

Hydrodynamic Characteristics of the Complex Terminal aquifer in the Region of Oued Righ (Algerian Sahara).

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Abstract—The groundwater resources in valley Oued Righ North represented by the superimposed major aquifer systems: the complex terminal

The establishment of piezometric maps shows a flow direction oriented toward the chott and hydrodynamic parameters of the aquifer are important.

In this work our interest is focused on interpreting the results obtained using different approaches; hydrodynamic of the water in the aquifer of the Complex Terminal in the North region Oued Righ.

Key-Words— Oued Righ, Complex Terminal, Hydrodynamic.

I. INTRODUCTION

In Algeria, the arid Saharan zone covers two thirds of the country's surface. Despite the hyperarid nature of the climate. The region of Oued Righ is part of one of the largest deserts in the world, it contains huge reserves of groundwater. These waters are in the form of aquifers containing geological horizons of different depths and thicknesses. In the great Algerian Sahara, two famous reservoirs met; from bottom to top we have, the Continental Intercalaire says (CI) very deep in the north eastern basin, and containing warm waters and often very mineralized and the Terminal Complex says (CT) shallower but salty. These two aquifer systems contain several layers of water superimposed on each other.

These different aquifers contain significant water potential, which is currently extensively exploited for domestic, industrial and palm grove irrigation This work aims at summarizing the data

collected on the region and defining the hydrogeological and hydrodynamic aspects.

II. LOCALIZATION OF THE STUDY AREA

The land area. The region of Oued Righ is part of one of the largest deserts, is located in Southeastern of Algeria, specifically the northeastern Sahara, bordered to the north by the Saharan Atlas, south by the wilayas Tamanrasset and Illizi, in the northwest by the province of Djelfa, in the West by the wilaya of Ghardaia and east by Tunisia and Libya. It begins on the south by the village of El Goug (Touggourt) and ends at a distance of 150 km further north to the village of Oum Thiour (100 km from Biskra), 500 Km south –east of the capital Algiers, latitude $32^{\circ} 54' 39''$ North, longitude $05^{\circ} 50'$ to $05^{\circ} 75'$ East it is part of the low-Sahara basin with an area of 600.00 km². The climate of the region of Oued Righ is like the Saharan climate is characterized by low rainfall levels, high temperatures, a significant evaporation and excessive solar radiation.

Administratively the valley of Oued Righ part of two wilayas: Ouargla and El-Oued. Due to the great extension of the study area, we are only interested to study the party is in the territory of the wilaya of El-Oued; ie Oued Righ North encompassing daïra Djamaa and Meghaier. From a geographical perspective, our study area is none other than the North Valley Oued Righ, defined geographical entity. (See map, Fig.1).

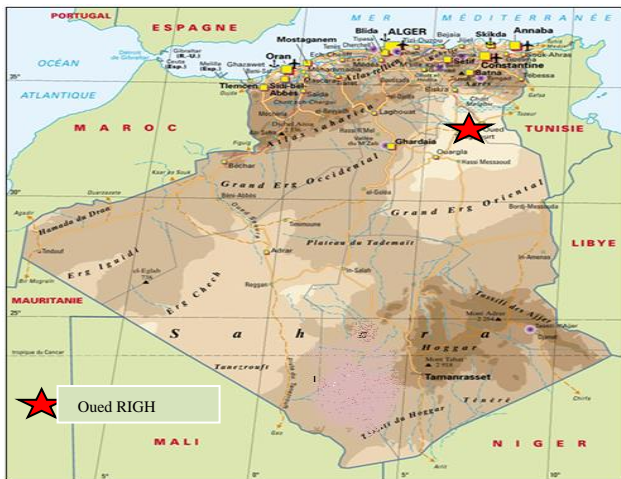


Fig.1: Localization of the study area.

III. GEOLOGY AND HYDROGEOLOGY OF THE REGION

Geologically, it is formed by two structural units; Precambrian socle composed of igneous and metamorphic rocks, surmounted by thousands of meters of sedimentary layers from Cambrian to Quaternary which are characterized by the absence of major tectonic deformations.

