

Guidelines on groundwater and environmental issues in tunnelling. Experiences from Italy



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ABSTRACT

Tunnelling meets the ever increasing requirements of a fast and sustainable mobility either between cities or inside cities transportation network so tunnels and big urban excavation works sprawl rapidly. At the same time the rapid growth in renewable energy is creating a development of underground hydroelectric power plants. This growing interest in exploitation of underground space represents the most impacting engineering work affecting groundwater. Severe effects may occur during and after excavation (e.g. hydraulic head drawdown, base-flow impoverishment, subsidence), making more difficult local people acceptance of ongoing projects. Often, the undesired environmental consequences of tunnelling represent the outcome of an unforeseeing design. It can happen when groundwater is considered simply as a “geological accident” and a geotechnical obstacle for the tunnel advancing and stability and when poor attention is devoted to the interaction between tunnel and groundwater flow systems. In the stages of environmental impact assessment and hydrogeological modelling and monitoring, the expected modifications of local groundwater budget terms (recharge-discharge) along with ecological effects against groundwater dependent ecosystems must be carefully take into account.

This contribution deals with the need for coordinating all hydrogeological activities in tunnelling planning, in order to improve environmental sustainability. The authors experience put in evidence the need for guidelines on this topic, that should help hydrogeologists and decision makers to improve the water resources management in tunnelling. An hydrogeologically-based approach, hopefully founded upon a common protocol, will surely help to consider the tunnel not merely in terms of “drilling production” but also of “hydrogeological effects”, in order to manage the geotechnical excavation constrains, the environmental impacts and, at the same time, to valorize the water resources drained into the underground excavations and the associated heat.

The synthesis of different case-studies, in Italy and abroad, where either a professional best-practice and/or a research-focused approach have contributed to treat groundwater flow as the main target of the analysis, is considered as the basis for this guideline proposal.