Groundwater Resources Evaluation in Durdaib Area –NE Sudan

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Abstract

The prime objective of the present study is to assess the groundwater resource of Durdaib area through characterization of the hydrogeolgical setting, estimation of water balance components and identification of water quality parameters.

To achieve these objectives geological and hydrogeological investigations were employed and complemented with geoelectrical resistivity survey using vertical electrical sounding techniques, in addition chemical analysis of water samples using standard methods was carried out. The acquired data were processed and analyzed using appropriate computer softwares.

The study revealed that the hydrogeological setting of the area comprises three zones of different resistivity values which are unsaturated, saturated and non water-bearing zones. Aquifer parameters are variable because of the heterogeneity of the aquifer composition. It is found that the transmissivity ranges from low (88.77 to 1556.69) m^2 / day, where as the hydraulic conductivity ranges from small (5.9 to 82.5 m/d)and the effective porosity has values between 0.2 and 0.4. The aquifer is recharged seasonally by the infiltration from the wadis' runoff and direct precipitation over the basin. The annual groundwater recharge is estimated as 10.4Mm^3/year. The annual discharge by various mechanisms is 5.2110×10^4 m^3/y, while the storage capacity of the aquifer is estimated to be 11.5×10^3cubic meters. The groundwater quality parameters fall within the acceptable range of the local and the WHO standards except for some locations where high TDS, chloride, sodium, and sulphate values were recorded.

المستخلص

الهدف الرئيس للدراسة هو تقييم مورد المياه الجوفية في منطقة دروديب وذلك من خلال معرفة الوضع الهيدروجيولوجي وعناصر الموازنة المائية إضافة الي نوعية المياه الجوفية. ولتحقيق هذه الاهداف تم إجراء دراسات جيولوجية وهيدروجيولوجية مكملةً بمسح جيوكهربي أُستخدمت فيه تقنية الجس العمودي وكذلك تم تحليل كيميائي لعينات من المياه الجوفية بإستخدام طرق قياسية. تم تحليل البيانات ومعالجتها بإستعمال برامج حاسوبية متخصصة.

أظهرت الدراسة وجود ثلاثة نطاقات مختلفة الخواص وهي من الأعلي الي الأسفل: نطاق غير مشبع بالمياه ونطاق مشبع بالمياه ونطاق غيرحامل للمياه الجوفية. يتكون النطاق المشبع من رسوبيات رملية ناعمة وخشنة وحصوية كما يشمل الاجزاء المجواه والمكسرة من صخور الاساس. اظهرت خصائص الخزان الجوفي تبايناً نتيجةً لعدم تجانس مكوناته حيث تراوح معامل الناقلية بين منخفض(88.77 متر مربع / اليوم–1556.69 1556.69 متر مربع / اليوم) و معامل التوصيل الهيدروليكي من منخفض (4 متر/ اليوم) الي عالٍ (137 متر/ اليوم) وتراوحت قيمة المسامية الفعالة بين 0.2 الي 0.4. تتم تغذية الخزان الجوفي سنوياً بواسطة رشح مياه الجريان السطحي والهطول المباشر وتم تقدير التغذية السنوية للمياه الجوفية ب 10.4 مليون متراً مكعباً والمياه المسحوبة سنوياً من الخزان الجوفي عن طريق العمليات المختلفة ب 5.2110×10^4 مليون متراً مكعباً و السعة التخزينية للخزان الجوفي تقدر بحوالي 11.5×10^3مليون متراً مكعباً. ودلت الدراسة علي أن عناصر نوعية المياه توافق المعايير السودانية ومعايير منظمة الصحة العالمية، عدا بعض المناطق التي سُجل فيها قيم عالية لكل من الاملاح الكلية الذائبة والكلور والصوديوم والكبريتات.

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The total volume of groundwater in storage is about 7.3×10^{3}million cubic meters. The annual groundwater recharge is equal to 2.3×10^{6}million cubic meters and the total discharge is 4×10^{6} m^3/y. The annual water surplus is about 2.3×10^{6}million cubic meters. The volume of water extracted artificially for water supply purposes is estimated as 0.26 million cubic meters per year which is representing the 33.3% of the total annual groundwater discharged from aquifer. The volume of water extracted naturally by the evapotranspiration process and subsurface outflow represent 66.6% and 0.1% of the total annual groundwater discharged from aquifer respectively.

6.2. Recommendations:

The geological environment of Duredeb area indicate that the presence of economic minerals due to that there are a chance to developed area by established industrial factory for mining in area. The present study is providing good knowledge of the hydrogeology system in the area, and suggests the following recommendations to be taken into consideration in future:

1) Test drilling at the areas of proposed high groundwater potentiality.

2) Production well should be designed properly and not concentrated in particular area to avoid continuous decline of water table.

3) Regular and systematic monitoring of groundwater resources in the area for effective management. This can be done by automatic measuring to water table and discharge, in addition to periodically manual measurements to EC, pH, Temperature and TDS.

4)politically the area is main point for Sudanese government, the area of military or soldiers depend on water.

5)Construction of artificial pools (Hafir) and Dams in sufficient models is required to up hold life of the farness inhabitant.