AAPG Datapages/Search and Discovery Article #90254 ©2016, GEO-2016, 12th Middle East Geosciences Conference & Exhibition, Manama, Bahrain, March 7-10, 2016

An Integration of geophysical and GIS for groundwater potentiality and artificial recharge in Wadi Tayyah, southwest of KSA.

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ABSTRACT

The increasing demand of fresh water in Saudi Arabia is one of the national requirements. In the Arabian Shield southwest of KSA, there is an observable lacks in a permanent groundwater aquifer.

The objective of this study is using electrical resistivity combined with GIS to explore the groundwater potentiality in Wadi Tayyah west of Abha. The intent is to realize the rainfall and flash flood impacts on this Wadi to predict sustainable plan to store the water.

Wadi Tayyah one of the main Wadis of Arabian shield, runs from east to west with 50 km length. Geomorphologicaly, its upstream beginning on the east from the heights of the Arabian Shield descended into semi-flat areas on the west with relatively high slope angle in its upstream portion. Wadi Tayyah characterized by high annual runoff, casing catastrophic flash flood events on the infrastructures of its downstream inhabited areas plus rural settlements along its stream.

Geoelectrical and GIS techniques revealed detailed information about the geometry of the subsurface hydro- stratigraphic sequence in the aquifer system. The electrical resistivity investigation locate three subsurface layers of shallow alluvial deposit in downstream, which is work as potential zone to recharge the groundwater and store it in the underlain fractured hard rock aquifer. In addition, a hydrogeophysical cross section along Wadi Tayyah was constructed to locate the lateral subsurface lithological variations due to water saturation. Significantly, fault and lineaments system recorded on the surface, as well as, on the subsurface, which yield to more recharge into the fractured rock aquifer.

Since the surface runoff is the main recharge source for the aquifer, detailed morphometric analysis employed on Wadi Tayyah derived from DEM and ASTER satellite image to identify the hydrologic conditions and surface runoff, which is responsible to recharge the Quaternary shallow aquifer.

In regard of flash floods beneficiation and mitigation in yield of groundwater recharge, construction of multi-functional facilities like subsurface or surface dams, retardation dams and harvesting ponds should be consider to control floods. In addition, to reduce flow velocity that leads to protect soil cover from drift and to retain water to promote rising of groundwater levels by infiltration and recharging the underlain fractured aquifer.