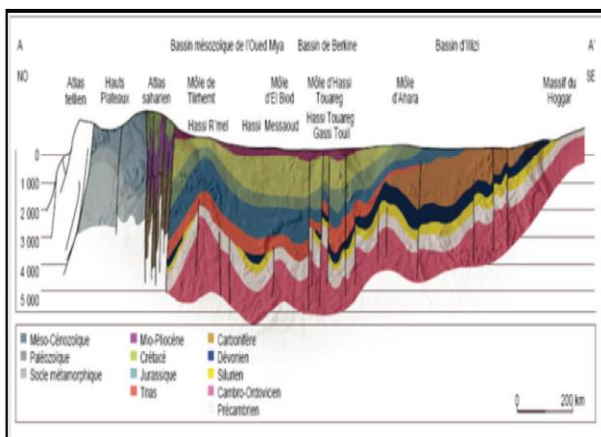


Fig. 2: Géo-structural transversal cutting (WEC, 2007). [3]

From a hydrogeological point of view, the Northern Sahara basin is composed of several heterogeneous formations very extensive, separated by impermeable formations, known as: the Intercalary Continental and the Terminal

Complex. In the study area, the following three layers are encountered (from bottom to top):

- The Continental Intercalary aquifer.
- The Complex Terminal aquifer which is the subject of our study.
- Phreatic aquifer.

In the region of the Oued Righ, three aquifers are well differentiated in the complex terminal: The first and second layer of Mio-Pliocene sands then the limestone of the Eocene inferior.(Fig.3)

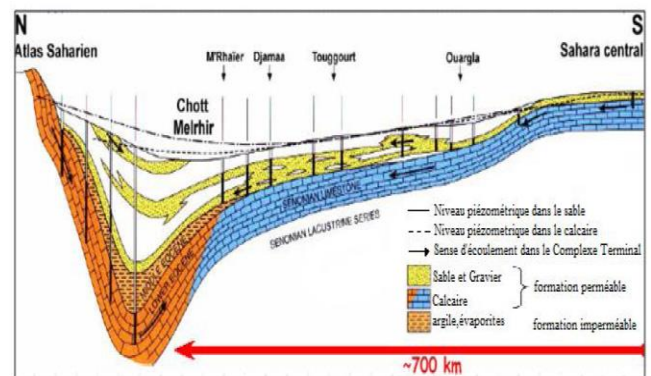


Fig. 3: Hydrogeological transversal cutting of the Complex Terminal (UNESCO, 1972). [2]

IV. RESULTS AND DISCUSSION

IV.A. HYDRODYNAMIC CONTEXT OF THE REGION

IV.A.1- PIEZOMETRIC MAP:

The piezometric map (Fig .4) has been established from the piezometric relieved of 10 drillings. Note that the operation of ground water is related to the geology and geometry of the reservoir rock.

VI.A.1.1- The Direction of Flow:

The location of groundwater, its movements (flow direction) are indicated by arrows on the map Oued Righ North (Fig .4)

shows that the general flow directions are:

- ❖ In the southern part (Djamaa):

The curves draw at the drilling A 02 a dome, from which the water flows in all directions. This dome is due to elevation the piezometric level at this level.

- ❖ The central part and the northern part:

In the region of Meghair the flow shows a depression that appears at the borehole Number 05. In general, the flow direction oriented from South to North (toward the area of Chott Merouane).

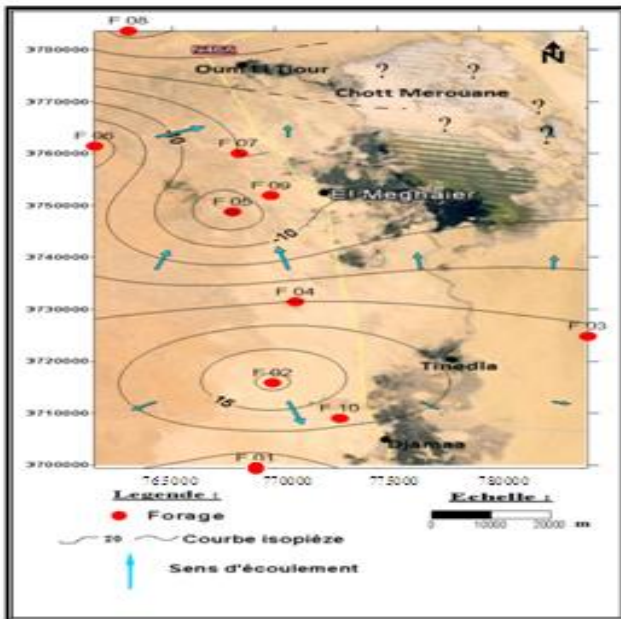


Fig.4: Piezometric map of the complex terminal oued Righ North.

IV.A.2- THE GROUNDWATER PUMPING PROPERTIES

The determination of different hydrodynamic parameters (transmissivity (T) - Coefficient of storativity (S) Permeability (K)) is essential for the evaluation of the capacity of the aquifer.

We used an automatic mapping software "Aquifer test," it was based on the interpretation of the method: CE Jacob to interpret the results of the four pumping tests performed in drilling levels in the aquifer of the terminal complex of the valley oued righ North are:

- ❖ Djamaa Test.
- ❖ Sidi khlil Test.
- ❖ Meghair Test.
- ❖ Oum thiour Test.

