

GROUNDWATER POTENTIAL MAPPING USING FREQUENCY  
RATIO AND RANDOM FOREST MACHINE LEARNING TECHNIQUE

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**Thesis submitted to the Universiti Teknologi MARA Malaysia  
in partial fulfilment for the award of the degree of the  
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## DECLARATION

I declare that the work on this project/dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA (UiTM). This project/dissertation is original and it is the result of my work, unless otherwise indicated or acknowledged as referenced work.

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## ABSTRACT

Groundwater is an important source of water for humans, animals, and also plants. The shortage of groundwater will decrease the economy of a country as it will affect many sectors such as industrial and agricultural. Therefore, to prevent this problem from happen, groundwater potential mapping must be conduct in order to determine the groundwater potential area. This study is aim to determine the groundwater potential area in Kedah by using Frequency Ratio (FR) and Random Forest (RF) machine learning technique. There were 15 groundwater conditioning parameters which are slope, aspect, elevation, topographical wetness index (TWI), plan curvature, drainage density, geomorphology, geology, lithology, aquifers, tube well distribution, distance to fault, rainfall, soil types and land use that has been obtained through various resources and departments. The groundwater potential map was determined by using FR method to define the relationship between dependent variables and independent variables. Then, 2,611 random points were generated through FR method. A total of 88,2782-pixel that contains the location for groundwater and non-groundwater has been extracted into each of the random points. These points were randomly partitioned into 70:30 for training and testing model using random forest machine learning technique. The maps of groundwater potential using FR and RF were classified into five different classes which are very high, high, medium, low and very low. It is found that the ROC(AUC) value for FR were 81.4% and RF were 82.4% respectively. It indicates that the validation of RF gives a high prediction rate compared to FR. The outcome of this study will help the state government of Kedah and any related agencies in control the additions and subtractions of the groundwater sources for the groundwater sustainable planning. It will help to prevent any water shortages from happening as well as to ensure that the residents in Kedah get to use the water sufficiently.

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