

Spatial modeling of groundwater quality assessment: a case study of Peshawar District

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High population growth and increased exploitation of groundwater resources causes the degradation of groundwater quality. In Peshawar district groundwater is the most important source of drinking. To evaluate the vulnerability of groundwater pollution a GIS based study on groundwater quality was conducted in Peshawar district which is most populated area of Khyber Pakhtunkhwa. The objectives of the study were (a) physiochemical assessment of groundwater quality (pH, TDS, EC, Turbidity, T. Hardness, Ca Hardness, Mg Hardness, Alakalinity, Nitrate and Chloride) (b) geospatial analysis & mapping of groundwater pollutant distribution and (c) vulnerability assessment of groundwater pollution with DRASTIC model. In order to assess the quality of groundwater 105 water quality samples were collected from the study area. The lab analysis of ground water samples revealed the maximum values for pH, Ec (electrical conductivity), TDS (total dissolved solids), Alkalinity (HCO_3), total hardness, Ca hardness, Mg hardness, NO_3 (nitrate) concentration, Cl^{-1} (chloride) concentration and turbidity were found to be 8.05 with average of 7.7, 1695 $\mu\text{S}/\text{cm}$ with average of 809.4 $\mu\text{S}/\text{cm}$, 795 mg/L with average of 377.8 mg/L, 540 mg/L with average of 329 mg/L, 770 mg/L with average of 372.4 mg/L, 368 mg/L with average of 189.5 mg/L, 430 mg/L with average of 182.9 mg/L, 41.7 mg/L with average of 12.2 mg/L, 95 mg/L with average of 30.1 mg/L and 7.36 NTU with average of 1.3 NTU, respectively. Spatial statistic techniques such as Inverse Distance Weighted and Spatial Distribution (Standard Ellipse) in ArcGIS were used to map the spatial and directional distribution of each parameter. All parameter were found to be highly concentrated in the main city as well as some parameter like TDS, EC, T. Hardness, Ca Hardness, Mg Hardness, Alakalinity, and Chloride were found to be concentrated in the northern areas (Jogani), in the eastern areas (Wadpaga, Mehl Therai No 1, Chamkani and Surizaie) and in the southern areas near Mattani. While nitrate & pH were found to be concentrated in the South-East (Urmar and Maryamzai) and South-West areas (Achni bala). High Turbidity was found in the North-West areas (Shahi Bala) of Peshawar District. The Pakistan Standards Drinking water quality and WHO criteria's were used as a benchmark for classification of water quality parameters into safe, and unsafe for drinking purpose. Overall the South-West (Achni bala) and North-West (Shahi bala and Malakandere) areas were found to be safe and the South-East (Surizi, Mehl Theri and Wadpaga) areas were found to be unsafe for drinking purposes. It recommended that water treatment plants should be installed at various location of the city to facilitate the inhabitants for drinking purpose. However for long term remedies should be taken to reduce the groundwater pollution.