Tableau. 1: Hydrodynamic criterion.

Region	Djamaa	Sidi khlil	Meghair	Oum thiour
Parameter				
X	6° 01' 02" E	05° 55' 47" E.	05° 55' 58" E.	05° 51' 02" E.
Y	33° 34' 5.7" N	33° 50' 37" N	33° 56' 43" N	34° 08' 31" N
Z(GPS)	2.1 m	13 m	2.1 m	01 m
Depth	172m	9,12m	221 m	269 m
Maximum Rabattement	9,12m	9,12m	5,59 m.	19,35 m
maximum dynamic level	18,98m	33,51m	34,74 m	45,80 m
Static level	9, 89 m	14,65 m	29,15 m	26,45 m
Thickness	30m	50m	47m	60 m
Duration of pumping	4320 s	4320 s	4320 s	4320 s
Constant debit	50 l / s	40 l / s	40 l / s	44 l / s

IV.A.2.1- DJAMAA TEST:

The test was realized in the captive aquifer in siliceous coarse sand and anhydrite. The pumping data, abatement in meter and time in seconds is plotted on a semi logarithmic graph. These data allow to draw a straight line representative of the test.

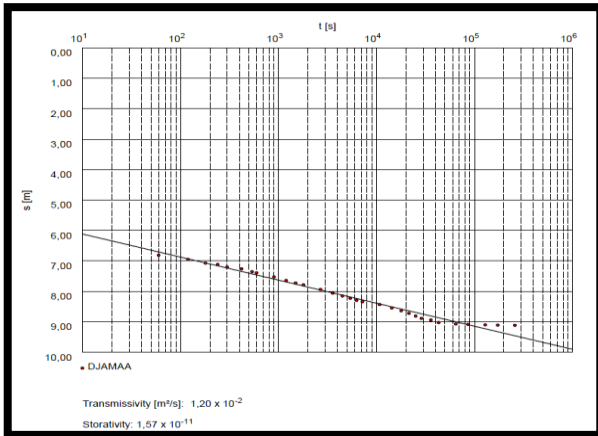


Fig .5: Pump Test long duration DJAMAA by the method of Cooper-Jakob descend.

IV.A.2.2- SIDI KHLIL TEST :

The test was realized in the captive aquifer in young coarse sand and white coarse sands and clays young.

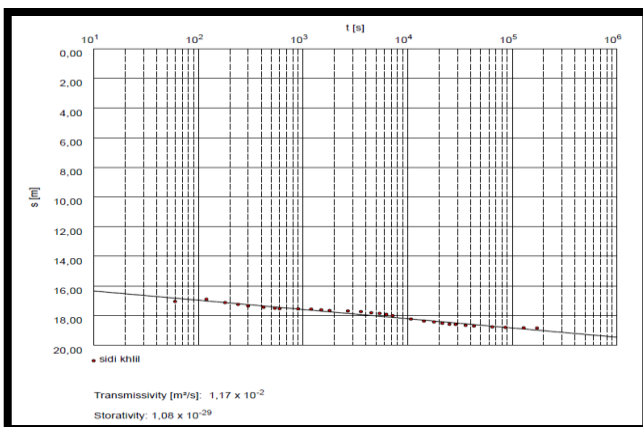


Fig .6: Pump Test long duration Sidi Khilil by the method of Cooper-Jakob descend.

IV.A.2.3- EL -MEGHAIR TEST:

The test was realized in the captive aquifer in coarse sands yellow and clays.

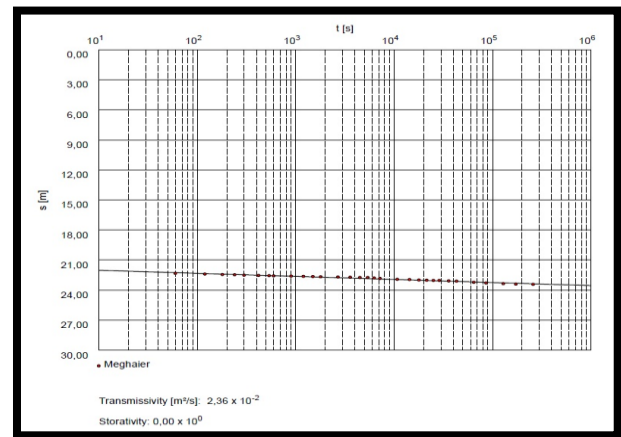


Fig.7: Pump Test long duration El -Meghair by the method of Cooper-Jakob descend.

IV.A.2.4- OUM THIOUR TEST :

The test was realized in the captive aquifer in siliceous white sand with some gravel and yellow and brown plastic clay.

