EXECUTIVE SUMMARY

Recognition of the groundwater potential in the quartzitic sandstones of the Table Mountain Group (TMG), following the development of relatively deep artesian wells in the Citrusdal region, 220 km north-east of Cape Town, has directed considerable attention towards the TMG resource as a potential long-term solution to the increasing metropolitan and urban water scarcity in the Western Cape Province. An incentive for developing new groundwater exploration and reservoir-characterization methodologies has been created, which also provides an opportunity for broadening and deepening the knowledge of rock temperature gradient and heat flux in the area.

Groundwater flowing naturally through an aquifer system transports heat, as well as solutes, and thereby alters the subsurface temperature field. Consequently temperature, which is easy, quick, and inexpensive to measure, compared to chemical and isotopic methods, is useful as a tracer of hydrogeological processes and a means for testing conceptual groundwater-flow models. Large-scale groundwater abstraction such as envisioned for Cape Town, if it leads to a substantial alteration of the deep flow regime, should have near-field impacts on the geothermal regime around a major well-field, and possibly far-field impacts on geothermal regimes in the recharge and discharge areas along a flowpath through the abstraction site. On the grounds that

- impacts cannot be assessed or measured without an actual experiment in large-scale abstraction, and
- the advective transport of heat in the shallow parts of the crust is not only a geophysical, but also an ecological and environmental issue,

the planning for any future groundwater abstraction experiment should include a programme of observation and measurement of geothermal gradient, thermal conductivity and heat flow around the proposed abstraction and environmental monitoring sites.

For a hydrogeological-geophysical experiment with a clear environmental purpose, it is a necessary prerequisite that baseline information on regional heat flow and thermal conductivity properties be obtained from suitable reference sites in the TMG and Cape Fold Belt. Aims of the present study are therefore:

- To establish background geothermal gradients and heat flux in areas unaffected by underground water flow;
- To prepare a theoretical and experimental basis for the monitoring of changes in geothermal gradients and heat flux in regions where groundwater extraction is in progress;
- To prepare specifications for future investigations in which quantitative use is made of heat as a groundwater tracer, through numerical modelling in conjunction with traditional chemical and isotopic methodologies.

Prior to this investigation, no heat-flow studies were available in those parts of the Cape Fold Belt where large-scale groundwater abstraction could be contemplated. Previous borehole geothermal surveys in the Western Cape were mostly unsuccessful because of evident

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