XXXVIII IAH Congress

Groundwater Quality Sustainability
Krakow, 12–17 September 2010

Extended Abstracts

Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmiecik

University of Silesia Press 2010

abstract id: **409**

topic: **1**
Groundwater quality sustainability

1.2
Groundwater vulnerability and quality standards

title: **Improvement of original DRASTIC model for groundwater vulnerability assessment of the Izeh plain**

author(s): **Babak Farjad**
Institute of Advance Technology, Universiti Putra Malaysia, Malaysia,
babak1978far@yahoo.com

Helmi Zulhaidi bin Mohd Shafri
Institute of Advance Technology, Universiti Putra Malaysia, Malaysia,
helmi@eng.upm.edu.my

Thamer Ahmed Mohamed
Department of Civil Engineering, Faculty of Engineering, Universiti Putra Malaysia, Malaysia, thamer@eng.upm.edu.my

keywords: groundwater, vulnerability, DRASTIC

ABSTRACT

Groundwater is an invaluable resource that meets a large portion of drinking water for mankind demands. The main objective of this study is to generate groundwater vulnerability map of the Izeh plain. For this purpose, besides the original DRASTIC model, 12-modified DRASTIC models were run. The model that achieved the highest correlation coefficient with water quality data was selected as an optimal model. Seventh modified DRASTIC model has the most correlation coefficient between all groundwater vulnerability models with a correlation coefficient of 0.65. Resulting map revealed that the aquifer is highly vulnerable in the south, southwest and northwest in comparison with other areas of the basin.

INTRODUCTION

Groundwater vulnerability to contamination could be described as the natural tendency for contaminants to reach some particular position in the groundwater system after their presentation at some point of the uppermost aquifer (National Research Council, 1993). It prioritizes the areas where groundwater protection is critical and evaluates land use activities with respect to the development of pollution. In addition, groundwater vulnerability map can expedite the remediation process with efficient allocation and information for clean up and also with designing of the monitoring network.

The main objective of this study is to generate groundwater vulnerability map for the Izeh Plain. The Izeh Plain is located in southwest of Iran (Figure 1). The plain extends about 140 km^2.

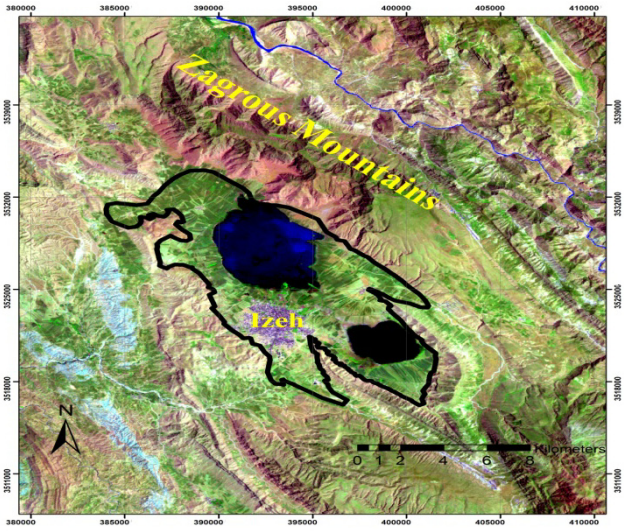

Figure 1. Study area.

METHODOLOGY

In this research, DRASTIC model was applied in GIS environment to create groundwater vulnerability map. DRASTIC model has developed by the United States Environmental Protection Agency (EPA) to assess groundwater contamination potential (Aller et al., 1987).

The parameters required for using DRASTIC model are: D - Depth to water, R - net Recharge, A - Aquifer media, S - Soil media, T - Topography, I - Impact of vadose zone media and C - hydraulic Conductivity. The original DRASTIC model applies a combination of all the parameters with a given weight (*w*) and rate (*r*), according to the following equation:

DRASTIC Index = DrDw + RrRw + ArAw + SrSw + TrTw + IrIw + CrCw (1)

RESULTS AND DISCUSSION

All seven DRASTIC factors were integrated in GIS platform. At first, the original DRASTIC model was provided using original weights and rates suggested by Aller et al., 1987. Pearson's (r) correlation coefficient of original model with nitrate samples was 0.37. This correlation coefficient was not satisfied. In order to improve and optimize the initial vulnerability map, the rates of each class and the weights of each DRASTIC parameters ware modified subjectivity, according to the conventional DRASTIC model, which allows the user to calibrate the model based on the particular region (Dixon, 2005). To do this, twelve models were run and correlation coefficients of the models were compared with water quality data (Table 1 and Figure 2). D7-DRASTIC model with the highest correlation coefficient, 0.65, with the field data was selected. Figure 3 illustrate the scatter diagrams of D7-DRASTIC model with nitrate samples and groundwater vulnerability map of this model is shown in Figure 4.