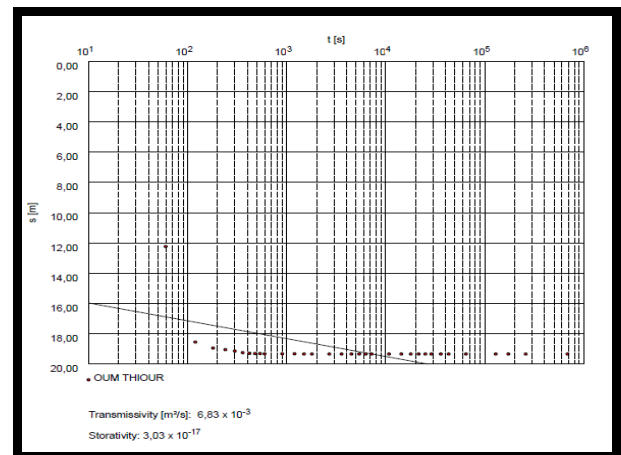


Fig.8: Pump Test long duration Oum Thiour by the method of Cooper-Jakob descend.

IV.A.2 EVALUATION OF HYDRODYNAMIC PARAMETERS IN THE MAPS:

IV.A.2.1 TRANSMISSIVITY MAP:

Transmissivity is an essential parameter in the hydrodynamic study of the aquifer complex terminal of Oued Righ, pumping test results allowed to draw a map of equal transmissivity (Fig. 9).

The figure shows that values of the transmissivity increases at the central part of the study area (Meghair).

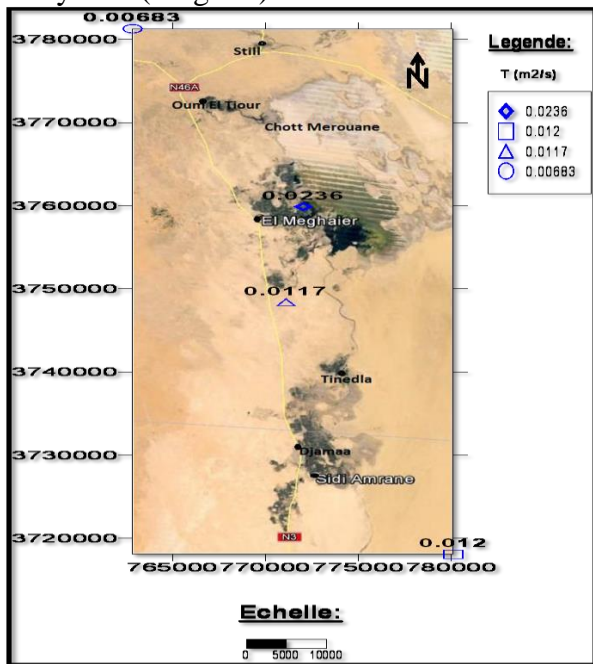


Fig. 9: Transmissivity map of Oued Righ North of the Complex Terminal.

IV.A.2.2. PERMEABILITY MAP:

The spatial distribution of permeability established in the map (Figure .10) in a range of variation that ranged from 1.13×10^{-4} to 5.02×10^{-4} m / s.

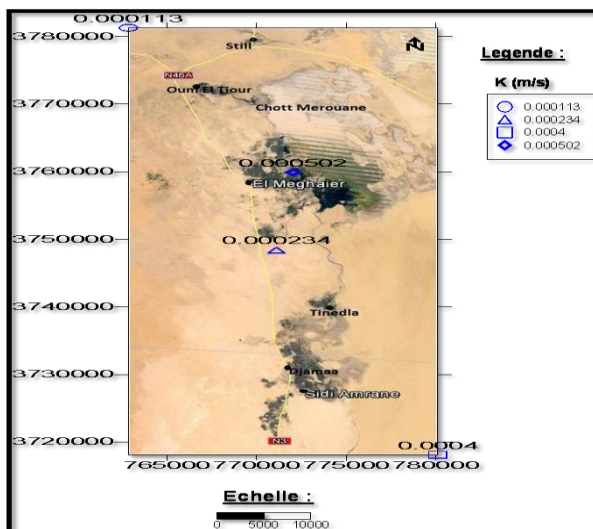


Fig.10: Permeability map of the Complex Terminal Oued Righ North.

V. CONCLUSION:

The establishment of piezometric maps is an important step in the hydrogeological study. It allows to study the groundwater table taking into account the direction of flow.

The piezometric map of the water in the aquifer of the Complex Terminal in the North region Oued Righ drew the flow behind the south to the north and these convergence areas showing areas chotts.

The interpretation of the constant flow drilling tests allows us to calculate the hydrodynamic parameters. In general, it is estimated that these values obtained are considerable.

Reference:

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