

ABSTRACT

Rio Tinto hydraulic parameters database spans multiple deposits, and data acquisition is vast compared to other global mining houses. Data acquisition is at the centre of the Water Resource Department. Understanding hydraulic parameters and the formulation of statistics and probability density functions of these parameters is crucial to inform the analytical and numerical modelling of deposits and water resources. Historically hydraulic aquifer testing has been undertaken for several reasons including, dewatering, water supply and environmental impact assessments. Hydraulic aquifer properties such as hydraulic conductivity (K), transmissivity (T), storativity (S) and specific yield (S_y) are fundamental aquifer input parameters required for groundwater numerical and analytical modelling. There is no formal process within the Water Resource Evaluation (WRE) group about how aquifer parameters are assigned to analytical or numerical groundwater models. The primary objectives of this research aim to establish statically how hydraulic conductivity varies across deposit, site, and aquifer types.

The datasets used for this research were sourced from Rio Tinto's internal databases. After data collation, cleaning of datasets was undertaken to remove data missing observations or values and column names. Data analysis was undertaken using the R programming code.

The research concluded that the lognormality of the hydraulic conductivity distribution (K) generally holds and is supported by conceptual knowledge; although, there are some data deviations in the tails. The deviations in the distributed tails are likely to be attributed to fractured rock (i.e., right-skewed) and low permeability shales (i.e., left-skewed).

It is observed that the hydraulic conductivities of aquifer types are within approximately one order of magnitude. Individual interquartile ranges of hydraulic conductivity (K) for each aquifer type generally cover less than an order of magnitude; however, CID and MM have noticeably larger interquartile ranges. The CID, DG_M, LowP and Witt_K have very low permeability outliers. The mean distribution of hydraulic conductivity does not differ between mineralised and unmineralised units. It was also observed from the hydraulic parameters that there are more extensive ranges of hydraulic conductivity for Yandicoogina, Marandoo and Hope Downs 4. There are noticeably higher mean values for Marandoo than the rest of the sites. It can be attributed to drilling into the orebody aquifer type at Marandoo. The Yandi channel iron deposit has a noticeable right-shifted distribution (i.e., on average, higher values) of K by plotting hydraulic conductivity by the site.

The research recommends further reconciling the early stage pumping data and validating the yields against geology to determine whether geology is a factor. In addition, it is recommended that further study is required to correlate airlift yields with permeability, transmissivity, and other relevant hydraulic parameters. It would validate an approach that combines statistical learning with well-completed data. It is also recommended to transfer or automate the extraction of relevant PDF files into a centralised database to extract additional data and enhance parameter knowledge.