Geophysical Research Abstracts
Vol. 20, EGU2018-4425, 2018
EGU General Assembly 2018

Impact of river - hydropeaking to groundwater recharge: a case study from South Tyrol

Lorenz San Nicolò (1) and Ernesto Scarperi ()

(1) Geologisches Buero Lorenz San Nicolò, Italy (lorenz.sannicolo@gmail.com), (2) Suedtiroler Landesagentur fuer Umwelt – Amt fuer Gewaesserschutz

The phreatic aquifer of the Adige Valley between Merano and Bolzano represents an extraordinary water resource and is of primary importance for irrigation and drinking water supply of the area. The river Valsura, which is an alpine tributary, crosses the Adige Valley along its alluvial fan. Along this 5 km long river section, significant infiltration and consequent groundwater recharge takes place. The Valsura river is used for power production and is therefore subject to strong hydropeaking with river flow rates changing from less than 0,5 m3/s to more than 20 m3/s. A detailed hydrogeological assessment with combination of different investigation technologies produced a clear picture of the interaction between river and groundwater and allowed to calculate and compare the groundwater recharge rates for different hydropeaking scenarios.
The transmissivity of the aquifer system has been estimated by interpretation of temporal and spatial attenuation of the hydropeaking waves in the groundwater perpendicular to the river.
The visual evaluation of streambed clogging allowed to distinguish different river sections with very different degree of riverbed sealing. Infiltration tests in the riverbed showed vertical riverbed conductivity ranging from 5E-4 to 6E-6 m/s.
Based on field mapping, river flow and groundwater level monitoring, drillings, performance of different groundwater - stress tests and chemical analysis, a detailed conceptual site model was prepared.
Through the CSM it was possible to understand the complex interactions between river and groundwater: a total of six infiltration and exfiltration pathways have been identified
UPPER RIVER SECTION (no hydraulic contact between Groundwater and surface water):
Q1: Subsurface recharge from the alpine valley-fill aquifer (Valle d'Ultimo)
Q2: Infiltration, split into:
Q2a: direct vertical infiltration to GW
Q2b: Perched water accumulation on silt layer and displaced infiltration in groundwater
Q2c: infiltration under silt layer
LOWER RIVER SECTION (Groundwater and surface water are in hydraulic contact):
Q3: Infiltration (loosing river section)
Q3: Exfiltration (gaining river section)

The CSM was the basis of a 3D groundwater flow model, which was calibrated by transient simulation of different observed hydropeaking periods (summer and autumn). The simulated groundwater impact of hydropeaking matched with the observed groundwater fluctuations. For each observed period the infiltration and exfiltration rates for each pathway have been calculated. As an example the results for a two weeks summer period (18 – 31 July 2015) are summarized below:
Total duration of the observed period: 336 h
Number of high-water events (hydropeaks): 13
Total duration of low-water: 159,5 h
Total duration of high-water: 176,5 h
River flow rate – Low-water: 0,45 m3/s
River flow rate – High-water: 21,8 m3/s
Total flow volume in the period: 5,85 Mio m3

Total Groundwater recharge volume in the observation period:
Low -water: 0,28 Mio m3
High-water: 1,19 Mio m3
Total: 1,47 Mio m3