Hydrogeochemical studied on the area between el-ain el-sukhna and wady araba,gulf of suez, egypt

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The present thesis is mainly dealing with the hydrogeochemistry of the area between El-Ain El-Sukhna and Wadi araba, it lies within the northwestern part of Suez Gulf. It is delineated by latitudes 28o 45` & 30o 00` N and longitudes 31o 45` & 33o 00` E. It should be noted that groundwater in the investigated area is used mainly for tourist and industrial purposes. Hence, evaluation of groundwater quality along with possible treatment of some elements contributing to water salinity is required.The collected data, the methodology and the obtained results were edited and represented within six chapters under the following titles:1-Introduction:This chapter contains general outlines, location of the study area, aim and scope of the present work and previous related studies.2- Geomorphological, geological and hydrogeological aspectsThe area under consideration can be geomorpholgically subdivided into the following units:-(i) Watershed areas (high tablelands), they form the major part of the catchment areas of different Wadis located in the study area and discharge their loads toward either the main wadis or directly toward the Gulf of Suez.(ii) Water collectors (hydrographic basins). The most important wadis along the study area from north to south are wadi hagoul, Wadi badaa, Wadi Ghweiba and Wadi Araba. Wadi Ghweiba is considered the most important wadi in the investigated area since it receives the greatest amount of rainfall.(iii) Coastal plain. The surface of the coastal plain is built up of Quaternary deposits occupying the area between the mountainous terrain and the shoreline.The study area is occupied by sedimentary rocks belonging to Carboniferous, Jurassic, Cretaceous, Eocene, Oligocene, Miocene and Quaternary.In El-Ain El-Sukhna and Wadi Araba localities, groundwater is available from Quaternary, Pliocene, Upper Cretaceous, Lower Cretaceous and Carboniferous aquifers. They occur under unconfined and/or -confined conditions. Quaternary aquifer is the main water bearing formation in El Sukhna area and water flow is mainly from west to east toward Suez Gulf. In Wadi Araba locality, groundwater flows through fractures or fault planes where it issues on surface into springs.3-ExperimentalThis part includes all chemicals and methods used in chemical water analyses.4- Hydrogeochemical aspectsGenerally the total salinity shows that some of groundwater samples (22.22%) are related to fresh water type since, the salinity ranges from 466.03 mg/l to 1467.35 mg/l. The majority (50.79%) of the total samples are related to brackish water type where the water salinity ranges from 1504.81 mg/l to 4868.57 mg/l. Some of the groundwater

samples (17.46%) are considered saline water since the salinity lies between 5056.06 m/l and 9102.67 mg/l. About (9.52%) are related to highly saline water type where the water salinity ranges from 16763.07 mg/l to 41993.42 mg/l.It should be noted that, the large variability of TDS in the different aquifers in the study area is governed by many factors such as: climatic parameters (annual rainfall, evaporation), catchment and drainage pattern (area, slope, altitude, and distances from water divide), flow regimes and inflow / outflow parameters, lithofacies heterogeneity, structural elements, pumping rate as well as sea water intrusion.It is clear that almost all samples lie within a very hard water category. Such high level of total hardness is attributed to dissolution of limestone and dolomite rocks dominated in the study area.The ionic orders show the dominance of Cl>SO4>HCO3 with the cationic sequence Na>Mg>Ca followed by Na>Ca>Mg and Mg>Na>Ca. They reflect a fairly high stage of mineralization and a domination of marine facies of high chlorides, sulfates, sodium and magnesium ionic constituents. The combination of major ions reflects the composition of NaCl, MgCl2, and CaCl2, followed by CaSO4 and MgSO4.The Paleowater of Pluvial times significantly contributes the groundwater in the aquifer. This is indicated by the depleted stable isotopes, (avg., - 7.5 ‰ and - 49 ‰) and thousands years of radiocarbon ages, (7000 y.b.p. – 12000 y.b.p.). The paleowater in the different aquifers were induced by the intensive fractures and structural elements that characterize the Gulf of Suez province. The potential for groundwater renewal is essentially controlled by climatic conditions, land forms, lithofacies and natures of flow conduit.5-Geochemical clasification and evolution of groundwaterBased on different classification of groundwater, it should be noted that most of the investigated groundwater samples chemically display more developed stage of mineralization due to leaching and dissolution of marine sediments of the aquifer matrix by direct rainfall and/or subsurface water flow. In addition, the terrestrial salts Na2SO4 and NaHCO3 are reflected at the expense of Mg Cl2 and CaCl2 under the effect of cation exchange processes on the surface of the high shale and clay content characterizing some localities in the study area.Netpath modeling has been used to quantify the mass transfer that accompanies the rock / water interaction processes and to separate these effects from the mixing with sea water.6-Evaluation of groundwater quality and treatmentThe evaluation of the groundwater for the different uses in the present work is determined according to the chemical composition.For drinking and domestic uses the standards of WHO (1996 and 2003) and the Egyptian maximum permissible limit (2007) were considered. Generally, most of the groundwater samples in the investigated area are unsuitable to permissible for human drinking.For the consumption of livestock according US National Academy of science, it was found that most of the groundwater samples in the study area (73 % of total samples) are suitable for livestock and poultry, since they have a total soluble salts less than 5000mg/l while the rest (30% of total samples) are unsuitable for this purpose.The suitability for the irrigation uses according to EC, SAR, was evaluated and reflects that some of the groundwater wells (about 12.7%) can used without problems, 25.4% are considered as moderate water for irrigation while 4.76% can be used with some problems. The rest of groundwater sample could not be used for irrigation.Some of the groundwater wells in the study area are suitable

for using for some industries. On the other hand, some groundwater wells are required special treatment.Several methods were used to prepare anion exchange polymers with higher crosslinking and reasonable ion exchange capacity. The type of solvent influenced the degree of amination when the crosslinker ratio was increased. The anion exchanger prepared in this investigation had improved thermal stability as compared to commercial resins.In addition to the synthesis and characterization of the ion exchange systems, an area of specific interest for this study was the removal of excess nitrate, sulfate and chloride ions from brackish and moderately saline waters. These anions, along with cations such as sodium, calcium -and magnesium, contribute to the salinity of water.The results from the ion exchange experiments suggest that this kind of anion exchanger is more selective for divalent anions rather than monovalent anions especially chloride. However, it works well with chloride when the concentrations of other divalent anions (e.g. sulfate) were significantly lower than that of the chloride.RecommendationsIn order to develop the groundwater in the Northwestern Suez Gulf, the following bases should be taken into account:1-It can be recommended that the groundwater occurrences in Wadi Ghweiba more promising than Wadi Badaa. The best areas for digging water wells in the concerned area are the western part of Wadi Ghweiba (since this part is very close to the catchment area) and small area in the north of Wadi Badaa (due to presence of perched water conditions).2-To avoid the effect of -the sea water intrusion and to protect the wells against overexploitation (over pumping) sustainable management and policy actions must be taken. An example of these actions is sharing the use of wells located in one place.3-The main problem opposing the development of the groundwater in such area is the relatively high water salinity. This problem can be solved by desalination of relatively low water salinity zones and relatively high potentialities. This is comparatively cheaper than desalination of saline water and sea waters for drinking and other domestic purposes using reverse osmosis membranes technique.4- The waste of different factories located in the study area should be monitored by government and not to be drained underground.5-Monitoring of the changes in water level and salinity with time in such area will be necessary.