Managed Recharge into a Karst Aquifer - Wala Dam, Jordan

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Introduction
Managed Aquifer recharge of groundwater is used in the implementation of Integrated Water Resource Management (IWRM) in the Lower Jordan Rift Valley, within the framework of the SMART II project (Sustainable Management of Available Water Resources with Innovative Technologies, BMBF).

The Wala dam was constructed (1999-2002) to collect floodwater and recharge it into the underlying limestone aquifer, where it is reclaimed for drinking water supply at Heidan well field (Figure 1).

Objective
Obtain a better understanding of the dynamic system of runoff and storage in the reservoir, recharge of the karst aquifer and recovery of the water. This includes the investigation and observation of:
- water level fluctuations in the reservoir and aquifer
- sedimentation in the reservoir
- turbidity and fecal bacteria in the groundwater
- flow path and transit times from the reservoir into the Wadi near RW 6

Methods and Results
For recording the water level fluctuation in the reservoir and the aquifer, 5 Divers were installed in selected wells in November 2011 (Figure 5).

- CTD Diver: Water level, Temperature, EC
- Cera Diver: Water level, Temperature

Figure 6a shows the rising water level in the reservoir during flood events and the associated changing of the electrical conductivity.

Figure 6b shows the decreasing water level in two recharge wells after the ending of artificial recharge. Hereby, 1000 m³ per day were infiltrated by gravitation into the aquifer (Jan. 2011 - Jan. 2012).

Conclusions
- Sedimentation in the reservoir led to a reduction of the infiltration rate (Figure 4), especially during low water level.
- Most of the infiltration from the reservoir takes place laterally along the vertical and horizontal faults and fractures.
- With the installation of water level recorders it is possible to determine the behaviour of the aquifer during artificial recharge. This helps to improve the management of the recharge wells e.g. to avoid overflow of the dam and also the effloration from the aquifer into the Wadi near the recharge wells.

Further studies
- Implementation of a tracer test to determine flow path, and transit times from the reservoir to the well field.
- Numerical simulation (FEFLOW) of the test site.
- Measurements (sediment traps, yard sticks) and investigation (core drillings) of the sediments in the reservoir.
- Observation of turbidity and fecal bacteria in the groundwater.

References
- Database from the Ministry of Water and Irrigation (MWI) and Water Authority Jordan (WAJ), Amman.