Mohammed M. Z, Int J Earth Sci Geol. 2020
DOI: dx.doi.org/10.18689/2642-1569.a3.004

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5th International Conference on

GEOLOGY & EARTH SCIENCE

October 16, 2020 | Virtual Conference

2D Geoelectric Imaging and Electromagnetic Profiling at Groundwater Seepage Zones in a Typical Basement Terrain, Southwestern Nigeria

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2D geoelectric imaging and co-planar loop electromagnetic measurements have been conducted around groundwater seepage zones located withinthe western section of the Adekunle Ajasin University campus, Akungba-Akoko, Southwestern Nigeria. The study was aimed at mapping and identifying subsurface geological structures that could have impacted the seepages and their groundwater feasibility. Apparent ground conductivity measurements at 5 m station intervals were obtained using EM 34-3 equipment with a co-planar loop system along three traverses, while resistivity datasets included three dipole – dipole profiles, with electrode separation of 10 m and n factor of 5 for a maximum dipole length of 70 m, and eight Schlumberger vertical electrical soundings.EM profiles generally revealed two dominant short and long wavelengths of positive peak anomalies. The highs with values greater than 15.0 mS/msuggestednear – vertical disposed linear geological interfaces or pockets of trough-like structures/groundwater conduits. Geoelectric sections revealed three subsurface layers; thin topsoil with resistivity range of 60 - 569 Ωm and thickness range of 0.7 - 3.5 m, weathered/fractured layer with resistivity values that ranged from 35 - 655 Ωm and thickness values of 1.1 - 23.0 m, and the fresh bedrock with resistivity in excess of 1000 Ωm and infinite thickness. 2D resistivity models imaged distinct low resistivity zones, cutting into a continuous and consistently high resistivity basement/basal layer which were typical of near-vertical discontinuities/geological fractured interfaces/weathered basement troughs. The two prominent groundwater seepage points A and B coincided with these zones as corroborated by the EM responses as observed at stations 30 and 95 m along traverse 2. It may, therefore, be concluded that the seepages may have been sourced from the perennial groundwater flow from the foot of the hill to discharge at topographic lows via the interfaces and/or subsurface conduits as groundwater seepages.The continuous/fractured - controlled nature of the discharges, with overburden in excess of 20 m thick, was suggestive of a potential for shallow groundwater development anda measure of arresting continuous flooding of the entire mass land.

Keywords: Seepage, geoelectric, electromagnetic, geological interfaces, groundwater