Identification of Flow Paths and Travel Times in an Alluvial Aquifer Using Natural Tracers and Tracer Tests

The proposed master thesis is part of the project ReCorD (Restored Corridor Dynamics) within the competence center environment and sustainability (CCES) of the ETH domain. The project aims at estimating, how river-groundwater interactions are altered by river restoration measures and to which extent river restoration increases the resilience of the ecosystem, improves groundwater quality, or even endangers drinking water supply from alluvial aquifers. In the framework of this project, the Swiss Federal Institute of Aquatic Science and Technology (Eawag) in cooperation with Environmental Agency of Kanton Thurgau (AfU TG) is offering the following master thesis in hydrogeology:

In Switzerland, many drinking water wells are located close to losing rivers. For an assessment of the effects of river restoration operations on ground water (e.g., lateral extension of banks), we identify flow paths and travel times of young hyporheic ground water from a losing river and travel times from the river to a groundwater well are very important. A lateral extension of banks may lead to shorter travel times and altered flow paths, potentially causing a conflict between river ecology and well protection. An experimental field site at Niederneunforn/TG consists of two transects with many piezometers. The piezometers are equipped with data loggers for hydraulic head, temperature, and electric conductivity.

The goal of this Master Thesis is to identify the flow paths and travel times of the young hyporheic groundwater at a restored section of River Thur (Switzerland). As a member of the project group, the student analyzes high-frequency time-series signals for travel-time distributions of up to one month needed for an assessment of the flow field (Cirpka et al. 2007). Water concentrations of $^{222}$Rn (Hoehn & von Gunten, 1989) will be analyzed for travel times (radon water ages) in the range of two up to two weeks. To compare, small-scale well-to-well tracer tests with dyes (and evtl. heat) will be performed. They help to detect flow paths and to determine the distribution of groundwater flow velocities, effective aquifer porosity, and mixing/solute dispersivity. Basic hydrochemical parameters (major ions) will be monitored periodically, to help to identify mixing ratios of ground waters of a differing origin.


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Further MSc Thesis Project Documents can be made available.
Abstract on homepage

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