

Hydrological characterization and groundwater resource studies in coastal areas: Sagar Island region, West Bengal, India

RANJIT KUMAR MAJUMDAR & DEBABRATA DAS

Department of Geological Sciences, Jadavpur University, Kolkata-700032, India

ranjit_mazumdar2000@yahoo.co.in

Abstract Sagar Island is the largest island in the Ganga delta and is built up of unconsolidated alluvial sediments of Quaternary age. For water supply, villagers are totally dependent on the sweet groundwater tapped from deep confined aquifers through tube wells of depths more than 240 m. The deeper fresh aquifers lie between 180 m to 335 m below ground level (bgl). Surface water or dug well water is saline. The overlying shallow aquifer is also saline water bearing. The present study comprises an integrated geological, geoelectric and geochemical investigation to assess the prevailing surface and groundwater condition, viz. aquifer depth, chemical quality of groundwater and hydrological characteristics in parts of Sagar Island for groundwater resource studies. Vertical electric soundings (VES) were carried out with maximum electrode spacing of 1200 m and the resistivity layers parameters obtained from VES studies threw light on the facies change in the subsurface lithology and reveal the existence of a saline water bearing zone overlying a freshwater bearing zone. The combination of the VES data with the borehole data provides useful information on subsurface hydrogeological conditions. The results show the presence of six prominent layers consisting of alluvial top soil, saline water, brackish water, impermeable clay layer, freshwater and lowermost clay with silt and sand lenses under the prevailing hydrodynamic condition. Such a fresh confined aquifer is typical of developed areas with overlying clay-rich silty formations which prohibit the infiltration of saline and brackish water. The average thickness of the freshwater bearing zone under confined condition is about 184 m at an average depth of about 178 m from the surface. A litho-resistivity relationship is also established for this area. Chemically the fresh groundwater is Na-HCO₃ type with TDS ranging from 495 to 740 mg/L. The groundwater is safe for drinking and domestic purposes with low to medium sodium adsorption ratio (SAR) values. The Na content is relatively higher than that of other elements present in the groundwater. The seawater contamination (SWC) values for these water samples are significantly low.

Key words vertical electric sounding; sodium adsorption ratio; seawater contamination; estuarine process; aquifer