



Application of Resistivity Techniques to Identify Soil and Geological Characteristics and Groundwater Distribution Along the Muda River Between Penang and Kedah, Malaysia



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Abstract

Groundwater is generally recognized for its hygienic and consistent quality compared to surface water. However, its abstraction can be limited in areas affected by desiccation or seawater intrusion. In such cases, natural or artificial recharge—such as through infiltration or bank filtration—can be an effective alternative. Bank filtration involves inducing river or lake water into adjacent aquifers through pumping from wells located near the banks, primarily for potable water supply.

This study was conducted along the Muda River, located between Penang and Kedah, Malaysia, to evaluate the hydraulic properties of the riverbed and adjacent aquifer system, and to assess the effectiveness of bank filtration as a groundwater recharge method. Specifically, the study aimed to determine the optimal water extraction rate and capacity of the system. Grain size analysis revealed that the sediment composition of the test wells (TW1 and TW2) ranged from 0% to 92% clay, silt, sand, and gravel.

Resistivity imaging indicated subsurface layers composed of fine- to coarse-grained sand with gravel mixtures and increasing moisture content toward the aquifer system. Key parameters such as total discharge, drawdown, transmissivity (T), hydraulic conductivity (K), and well efficiency (We) were evaluated for both test wells.

The results showed that TW2 exhibited more favorable characteristics in terms of aquifer properties and proximity to groundwater zones, making it more effective for groundwater extraction and bank filtration purposes.