Groundwater protection in urban areas incorporating adaptive groundwater monitoring and management - Reconciliation of water engineering measures along rivers

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Abstract

This study investigates groundwater systems and their usage related to interference during flood events and water engineering activities along rivers in urban areas. In the context of river training for flood protection a multitude of river engineering measures are currently planned in Europe. Due to the experience gained from hazardous flood events in the last twenty years, most countries have acquired a more comprehensive view of rivers. This includes the consideration of processes at the catchment scale as well as ecological aspects. Multiple interests concerning groundwater use and protection challenge the intentions of water engineering and groundwater protection schemes that can only be solved by simultaneously considering all of the various interests.

Extending current protection concepts with process-based approaches that consider the interaction between surface and subsurface waters could enhance sustainable development of groundwater resources. Knowledge of the composition of groundwater quality, including an adequate consideration of variable hydrologic boundary conditions and fluctuations of loads in rivers, is therefore of great importance.

Previously, decisions concerning impacts on urban groundwater flow regimes were typically taken at the level of the individual project. However, it is the sum of all impacts, and their interaction in time and space, that has to be considered. To accomplish this, it is necessary to develop instruments that facilitate to adequately quantify the consequences of the cumulative effects of numerous decisions concerning the groundwater flow regime and groundwater quality. At the same time, system profiles must be identify together with the delineation of boundaries and specific targets that lead to defined overall goals for specific groundwater areas.

These instruments form part of groundwater management systems, comprising among others, the setup of groundwater observation systems, high resolution numerical groundwater modelling, and the development and evaluation of scenarios. Applying methods of scenario development facilitates the assessment of effects of water engineering measures on riverine groundwater and its usage for drinking water. The implementation of these process-based approaches is illustrated by selected examples in the agglomeration of the city of Basel, Switzerland.