Application of Vertical Electrical Sounding to Delineate and Evaluate of Aquifers Characteristics in Baiji–Tikrit Basin

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Application of Vertical Electrical Sounding to Delineate and Evaluate of Aquifers Characteristics in Baiji –Tikrit Basin

A thesis
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By

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Abstract

The current study includes applying the vertical electric sounding by using the symmetrical Schlumberger configuration in the area which located between Baiji and Tikrit to the West of Tigris, between longitudes (43° 40' 12.3") and (43°56'22.6") and latitudes (34° 35' 13.3") and (34° 54' 41.7"), with total area of approximately (700 km^2), in order to identify the thickness and the expansion of the aquifers, then to delineate and evaluate their hydraulic characters.

This study adopted the measurements of Apparent resistivity measured in 40 VES points in located area, achieved in cooperation with the geophysical team of the General Commission for Groundwater. VES points were distributed along 6 electric traverses in order to obtain a possible coverage of the studied area. The spreading of current electrodes (AB/2) reached a distance up to (400 m), and a distance of (40 m) was reached for the spreading of voltage electrodes (MN/2); thus, a depth penetration of (151 m) was obtained.

Apparent resistivity measurements were drawn, and their deformations, which resulted from smoothing, were treated. Field curves of VES points were interpreted qualitatively by three procedures to obtain a primary idea about the number of the electrical zones and the depths of the separating surfaces between them, and to map the vertical and the horizontal change locations in the apparent resistivity values. Then the curves were interpreted quantitatively manually by Auxiliary point method and by Ebret method to find out the values of quantitative resistivity and thickness of the electrical zones. After that, the sounding curves were interpreted automatically by the computer program (IPI2win) applying the Inverse manual interpretation method to scrutinize the manual interpretation results and enhance their accuracy if it might be few of their parts by manual interpretation.

The program (IPI2win) results of interpretation were used to draw (6) Geoelectrical sections along the survey traverses, then they were transferred to geological sections by achieving the proper smoothing, after the matching of the electric zones limits gained from the interpretation process results with the limits of the layers which were penetrated by the drilled wells in the area of study with regard to the effect of the two principle of equivalence and suppression. Likewise, the results of the interpretation showed that the thickness of the main aquifer of the area is from (50-128 m) and consists of sediments (sand, clay sand and clay) which belongs to the Injana formation, whose conditions are apt to change in the area, from the confined type to the semi confined, depending on

the confining clay layer thickness which bound the aquifer from the top part, and the extent of being affected by folding. A gravel layer belong to Quaternary sediments mounts the aquifer in middle and south of the study area; a part of this layer is within the water saturated zone in the southern part of the study area, which made in this area a sub-aquifer of the unconfined type with a thickness of about (5-25 m). Moreover, the geoelectrical sections showed the existence of a high-conductivity layer bounds the aquifer from beneath and was considered as a layer of claystone saturated with salt-water.

Many empirical relations have been put between the geoelectrical parameters, and the Hydraulic parameters by which a Geophysical model was suggested for the aquifer which is supposed to have a constant thickness and varying resistivity and hydraulic conductivity. These relationships have given several mathematical equations, some of them were used to calculate the hydraulic parameters represented by (Hydraulic conductivity and Transmissivity) at the electric VES points where no experimental pumping wells were available. These values were used to draw the two maps of the hydraulic conductivity and the transmissivity for the aquifer. These two maps displayed sites where hydraulic parameters for the aquifer and the areas of low hydraulic parameters rise, so it became possible to new wells locations with high discharge.

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