Table 1. Pearson correlation coefficient of each DRASTIC model.

DRASTIC Models	D-Original	D1	D2	D3	D4	D5
(r)*	0.37	0.11	0.43	0.53	0.47	0.19

DRASTIC Models	D6	D7	D8	D9	D10	D11	D12
(r)*	0.26	0.65	0.61	0.55	0.59	0.48	0.58

*(r) = Pearson's correlation coefficient

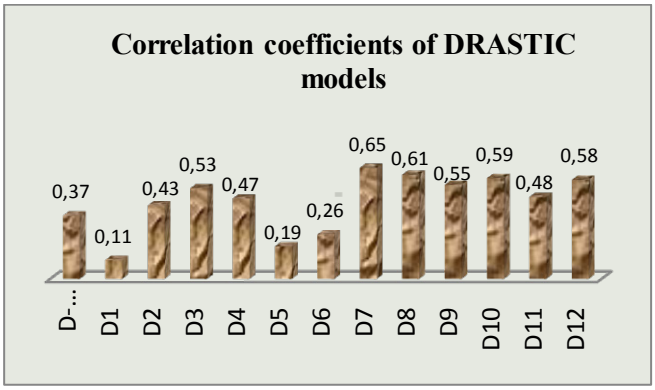

Figure 2. Correlations coefficients between DRASTIC models and nitrate concentrations.

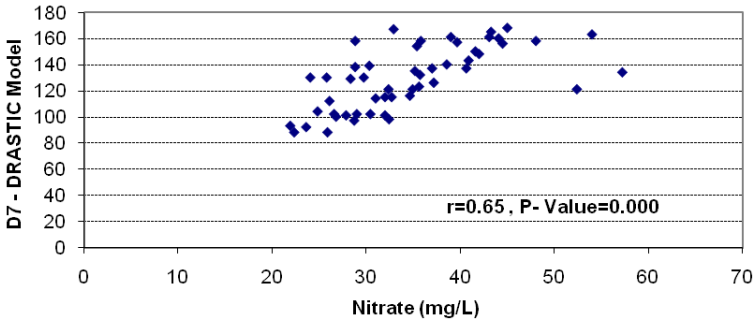

Figure 3. Scatter plot between D7-DRASTIC model and nitrate concentrations.

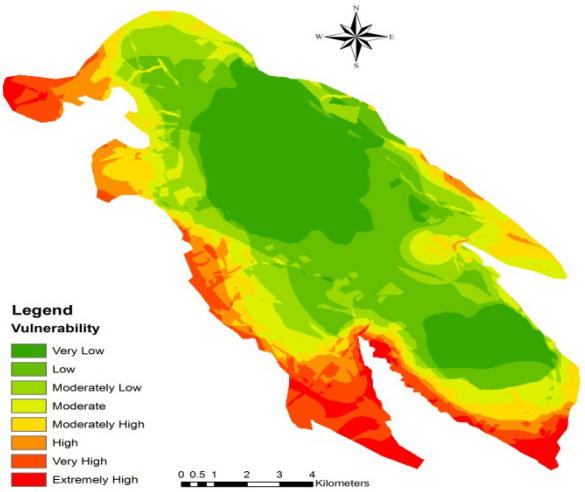

Figure 4. Groundwater vulnerability map.

CONCLUSIONS

Groundwater vulnerability map for Izeh Plain was generated. The final vulnerability map was created from the D7-DRASTIC model. D7-DRASTIC model achieved from improving initial DRASTIC model with correlation coefficient of 0.37 to 0.65. Resulting map revealed that the aquifer is highly vulnerable in the south, southwest and northwest in comparison with other areas of the basin.

REFERENCES

Aller L., Bennett T., Lehr J. H., Petty R. H. and Hackett G., 1987: *DRASTIC: A standardised system for evaluating groundwater pollution potential using hydrogeologic settings*. Oklahoma: Robert S. Kerr Environmental Research Laboratory. US EPA Report 600/2– 87/035.

Dixon B., 2005: Groundwater *vulnerability mapping: A GIS and fuzzy rule based integrated tool.* Applied Geography 25: pp. 327-347.

National Research Council C., 1993: *Groundwater vulnerability assessment: Contamination potential under conditions of uncertainty*. Washington, DC: National Academy Press.

International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0