

Effect of river revitalization on groundwater quantity and quality

Context and objectives

In Switzerland, 4000km of rivers have to be revitalized in the coming 80 years often combined with measures to improve flood protection. Many of the project sites are located in zones with alluvial aquifers. River revitalization tends to increase groundwater-surface water interactions due to the regular reconfiguration of streambeds and banks, removing clogging layers that limit exchange. While this effect can be beneficial for groundwater quantity and the redox state of aquifers (increased oxygen concentration), there is a concern that the microbial groundwater quality deteriorates due to less effective filtration of microorganisms. The aim of the project is to investigate how the removal of clogging layers influences the chemical and microbial water quality focusing on long-term effects. The project will be carried out at a unique experimental field site, where the clogging layer had been removed by excavation (see Fig. 1).

Methodology

The field site is equipped with an experimental pumping well and a network of monitoring wells. A several week-long pumping test will be carried out. Hydrological (water levels, flow rates), hydrochemical and microbial parameters will be monitored continuously. Microbial data will be recorded in situ with flow cytometry and the microbial populations might be analyzed by sequencing their DNA. Environmental tracers (^{222}Rn , ^{18}O) will be used to characterize the surface-water groundwater interactions. In addition, artificial tracer tests will be carried out to investigate the flow field around the pumping wells. The results will be compared with earlier studies immediately after removing the clogging layer to evaluate the long-term effect of the de-clogging event. Depending on the advancement of the project, a numerical model might be used to support data interpretation.

Supervision and collaboration

The project will be supervised by Daniel Hunkeler. The project will be carried out in collaboration with International Rhine Regulation (IRR) agencies that is planning the Alpine Rhine flood protection project (Rhesi), which will also revitalize the Rhine (rhesi.org).

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Figure 1: Artificial de-clogging of the Alpine Rhine river by excavating the river sediments.