

Ground Water Quality Assessment for Identifying Human Health Vulnerability in Three Most Densely Populated Districts of India

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Abstract: The National Capital Territory (NCT) of Delhi is witnessing urban population growth at a rate unprecedented in recorded history. Delhi mega city records a population of 16.7 million (11,297 persons per sq. km) making it one of the top ten most populated cities in the world. All the administrative districts of NCT have very high density of population. In fact, the geographically linked districts of North-east (NE) Delhi, Central Delhi and East Delhi are the three most densely populated districts in India. Water is an essential pre-requisite for supporting this large scale of population. However, present day water demand of Delhi exceeds water availability considerably. The unavailability of adequate water for drinking and other uses is responded by developing coping strategies to water shortage. Deficit in drinking water supply is therefore leading to high dependency on Delhi's ground water resource. Consequently, while average ground water development in India is 58%, it is 170% in case of Delhi. A large population of the NCT of Delhi is evidently dependant on ground water for meeting its daily water requirements. The ease of availability of ground water at the very location where water is required has led to its greater exploitation during the ongoing rapid urbanisation of NCT. At the same time, processes within urban environments of Delhi have led to the deterioration of ground water quality. The present contribution is an attempt to analyze ground water quality of shallow aquifer in the above mentioned three most densely populated districts of India. A spatial understanding of ground water quality is developed using a water quality index (WQI) approach. This is then used to identify human health vulnerability due to very high dependency on ground water in these districts. A spatio-seasonal (wet and dry season) assessment of ground water quality in terms of 15 physico-chemical parameters (pH, alkalinity, F, Cl, NO₃, SO₄, Mg, Ca, Cr, Mn, Fe, Cu, Zn, Cd, Pb) was carried out. Ground water quality was found to note consistent spatial and seasonal variation in the three districts. The results obtained were validated against drinking water quality standards as prescribed by the Bureau of Indian Standards using the WQI method. Greater than permissible concentration of fluoride (max con. 6.60 mg/l) was found in the ground water of NE district in both the seasons. High manganese was found in the NE district in the dry season. Greater than permissible concentration of nitrate was noted in the dry season in both NE and East districts. Ground water in Central district was found to have very high cadmium concentration which worsens during the dry season. WQI-Interpolation reveals that ground water quality in the three districts in wet season falls under 'healthy' and 'very unhealthy' categories. In the dry season, ground water quality in Central district degrades to 'very unhealthy' while it shows considerable improvement in the NE and East districts. This calls for immediate measures to improve ground water quality and regulate its withdrawal lest lakhs of people will continue to consume impaired water quality.

Keywords: ground water, water quality index, human health, NCT of Delhi.