SUMMARY AND CONCLUSIONS

The present study deals with the geologic, geomorphologic and hydrologic conditions of water resources in Wadi Oqaba, Wadi Abu Turifya, Wadi El Rouaq and Wadi Gerafi. The study area occupies the eastern portion of central Sinai. It is bounded from south and north by latitudes 29° 20' & 30° 10' N. While from west it is bounded by longitude 33° 45' and longitude 34° 45' and the Egyptian Palestinian boarder delineates the concerned area from east.

The climatic, geomorphologic, hydrographic, geologic and hydrogeologic conditions are studied as the main controlling factors upon the water resources in the area of study. Based on the investigated functions of these factors, the surface runoff, groundwater occurrences, the aquifer characteristics and the geochemical characteristics of the groundwater were discussed.

The collected data and the obtained results by the present work were presented within five chapters under the following titles:-

- Introduction.
- Geologic setting.
-Geomorphology and surface hydrology.
- Hydrogeologic setting.
- Hydrogeochemical setting and groundwater evaluation.

Geologically; the area of study is mainly occupied by sedimentary rocks range in age from Lower Cretaceous to Quaternary. The former is represented by the Nubia Sandstone Malha Formation which has limited surface exposures while the later is dominated by vari- size alluvial deposits which cover vast area in the intervening plains and the dissecting drainage basins.

Structurally, the concerned area is classified into two main units according to Shata, 1956:

1- The stable foreland zone (El Tih and El Egma plateax).

2- The gently folded zone (Geomorphic hilly area).

El Themied fault (Raqabet El Naan fault) extends along central Sinai in E-W direction for about 200 km from the Dead Sea to Gebel El Raha. This major fault plays a great role in groundwater occurrence and movement.

Geomorphologically, the investigated area is subdivided into several geomorphic units of variable hydrogeologic importance as follows:-

1-The watershed areas (highlands), which are classified into:

-Tableland area (El Tih and El Egma plateax).

- Hilly area.

2- The water collectors (low lands).

The existed water collectors are discriminated into two geomorphologic units as follows:

- The intertableland depressions (peniplains).

-The hydrographic basins (drainage networks); which include the Mediterranean drainage system and the Dead Sea drainage system. hydrographically; the studied drainage basins are qualitatively and quantitatively studied, based on topographic maps (1:50,000). The drainage parameters for the aforementioned Wadis estimated. The obtained results of morphometric parameters, thus determined for the different drainage basins, the following results achieved.

1- The bifurcation ratio (Rb) is high (>2) (3.75-4.6). This means that all drainage basins nearly elongated in shape and this permit the passage of runoff over extended period of time.
2- The drainage frequency (F) is high (2.5-3.5). This means that all drainage basins tend to give more possibilities for collecting surface water.
3- The drainage density (D) is high (2.6-4.2), which indicates that these basins are characterized by high relief, highly impermeable surface layer and sparse vegetation.
4- The length (Lu) is high, which means that these basins receive high quantities of surface runoff.

From the aforementioned data, lineation analysis, flash flood strength and surface runoff estimation reflect the following:

1- Wadi Oqaba have high potentiality and high flood strength.
2- Wadi El Gerafi has moderate potentiality and weak flood strength.
3- Wadi El Rouaq and Wadi Abu Turifya have low potentiality.

Hydrogeologically; in the area of study, the groundwater is available from a wide variety of water-bearing formations belonging to wide range of geologic time. They are classified according to the stratigraphic sequence into the following three aquifers from top to base:

The Quaternary (alluvial) aquifer; is recorded in Wadi Gerafi and Wadi Oqaba by three hand dug wells. The groundwater of this aquifer occurs under unconfined condition and recharging directly from surface runoff and local rain fall. The depth to water ranges from 9.4 m to 12.55 m.

The Upper Cretaceous (Turonian) aquifer; is recorded in Wadi Oqaba and Wadi Shaera. The groundwater of this aquifer occurs under unconfined and confined conditions. The unconfined condition is represented by 12 hand dug wells. The concerned aquifer consists mainly of limestone, the secondary structure constitutes the secondary porosity of this rocks. The depth to water ranges from 6.39m to 10.15m wells. The concerned aquifer consists mainly of limestone, the secondary structure constitutes the secondary porosity of this rocks. The depth to water ranges from 6.39 m to 10.15 m. The confined conditions of this aquifer are represented by two drilled wells at Wadi Shaera and Wadi Oqaba, the depth to water is 85 m and 380 m respectively.

The Lower Cretaceous sandstone aquifer; is recorded in Wadi Gerafi, Wadi Oqaba, Wadi Shaera and Wadi Abu Turifya. The lithology of this aquifer is mainly vari-colored sandstone with occasional shale interbeds. The groundwater of this aquifer occurs under confined conditions where the depth to water varies from 175 m to 382 m.

The hydrochemical characteristics of the groundwater in east central Sinai area were discussed through the following main items:

1- Geochemical compositions; the geochemical composition of the groundwater of the studied aquifers was discussed as follows:

- The groundwater salinity of the Quaternary aquifer ranges between fairly fresh (873.3 mg/L) to slightly brackish (2985 mg/L).
- The groundwater salinity of the Upper Cretaceous aquifer ranges between fairly fresh (737 mg/L) to slightly saline (5068.5 mg/L).
- The groundwater salinity of Lower Cretaceous aquifer ranges between fairly fresh (1040.7 mg/L) to passably brackish (1904.3 mg/L).

- The ion dominance are Na> Ca>Mg and Mg> Na> Ca for the anions and Cl >SO_4> HCO_3 and So_4> Cl > HCO_3 for the cations.
- The hypothetical salts combinations of the majority of water samples are KC1, NaCl, $MgSO_4$ $MgCl_2$, $CaSO_4$ and $Ca(HCO_3)$.

2- Geochemical classification of groundwater; the groundwater of the concerned aquifers is geochemically classified by using:

- Sulin's diagram; the majority of the water points have recent marine origin diluted with meteoric water origin, while the lowest have meteoric origin.
- Piper diagram; all water samples plotted in the upper triangle of the diamond shaped field parallel to the vertex Ca & Mg reflecting secondary salinity properties where Cl & SO_4 are predominant.

3- Evaluation of groundwater; the different water points are evaluated for different purposes, the obtained results reveal the following:

- The majority of water samples are unsuitable for drinking where its salinity more than 1500mg/L.
- All the water points are unsuitable for laundry uses because it's total hardness more than 120 ppm.
- All the water points are suitable for all kinds of livestock and poultry.
- The groundwater samples are suitable for irrigation under special conditions of soil properties (coarse texture and high permeable) and good drainage systems.