

Forecasting high groundwater levels for deeper excavations

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ABSTRACT

During construction it very often happens that the basement of a constructed object or part of it interacts with groundwater. According to the type of interaction with groundwater objects can be classified into two groups. In the first group there are objects that are permanently flooded with groundwater. For this type of interaction a special construction procedure is needed. In the second group there are objects that are flooded only occasionally. If the frequency of groundwater appearance at the bottom of an object is very high, engineering solutions are very similar to those for permanent flooding. When flooding with groundwater appears with small frequency the engineering solution for groundwater problems depends on the significance of the constructed object. If the object is not very significant (e.g. local underpasses), occasional flooding with groundwater can be allowed. During the design stage it is therefore very important to properly forecast the frequency of flooding, and to predict the return period and the level of groundwater flooding in relation to the constructed object.

The frequency of groundwater flooding can be estimated in similar way, as is the case in surface water flooding prediction. From long-term groundwater observations the return periods of extreme groundwater levels can be estimated on the basis of theoretical statistical distributions. Among them normal, lognormal, gamma, Pearson III and logPearson III distributions are used. In the article special emphasize is given to proper estimation of empirical distribution model for groundwater level extremes and to trend analysis of long groundwater level observations.

A case study of groundwater extreme levels in the large Quaternary aquifer of Dravsko polje in the northern part of Slovenia is given. The analysis was performed during the design stage when different courses and levels of highway in long trenches were studied. On the basis of our study the planned highway level was shifted up.