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Концепция за прогнозни хидродинамични изчисления: обзор на изследванията в Сърбия

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The main purpose of the hydrodynamic model is to simulate the predictive state of the groundwater regime. Therefore, the use of a hydrodynamic model for prediction for various purposes represents the final phase of the overall effort around its creation and is carried out on calibrated and verified model. The solution of a calibrated and verified model is most often the starting point for all planned prediction. Most commonly, a future groundwater regime prediction is carried out or prediction based on weather forecast. The process consists of setting the desired input parameters to the model, whereby as a result, the values of groundwater regime parameters, mainly groundwater levels or rate of flows, are obtained. The degree of reliability of the predictive calculations depends on the period for which they are carried out and the manner in which the boundary conditions are set. With the increase of the prognostic period, the degree of reliability of the results of the forecast calculations decreases, since it is usually not possible to define parameters through the process of calibration in a wider zone of terrain which covers long-term exploitation.

The transition from the phase of calibration and verification of the hydrodynamic model to the predictive calculations of variant solutions is an extrapolation of conditions for which calibration has been performed for some new conditions, which are related to changes or setting of new boundary conditions. At the phase of predictive calculations, the geometrical characteristics of the model do not change, except if there is a change in the predictive calculations due to anthropogenic or natural activities, and no filtration characteristics are altered as well.

Additionally, some difficulties with extrapolation arise in terms of predicting the value of boundary conditions. Examining the solution of the problem through its comparison to more options, it is common for the predictive calculations relative to the effects of technical solution according to variants to be implemented for the selected one or more time intervals, which represent certain probabilities of the groundwater regime occurrence, whereby, in addition to deterministic components contained in the model itself, a certain degree of random stochastic component is introduced into predicted groundwater regime.

The predictive hydrodynamic calculations of the groundwater regime in the new conditions provide a far greater advantage over other interpretation and predictive methods. Usually several variants of the solution are obtained when solving the problem by means of the predictive hydrodynamic analysis.

The examples from Serbia are mostly about designing groundwater control systems or groundwater abstractions. More particularly, this refers to the prediction of the effects of groundwater source operation for a long period (Polomčić et al., 2013, 2014b, 2016; Bajić et al., 2017b), followed by the mine defense prediction against groundwater as well as the prediction of groundwater levels after

the cessation of the defense system (Polomčić et al., 2012, 2014a; Šubaranović et al., 2013; Polomčić, Bajić, 2015) and the prediction and assessment of the impact of groundwater reductions on other hydrogeological and construction facilities, that is, groundwater risk assessment (Polomčić, Bajić, 2014; Polomčić et al., 2018).

One of many interesting examples from Serbia is shown. In this case, the main objective of predictive hydrodynamic calculations was to as-

