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APPLICATION OF GROUNDWATER FLOW SIMULATION MODELS FOR DESIGN OF DEWATERING SYSTEM IN POROUS AQUIFERS

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The aim of the study is an hydrogeological survey on a stretch of artificial tunnel link, planned in an highway project, through the implementation of groundwater flow simulation models (MODFLOW).

In particular, the purpose of the model is to provide an initial assessment of the effects induced during construction and during operations, in respect of groundwater flow, and therefore optimize dewatering system during construction phase (well-points and deep wells).
The artificial tunnel in question is configured in the redevelopment of a section of SP 103 called "Cassanese", located between the cities of Brescia and Milan, south of the town of Pioltello (Milano district, Italy). The road section is part of the edge of urban areas with widespread presence of road infrastructure, technology networks and services.
The knowledge of the geological and hydrogeological conceptual model was supported both by sub-regional evaluations and boreholes drilled along the artificial tunnel position; geo-stratigraphical tunnel profile was produced as a synthesis of the local investigations, determining scenario's piezometric levels referred to the construction and operative phases.
It has been setup at first a two-dimensional simulation model of groundwater flow along 2 vertical cross sections of the tunnel axis of the gallery, representing the most severe conditions in the two phases of work, in term of lowering of groundwater levels to achieve, and then a three dimensional model in a zone of tunnel at great depth of excavation.
The model was first calibrated in steady state, with reference to the current piezometric conditions, reproducing the natural groundwater flow and hydrogeological balance, and then it was extended in order by checking the changes in the flow field.
Estimated piezometric profile (upword-downward gradients) was determined both during the construction phase, appreciating effects due to introduction of piles and jet-grouting, both during the exercise phase, after the inclusion of a waterproof structure in the acquifer
The interference with the groundwater flow with the construction of artificial tunnel Pioltello are limited, in terms of gradients induced by and planimetric extent of disruptions of the natural groundwater flow field.
Therefore the model was implemented in transient state and it allowed to obtain the following informations.
1. Initial flow rate needed to produce the piezometric depression in the share base of the excavation.
2. Time interval after which the depression is achieved.
3. Flow amount that should be removed from the acquifer to maintain the level below excavations.
4. Lowering expected also in the area including the radius of influence characteristic of the acquifer.