A MULTIDISCIPLINARY STUDY OF GROUNDWATER CONDITIONS IN A STRUCTURED ROCK MASS, CASE STUDY THIRLMERE LAKES

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The Thirlmere lakes include five natural wetlands within a world heritage listed national park, where a decline in water levels has been observed over many years. Lake levels correlate with rainfall variability and are historically known to have dried several times during prolonged droughts. However, the cumulative effects of long term hydrological changes on the lakes are unclear, as are uncertainties associated with extraction of water for local uses and dewatering for longwall mining.

This study is part of a large multi-disciplinary research program, of which this part focuses on groundwater conditions in structured rock masses, and the possibilities of interactions with sediments below the lakes. Surface geophysical techniques and mapping of geological structures have been combined with deep drilling, wireline logging and investigations of sediment geology. Characterisation of sedimentary strata included permeability, bulk density, moisture content, porewater stable isotopes and XRD mineral identification. Two new deep drillholes were used to obtain information on hydraulic properties of formations. A staged geophysical survey program was designed to complement geological investigation, particularly to target sediment probing: resistivity imaging and ground penetrating radar to define heterogeneity within unconsolidated alluvium (clay and peat layers) and an indicative depth estimate to the underlying rock. A combination of these geophysical methods and contextural geological information, with magnetics/electro-magnetics attempted to determine the nature of structural anomalies, including infill materials and the extent of penetration of lineaments through rock formations. The results of this work provide a thorough evaluation of groundwater conditions in structured rock that underlie the sediments of Thirlmere Lakes.