Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2021.26643

212 (2021) 152–163
February

Groundwater contamination monitoring and modeling for a part of Satluj River basin

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Received 3 April 2020; Accepted 24 September 2020

ABSTRACT

Owing to growing urbanization, industrialization, and rise in agronomic development, the Rupnagar district of Punjab had been under stress by groundwater pumping during the past decade. The area has recently seen a substantial decrease in the water level of various boreholes and wells, and a major degradation in groundwater quality due to salinization (increase in total dissolved solids [TDS]). Leakage from some industries in the region might be a contamination source that would threaten groundwater quality. Thus, models for groundwater flow (MODFLOW) and particle tracking (mod-PATH3DU) for two periods, at the present (2020) and 10 y prediction (2030) were used to determine groundwater flow patterns, principal groundwater discharge and recharge zones, and estimates of groundwater travel-times in the region. Based on sensitivity analysis, it was observed that changes in hydraulic conductivity will boost flow patterns within the region, mainly because it contributes to the homogenization of flow and removes low-volume zones. Ten years prediction indicated that TDS tends to move from the topsoil to the deeper aquifer. The plume migration would not exceed 10 km in radius from all the sources and is considered to be a slow process. Consequently, both long-term observations and simulations showed that concentrations of TDS in the receiving waters are positively correlated with the intensity of urbanization and industrialization. Besides, rehabilitation of contaminated sites should be undertaken to prevent further mobilization of contaminants.

Keywords: Groundwater contamination; MODFLOW; mod-PATH3DU; Numerical modeling; TDS; Remediation

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