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Assessment of groundwater vulnerability in a coastal region using DRASTIC and IM-DRASTIC models (Case study: Kish Island, Iran)

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ABSTRACT

A significant proportion of the world's population lives in coastal zones, where water resource requirements are extremely high for drinking water supply, industry, agriculture and tourism. Therefore, monitoring and taking administrative measures in these areas has been significantly increased. Also, the measures are more significant and critical where the aquifer has limited water and it is a vital resource. Coastal aquifers potentially tend to be contaminated by seawater intrusion caused by the intensive exploitation of the groundwater resources. This study is done to evaluate Kish Island aquifer vulnerability. Kish Island is a 91.5 km^2 resort island, located in the northern Persian Gulf and in close proximity of southern shores of Iran (Figure 1). To study groundwater vulnerability of the Island, DRASTIC model was employed and a modified version was developed base on the coastal aquifer conditions known as IM-DRASTIC. A new parameter was added to DRASTIC model which describes the balance between seawater and groundwater level; this new parameter indicates the potential of seawater intrusion into the aquifer. Two sets of vulnerability maps were produced by DRASTIC and IM-DRASTIC models. The correlation of the maps was calculated with Electrical Conductivity (EC) as the main contaminant. Based on the DRASTIC vulnerability analysis, it was found that 23.8%, 49.9% and 26.3% of Kish Island areas have low, high and very extreme groundwater contamination risk, respectively. The results of IM-DRASTIC vulnerability analysis show that 20.4%, 44.8% and 34.8% of Kish Island is under average, high and extreme contamination risk, respectively. Overall, the results show that IM-DRASTIC model has more agreement with the coastal zones condition especially salinity distribution. The model clearly supports delineation of groundwater supply protection zones and the aquifer protection areas from seawater intrusion.

Keywords: Electrical Conductivity (EC), Coastal aquifers, Contamination, Modified DRASTIC and Vulnerability.