

Investigating groundwater characteristics of Wadi Al Arab wellfield, NW-Jordan

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Abstract: The understanding of groundwater quality and its interaction with the hosted aquifer is a very important issue for extraction of water in arid regions. Water quality deterioration, in addition to the shortage in water supply will make situation more and more complicated. Wadi Al Arab well field is located in the north-western part of Irbid Governorate, about 81 km from the capital city of Amman. Currently, Wadi Al Arab wellfield provides Irbid governorate with about 17 MCM/a ($\sim 40\%$ of Irbid water supply). The total area of the estimated groundwater catchment area of Wadi Al Arab wellfield is about 192 km². In Wadi Al Arab groundwater catchment, water is potentially present in the locally named Amman Wadi As Sir aquifer (A7/B2). This aquifer consist mainly of limestone and dolomitic limestone with some of chalk and marly limestone (Upper Cretaceous age).

Water levels in Wadi AL Arab wellfield have dramatically declined due to the increasing on water demands in that area. Recently, water levels decline reaches in some wells up to 10 m/a or even more, with total drawdown up to 90 m in some of the wells in 2017 (difference between static and dynamic water level). At the same time, water quality has severely deteriorated in Wadi Al Arab wellfield mainly due to potential downward leakage of groundwater contained in the overlying bituminous marly limestone layer, which is called Muwaqqar Chalk Marl formation (B3). This formation has not sealed partially or completely in many of the wells and therefore, leads to wells that are contaminated by heavy metals (e.g.: molybdenum, nickel, and arsenic).

For better understanding of the hydrogeological situation of Wadi Al Arab wellfield; chemo-physical evaluation of the available water resources in Wadi Al Arab wellfield were applied. For that purpose, full hydrochemical analysis (physical parameters, major ions, heavy metals) for the water of Wadi Al Arab wellfield were done, in addition to a continuous and regular measurements for the static and dynamic water level in Wadi Al Arab wells.

Wadi Al Arab wellfield assessment lead to a thorough collection of information that could be used to improve the generally low knowledge about Wadi Al Arab catchment area. The findings of this assessment are as follows:

1. The relation of rocks, their mineral contents and the elevated heavy mineral content in water are discussed
2. An estimation of the groundwater catchment area, and a generalized groundwater contour and flow directions map were prepared.
3. According to the collected and available data about the water levels and base of aquifer; remaining saturated thickness of the A7/B2 aquifer in wadi Al Arab wellfield area was calculated.
4. Regularly updated blending ratio plan, and a consequent reduction of groundwater abstraction from Wadi Al Arab wellfield is required in terms of water quality.