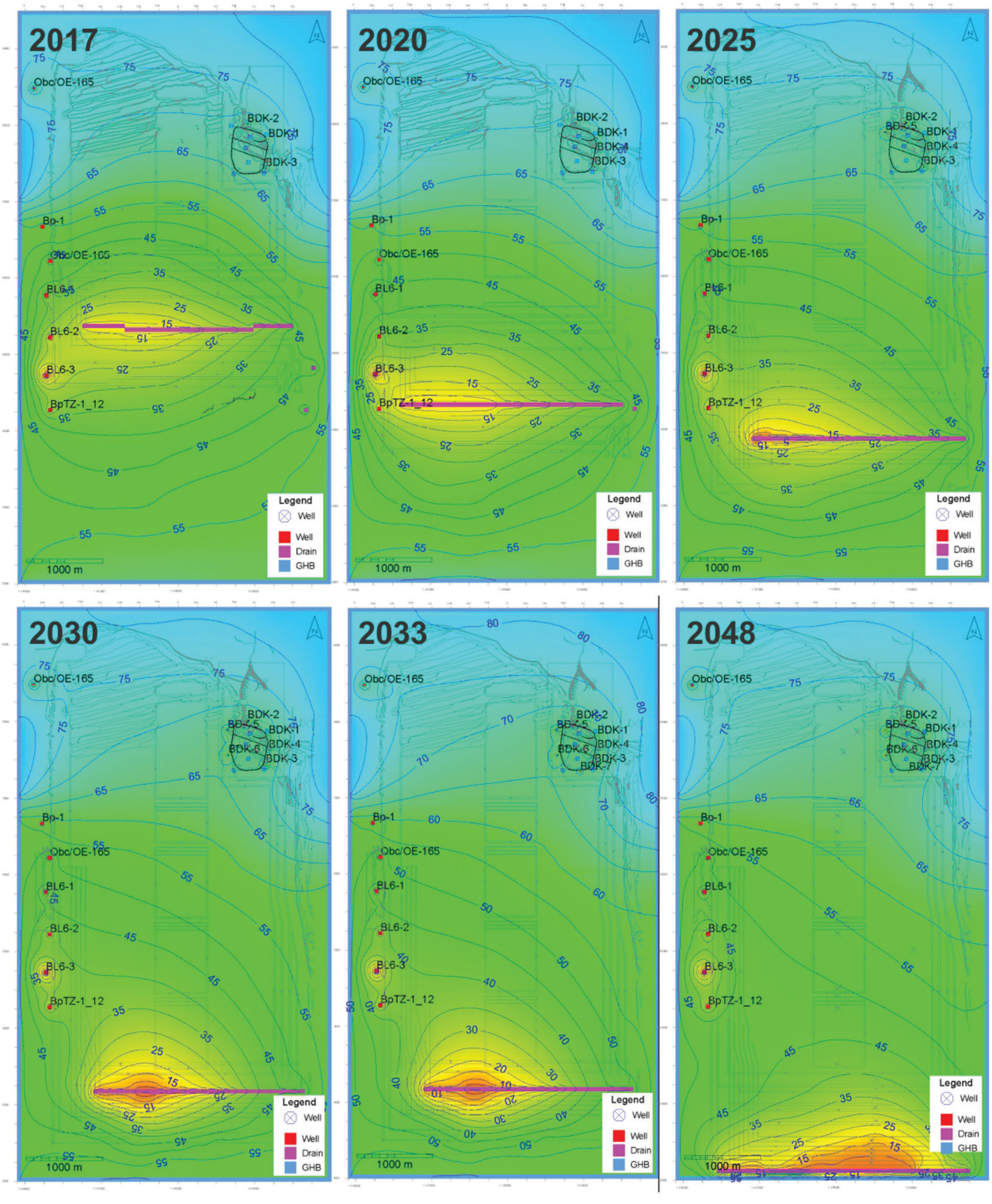

Fig. 1. Predictive hydrodynamic calculations – the piezometric levels for the future period (2017–2048)

sess the impact of the removal of the Tamnava-West Field open cast and drainage system from the Kalenić regional landfill site, as well as to analyze measures for maintaining the projected groundwater levels at the landfill site. In total, three variants of predictive calculations are defined, and the differences between them relate to hydro-meteorological and hydrological conditions in the study area (as input to the predictive model, i.e. predictive values of boundary conditions), as well as to drainage system characteristics: number, locations, initial capacities and scheduling (on/off) of the drainage wells. Fig. 1 shows one of the variant solutions, which is based on the sum of precipitation and surface flow regimes that prevailed during the May 2014 historic floods. Also, the piezometric levels can be seen for the future period of 30 years (2017–2048).

On the other hand, finding the optimal solution from several created alternatives with the help of predictive hydrodynamic calculations is often very complicated, so for this purpose it is further recommended to use the multiple-criteria decision making model (Bajić, Polomčić, 2014, 2019; Bajić, 2016; Bajić et al., 2017a, b; Polomčić et al., 2019).

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