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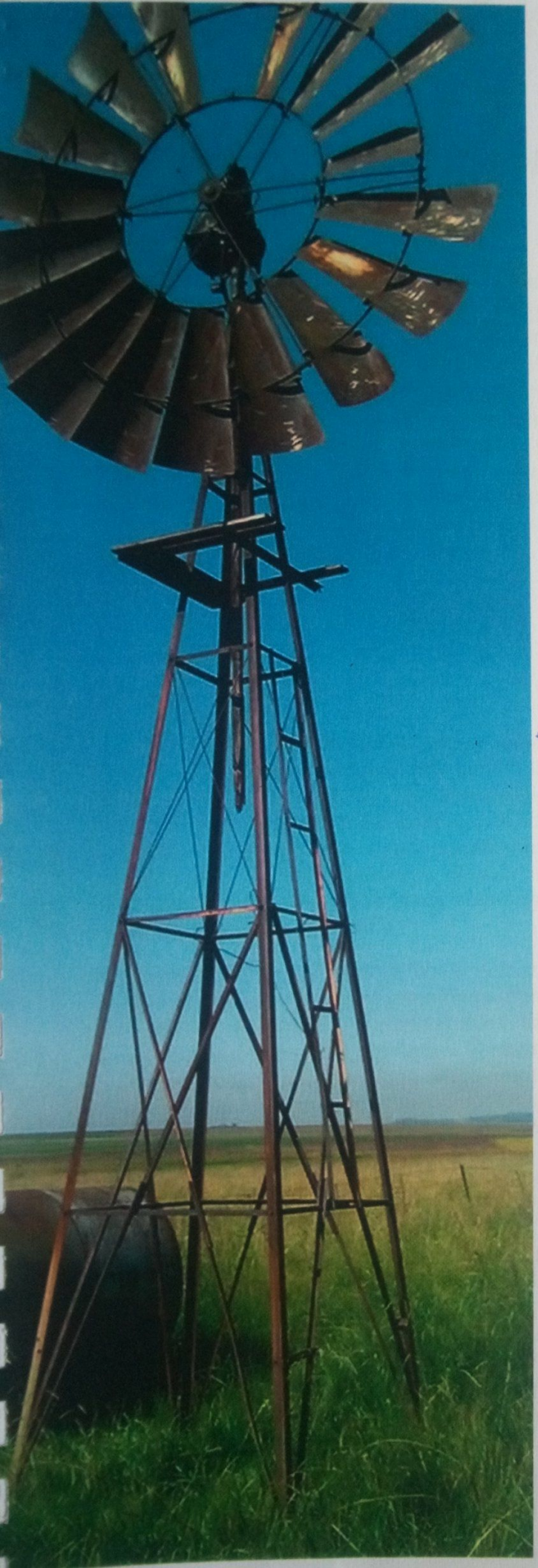

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CHARACTERISATION OF HYDROCHEMICAL FACIES AND WATER QUALITY OF THE COASTAL PLAIN-SAND AQUIFERS OF PARTS OF EASTERN NIGER DELTA, NIGERIA

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ABSTRACT

Soil and water pollution are major environmental problem facing many coastal regions of the world due to high population, urbanisation and industrialisation. The hydrofacies and water quality of the coastal plain-sand of part of Eastern Niger-Delta, Nigeria, was investigated in this study. Hydrogeological investigations show that the aquifers in the area are largely unconfined sands with intercalations of gravels, clay and shale which are discontinuous and, however, form semi-confined aquifers in some locations. Pumping test results show that the transmissivity ranged between 152.0 m^2/day and 2 835.0 m^2/day with an average value of 1 026.0 m^2/day, while the specific capacity varied between 828.0 m^3/day and 15 314.0 m^3/day with a mean value of 6 258.0 m^3/day. Well-discharge ranged between 1 624.0 m^3/day and 7 216.0 m^3/day with an average value of 3 218.0 m^3/day, while hydraulic conductivity varied between 3.2 m/day and 478.4 m/d with a mean value of 98.6 m/day. These findings indicate that the aquifer in the area is porous, permeable and prolific. The observed wide ranges and high standard deviations and mean in the geochemical data are evidence that there are substantial differences in the quality/composition of the groundwater within the study area. The plot of the major cations and anions on Piper, Durov, and Scholler diagrams indicated six hydrochemical facies in the area: Na-Cl, Ca-Mg-HCO_3, Na-Ca-SO_4, Ca-Mg-Cl, Na-Fe-Cl and Na-Fe-Cl-NO_3. Heavy metal enrichment index revealed 12 elements in the decreasing order of: Fe > Ni > Cu > Zn > Mn > Cd > V > Co > Pb > Cr > As > Hg. The study identified salt intrusion, high iron content, acid-rain, hydrocarbon pollution, use of agrochemicals, industrial effluents and poor sanitation as contributors to the soil and water deterioration in the area. Saltwater–freshwater interface occurs between 5 m to 185 m, while iron-rich water is found between 20 m to 175 m. The first two factors are natural phenomenon due to the proximity of the aquifer to the ocean and probably downward leaching of marcasite contained in the overlying lithology into the shallow water table, while the last four factors are results of various anthropogenic activities domiciled in the area. The DRASTICA model, a modification of the DRASTIC model, was developed and used in the construction of the aquifer vulnerability map of the area. Modern sanitary landfill that ensures adequate protection for the soil and groundwater was designed and recommended to replace the existing open-dumpsites. Owing to the monumental and devastating effects of hydrocarbon pollution in the area, the need to eradicate gas-flaring and minimise oil spills in the area was advocated. Bioremediation and phytoremediation techniques were recommended to be applied in the clean-up of soils and water contaminated with hydrocarbon in the area.