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A GIS Approach for Spatial Prediction and Visualization of Groundwater Pollution by Total Dissolved Solids (TDS) in Asmara, Eritrea.

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Groundwater is an essential source of water supply, but its quality is often threatened by pollution. This study aimed to develop a framework to spatially predict and visualize groundwater pollution by Total Dissolved Solids (TDS) in Asmara, the capital city of Eritrea, using GIS and Geostatistics. The framework was tested using 82 TDS concentration samples. The study applied geostatistical tools such as kriging to create a spatial prediction model of TDS concentration, which was classified into three categories based on standard classifications: Excellent (<500mg/l), Good (500-1000 mg/l), and Poor (>1000 mg/l). The study found that log transformation of TDS data sets was necessary to ensure normality of the data for creating an accurate prediction model using Ordinary Kriging. The Semi-variogram analysis showed that the Exponential model was the best fit model with moderate spatial dependence of TDS parameter. The cross-validation results indicated unbiased prediction with accurate standard errors. The TDS concentration in the study area ranged from 192 to 1798 mg/L, with an average of 791.71 mg/L and a standard deviation of 369.55 mg/L. Where, the prediction model map revealed that 39.1% of the study area had excellent TDS concentration, while 41.94% and 18.96% of the study area had good and poor ranges of TDS concentration, respectively. The Northeast, Northwest, and Southwest of the study area had very high levels of TDS concentration (Figure 1). This study provides evidence for the utility of GIS and Geostatistics in mapping groundwater pollution, highlighting their effectiveness in helping decision-makers and water resource departments visualize the spatial distribution of contaminants and to make appropriate measures before utilizing to end-users. The framework developed in this study can be applied to other part of the country for groundwater quality assessment and management.

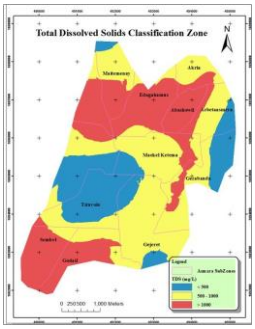

Figure 1. Classification zone map of TDS in the study area.