for a more detailed analysis of borehole yield and groundwater quality.

Although groundwater is not the main source of water supply to many larger users in that area, it can always be considered as an optional supplement to surface water in a drought situation.

Occurrences of the four recognised different types of aquifer in the area covered by the sheet Kroonstad are to be discussed in this section.

- **Intergranular aquifers**

This aquifer is weakly represented in the map area. The unconsolidated, water saturated alluvium occurs sporadically along the Vaal, Wilge, Klip, Sand, Vet, Modder and Vals Rivers. The thickness of the alluvial sediments that consist mainly of clay, sand and gravel at the bottom is limited to a few metres.

Two larger alluvial areas along the lower Vet and Klip rivers are indicated on the map as Q. The alluvial aquifers there are thin and not directly tapped by boreholes that usually bypass them. The two areas are therefore characterised as "intergranular and fractured" type of aquifer that ignores the alluvium reflecting only the water bearing character of the bedrock.

- **Fractured aquifers**

The tectonic forces and to a lesser degree the weathering processes have produced a network of fractures in the highly competent mainly quartzitic rock formations of Randian age. Little, or no decomposition of the rock mass took place due to their predominantly arenaceous and rudaceous nature. The storage volume of groundwater stored in this type of aquifer is therefore limited, much lower than in other aquifer types.

The groundwater pumped from the Free State Goldfields mines is considered to be stored in the network of interconnected fissures and fractures in the rocks of both the Witwatersrand and Ventersdorp Supergroups. It is isolated from the shallow, subsurface Karoo rock aquifer by the impermeable shales of the Ecca Group.

- **Karstic aquifers**

Karstic aquifers are formed by dissolution of a carbonate rock by circulating groundwater containing carbonic acid. The process is taking place along the faults, fractures and joint planes resulting in their enlargement. Channels, caves and other cavities are formed which are often partially filled by permeable residual products of chert rubble, iron and manganese oxides and hydroxides. Karstic aquifers are often characterized by high storage and high yielding of boreholes, should the dissolved rock sections be penetrated.

- **Intergranular and Fractured aquifers**

This aquifer system occurs practically in the entire map area. The action of tectonic forces together with the subsequent processes of weathering, created two hydraulically interconnected different zones that occur in a vertical profile namely:

A shallower, weathered zone, where the original rock structure has been changed to a mass of more or less loose rock fragments, in a matrix of fine products of weathering, mostly sand, silt and clay.

A fractured zone, down to a depth where the rock is becoming solid and fresh in appearance. The transition to this deeper zone is usually gradual. The lateral movement of groundwater in the top zone is very slow and boreholes tapping it are weak.

Nearly the entire area covered by the Kroonstad Hydrogeological Map is situated in the north-eastern part of the Central Karoo Basin. The thickness of the Karoo sediments increases gradually from the pre-Karoo bedrock outcropping at the Vredefort and in the northwest map corner towards south and close to the Lesotho border reaches over 2000 m. The age of the sediments decreases in the southerly direction.

The largest groundwater abstraction within the Kroonstad map takes place in the Welkom area, where mines of the Free State Goldfields are pumping approximately $33 \times 10^6 \text{ m}^3$ annually of mine water to the surface. Unfortunately, the high salinity of this water prohibits its utilization and it is being discharged to the numerous evaporation dams and pans.

The effect of the dewatering on the shallow Karoo aquifer is negligent as the mines are operating in a deep, confined aquifer. The pollution threat of local, shallow groundwater by all surface activities and structures like tailing, dumps, evaporation dams, effluents, etc. was satisfactorily addressed by involved mining companies.

More detailed studies are suggested on the following aspects:

1. Groundwater and dolerite intrusions. Study of occurrence of the fractured zones in the host rock and the dolerite body:
2. Detailed study of the waterbearing characteristics of the Chuniespoort dolomite, especially in the area covered by the Karoo rocks.
3. Statistical evaluation of the yield of boreholes associated with dolerite intrusions and of those drilled in unintruded rocks.