Protection of Qunnayah Spring

Authors

Dr. Manfred HOBLER
Dr. Armin MARGANE
Eng. Mohammad ALMOMANI
Eng. Ali SUBAH

With contributions from:

Eng. Mazen RAYYAN
Eng. Nidal KHALIFEH
Eng. Jihad Al MAHAMID
Geol. Hani HIJAZI
Geol. Zakaria ZUHDI
Geol. Saleh OURAN
Geol. Ali HAMMOUDEH

Abstract

Within the framework of a technical cooperation project between the Water Authority of Jordan and the Federal Institute for Geosciences and Natural Resources (BGR) in Germany, an hydrogeological assessments of the groundwater resources of northern and central Jordan has been carried out in recent years. This includes an improvement of the hydrogeological database, the preparation of thematic maps on important aspects of the hydrogeology of the area, the collection and evaluation of information relevant to the assessment and exploitation of the groundwater resources, and the preparation of groundwater models. The project results provide important basic data for the water information system of the Ministry of Water and Irrigation and for the ongoing updating of the National Water Master Plan of Jordan. The present report 'Contributions to the Hydrogeology of Northern Jordan' is the last volume of a set of technical reports on the ‘Groundwater Resources of Northern Jordan (see list after title page). The report deals mainly with the hard rock aquifers. With few exceptions (e.g. parts of the Jordan Valley), the importance of alluvial aquifers is rather limited in the project area. Thematic maps and hydrogeological cross-section for the entire area of northern and central Jordan show:

• the potential for groundwater exploitation,
• the distribution and the outcrop areas of the main aquifers,
• the groundwater recharge and discharge areas as well as the delineation of the areas of groundwater saturation and groundwater confinement,
• the groundwater flow pattern and the flow directions in all of the main aquifers,
• a review of aquifer parameters and
• information on the spatial distribution of groundwater salinity. The groundwater potential of Northern Jordan is shown in a colored map (Annex 1), which can be seen as a synthesis of the hydrogeological information presented in all the other thematic maps. The aim of this map is the presentation of the complex hydrogeological situation in a generalized and simplified way, so that

non-professionals in hydrogeology get an overview of the possibilities and constrains of groundwater withdrawal in northern and central Jordan. Recharge calculations for the main aquifer, the A7/B2, range from up to about 25 % of the annual rainfall in the outcrop areas in the northwestern highland in wet years to less than 3% in areas with low precipitation in the eastern part of the country. For the outcrop areas of the B4/B5 aquifer in the area north of Irbid, recharge rates of about 8 - 10 % and for large parts of the Azraq area, rates of approximately 3 % appear to be realistic. In the easternmost part of the country (large parts of the Hamad, Azraq and Sirhan Basins) most of the groundwater is probably of fossil origine and recent recharge predominantly occurs in the form of secondary recharge along the course of wadis or in other areas that favour infiltration processes. Evaluation of groundwater level monitoring data, groundwater balance calculations and the results of groundwater modelling indicate that the major aquifers are being used to their full capacity and that groundwater mining is now a serious problem. The deficit in the groundwater balance has increased considerably during the past twenty years and rapid declines of groundwater levels are common in the important well field areas (often 1-2 m/a). In some cases spring and baseflow have ceased altogether. Since the available water resources are so limited, it is urgent to reduce groundwater abstraction in order to come as close as possible to safe yield levels. The problem of insufficient water resources can only be adressed by a multi-level approach such as modernizing of the supply network in order to reduce water losses, reuse of treated waste water (mainly for agricultural purposes), rainwater harvesting and artificial recharge, demand management, raising of public awareness of the critical water situation, reduction of the waste of water, desalination, and thought-through exploitation of fossil groundwater. In addition, not only the problem of insufficient water resources, but also the increasing water quality problems will have to be adressed. Otherwise part of the scarce water resources will be lost for water supply because of contamination problems. From the hydrogeological point of view, withdrawal of additional amounts of groundwater makes only sense in areas where the groundwater would otherwise be lost for the water supply because of water quality deterrioration due to natural causes. Examples are the interception of the groundwater discharge from the deep sandstone aquifer before it flows into the Dead Sea and, to some degree, the interception of the groundwater flow in the A7/B2 aquifer in the so called ‘corridor wells‘ in the area west of the Azraq depression, before the groundwater salinity increases towards the central part of the basin. A further increase of groundwater withdrawal might seem justified in subsequent years of very low rainfall (drilling of ‚emergency wells‘ after the extremly dry winter of 1998/99). It must be kept in mind however, that each additional well brings the aquifer system closer to exhaustion. Thus the problem of insufficient water supply is projected into the future, when conflicting interests of water demand might become even more severe because of the rapidly increasing water demand.