PREDICTING GROUNDWATER QUALITY
AT WADI EL-NATRUN AREA EGYPT BY USING
SATELLITE DATA AND GIS

Submitted By

Mohamed Gabriel Aly Abd El-Kreem

B.Sc. of Science (chemistry), Faculty of Science, Al-Azhar University, 2008

A Thesis Submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Science
Institute of Environmental Studies and Research
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2018

<u>APPROVAL SHEET</u>

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This thesis Towards a Master Degree in Environmental Science

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Mohamed Gabreel Ali Abd El-kreem

ABSTRACT

Wadi El-Natrun area lies in the northeastern region of the Western Desert to the west of the Nile Delta**.** Wadi El-Natrun is a narrow depression 23 m below sea level, Wadi El-Natrun area is regarded as an extremely arid region of Egypt, long dry summer and a cold winter with little rain and daily evaporation rate are high.

The main aims of the present study are assessing of the quality of groundwater aquifer at Wadi El-Natrun area integrating remote sensing (RS) technology and geographical information systems (GIS) as effective tools for monitoring environmental change and the impacts of this change on the quality of groundwater and water resources.

The topographical characteristics of the Wadi El-Natrun area were determined by the use of the SRTM DEM with an accuracy of approximately 90 m as a GIS tool, morphometric parameters (linear aspect (La) the Areal aspects (Aa) and Relief Aspects (Ra)) of main basins at Wadi El-Natrun were detected, geological and morphological maps of Wadi El-Natrun were updated.

Integrate between (RS) and (GIS) was used to detect the reclamation processes occurred during the pried 1984, 2003 and 2016. The remote sensing images of Landsat Thematic Mapper (TM) of 1984, 2003 and Centennial two of 2016 have been used. Land cover/land use and change detection maps were prepared, which indicate the rapid change in

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the Wadi El-Natrun area and the heavy increase of the agricultural patch and urban expansion in Wadi El-Natrun area.

Water samples were collected from 60 wells from Wadi El-Natrun area and subject to different analysis to detect physical and chemical parameters, physical parameters including temperature, total dissolved solids, pH and electrical conductivity, chemical parameters including, major cations Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Sodium (Na^+), Potassium (K^+), major anions Bicarbonate (HCO_3^-), Carbonate (CO_3^{2-}), Chloride (Cl^-) and Sulfate (SO_4^{2-}), Nutrients (NH_4^+, NO_3^-, PO_4^{3-}) and some trace elements (Fe , Mn, Cu, Co, Ni ,Cr ,Cd ,Pb, As). These results were subjected to statistical reviews to make sure the measurement is accurate. These parameters are correlated with the groundwater situation and character in each part of the studied area by Extraction of distribution maps of groundwater quality.

(**Gibbs1970**) Diagram was used to determine the mechanism of adding positive and negative ions to groundwater. It was found to be mixed controlling mechanism rock-water interaction and evaporation.

(**Piper1944**) and (**Chadha's 1999**) diagrams were used to detect groundwater type at Wadi El-Natrun, in addition, classification by Hierarchical cluster analysis method **Ward (1963)** although used, it was found that water in Wadi El-Natrun area (sodium-chloride) and type (sodium-sulfate).

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Assess the groundwater of Wadi El-Natrun for different uses such as drinking, domestic and irrigation purposes and livestock & poultry drinking.

For drinking water compared the result of water analysis to (WHO, Nitrate pollution index (NPI), Toxic Metal, Water Quality Index (WQI)) which classified as %30good and 70% from poor to very poor and unsuitable.

For drinking irrigation compared the result of water analysis to Water salinity and alkalinity, Sodium percentage (Na %), Sodium adsorption ratio (SAR) SAR can be classified used Wilcox diagram, Residual sodium carbonate (RSC), Percent magnesium (%Mg), Permeability Index (PI), Kelly index (KI). Chloride content (Cl⁻), which indicate water unsuitable for irrigation and can be used for irrigating specific crops resist the saline water with high permeable soil.

For domestic purpose compared the result of water analysis to (total dissolved solids (TDS), total hardness (TH) and corrosively ratio (CR) which indicate this groundwater can't be used for domestic purpose.

For livestock and poultry drinking, indicate a lot of wells not suitable for poultry and fit for livestock, taking into account the special conditions such as what the kind of livestock, age, sex, pregnancy, the intensity of work performed by animals.

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