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Water Table Elevation and Groundwater Quality in Jaffna City, Sri Lanka

Thanushan Rasaiah*, Thamilini Sathees, Inthuja Ragunathan,
Kokilavathani Suntharalingam and L.D. Rajasooriyar

Department of Geography, University of Jaffna, Jaffna, Sri Lanka
**rthanush@univ.jfn.ac.lk*

Information related to hydraulic and hydro-meteorological parameters and their chronological trends is a prime requirement for city planners and policymakers to manage water resources in urban settings. Jaffna city faces various problems related to the quantity and quality of water resources and water-related hazards. Lack of information on hydraulic parameters is a hindrance in alleviation of these problems. The town depends solely on the availability of groundwater for drinking, domestic and livelihood needs, in the absence of surface waters. However, groundwater is saline in most of the areas within the city. Water scarcity is high in coastal Jaffna due to its high population (population density of 22,579 per km^2). Jaffna town has low surface elevations above the msl ranging from 0.1 m on the coast to 5.49 m inland. It is underlain by brown or grey calcareous sands. Aquifers in the said formations are unconfined in nature with shallow water tables ranging from 1-15 meters from the ground surface. Salinisation of groundwaters in Jaffna is believed to be a consequence of natural and anthropogenic activities such as leaching from calcareous sands and evaporation returns, mixing of saline waters, sea salt sprays and water table fluctuations. As a result, the majority of the areas in Jaffna city require freshwater supplies and water pricing has become a dominant scenario. The present study aims to analyse groundwater salinity levels against groundwater table elevations (msl). A systematic approach was adopted using a 0.25 km^2 grid covering the entire town (20.2 km2) and one sampling locality was selected from each grid. Depth to the groundwater table, Electrical Conductivity (EC) and Total Dissolved Solids (TDS) were determined using a digital portable EC meter in 285 dug wells. Water table elevations (msl) against water salinity were mapped with the aid of Arc Map 10.3. Groundwater table elevations (msl) vary from -3.1 m to 2.9 m in Jaffna, whereas groundwater salinity is found along the South, Southeast and Western coasts exemplifying a strong correlation with lower water table elevations. High groundwater salinisation however matches with that of water in the presence of calcareous sands in selected locations but no strong patterns were found. Groundwater salinisation in Jaffna town was probably due to fluctuations of water tables due to natural loss of groundwater discharge, over-extraction, leaching of salts from calcareous formations and needs to be monitored to arrive at better decisions with regard to urban supplies of water.

Keywords: groundwater table elevation, Jaffna city, salinity, water table fluctuations, spatial patterns