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Determination of Aquifer Properties and Groundwater Vulnerability Mapping Using Geoelectric Method in Yenagoa City and Its Environs in Bayelsa State, South South Nigeria

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ABSTRACT

Nineteen Schlumberger vertical electrical soundings (VES) were carried out within and around Yenagoa city, South South Nigeria, using a maximum current electrode separation ranging between 300 - 400 m. The objectives of the study were 1) to evaluate the possibility of mapping Quaternary sediments to infer the geological structure from the electrical interpretation and identify formations that may hold fresh water with low concentration of conducting minerals such as iron 2) to evaluate the vulnerability of the aquifer in the study area. The interpretation of the data collected was by computer assisted iterative interpretation using 1-D inversion technique software (1X1D, Interpex, USA). The results of the interpretation revealed four distinct geoelectric layers. Sounding curve types obtained in the area are mostly of the form $\rho_1 > \rho_2 < \rho_3 < \rho_4$ (where ρ is the density) but fresh water lenses with low concentration of conducting minerals such as iron were obtained only in locations that exhibit $\rho_1 > \rho_2 < \rho_3 < \rho_4$ curve types. Depth to the aquifer ranges from 4.5 m in the vicinity of VES 05 to 27.0 m at the vicinity of VES 14. The resistivity of the aquiferous horizon varies between 60 - 2868 Ω m. High transverse resistance values obtained were associated with zones of high transmissivity which agrees with the geology of the Benin Formation (Coastal Plain sands) consisting of fine-medium-coarse sands. The aquifer vulnerability map illustrates the impermeability of the overburden clay layer. Values of >0.5 mhos indicate good protective capacity, while values <0.3 mhos indicate vulnerable zones with probable risk of contamination.

KEYWORDS

Geoelectrical Soundings; Aquifer Properties; Transmissivity; Transverse Resistance

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