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ANALYSIS OF CHANGES IN THE QUALITY OF GROUNDWATER AND SURFACE WATER IN THE CONTEXT OF WATER SUPPLY FOR THE RESIDENTS OF NOWY TARG

Abstract

The main purpose of the doctoral dissertation was to assess the scope and origin of changes in the quality of groundwater and surface waters taken for the needs of the inhabitants of Nowy Targ, and then, based on it, to analyze the possibility of incorporating a closed water intake into operation and further use of the currently operating intakes. The study area covered a section of the Biały Dunajec stream located in the village of Szaflary and a fragment of the Dunajec catchment located in the city of Nowy Targ. The subject of the analysis of the doctoral thesis was the physicochemical and bacteriological composition of underground water taken from 21 wells in the area of Nowy Targ, as well as river water taken from the Biały Dunajec River. The research was carried out in three stages. The first stage covered the analysis of groundwater and surface water chemistry. The waters of the Biały Dunajec River in the area discussed are used to supply the population with drinking water. The waters of Biały Dunajec at the intake level in Szaflary, in terms of physical and chemical indicators, correspond to category A1 - water requiring simple physical treatment, in particular filtration and disinfection. However, the factors degrading the category of water quality were bacteriological indicators: the total number of Coli bacteria, the values of which indicate a significant impact of anthropopressure. In the case of groundwater, it was found that these waters correspond to the 1st class of purity. The bacteriological indicators of the intake waters in all the wells are not cause for concern, although the average concentration of nitrates may indicate distant bacteriological contamination of the waters in terms of time and space. Excessive concentrations of chlorides in the hydrogeochemical background level were a clear signal of a significant anthropogenic impact on the quality of these waters. Taking this observation into account, it was decided to conduct research in which individual groups of wells classified according to different ways of using the land within which groundwater intakes are located were used as independent variables. The results of the statistical tests to check whether there are statistically significant differences suggest the existence of statistically significant differences between the chloride content (Cl⁻) and the electrolytic conductivity (EC) between groups of intakes A, B and C, distinguished due to different ways of land use within which underground water intakes are located. Taking into account the above research results, it was concluded that in order to ensure the qualitative and quantitative safety of water supplied to consumers in Nowy Targ, the inactive Grel intake should be included in the future. Therefore, a hydrogeological experiment was planned, the aim of which was to understand the origin and conditions of the inflow of waters taken in by the Grel infiltration intake located at the Czarny Dunajec River. Field studies involving three-stage pumping with variable capacity have shown that the pressure propagation time between the intake and the mixing zone of the river with the aquifer is short (a few hours), which results in a significant inflow of water from the mixing zone even at low pumping speeds. As a consequence, this may cause noticeable changes in the concentrations of dissolved substances in the water flowing into the intake, even under moderate exploitation conditions. However, the share of river water in the stream of water flowing into this intake does not exceed a dozen or so percent. As a result, the water quality at the Grel intake remains good and it has been determined that the re-inclusion of this groundwater intake into operation is possible and will be an important element of increasing the reliability of water supply to recipients in Nowy Targ.

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