Autonomous local water supply systems for remote settlements - Municipality of Ruma (Serbia)

Dejan Nešković

Department for hydrogeology, Faculty of mining and geology, University of Belgrade, Serbia (neskovic.m.dejan@gmail.com)

There are currently 51 registered public waterworks companies, which provide population of Serbia with water for domestic use. For years, there was a problem of water supply for smaller, remote settlements because there was no possibility of centralized water supply from one source. That problem is particularly evident in Vojvodina, because of the great distances among the settlements. In this paper, the development of several local water supply systems for smaller settlements in municipality of Ruma is presented.

Municipality of Ruma is located in Vojvodina, in Srem region. It occupies an area of 582 square kilometres. It is located between Fruška Gora Mountain on north and Sava River on south. There are 17 settlements in this municipality, from which, 16 has rural character and one is the city of Ruma. The entire population is estimated at 60 000, from which, about 50% lives in rural settlements.

There are two big water supply systems in the studied area and they supply the population of Ruma and surrounding settlements with water, while other settlements use local water supply systems for their needs. Some of these local supply systems are under jurisdiction of public communal company, while others are managed by local community.
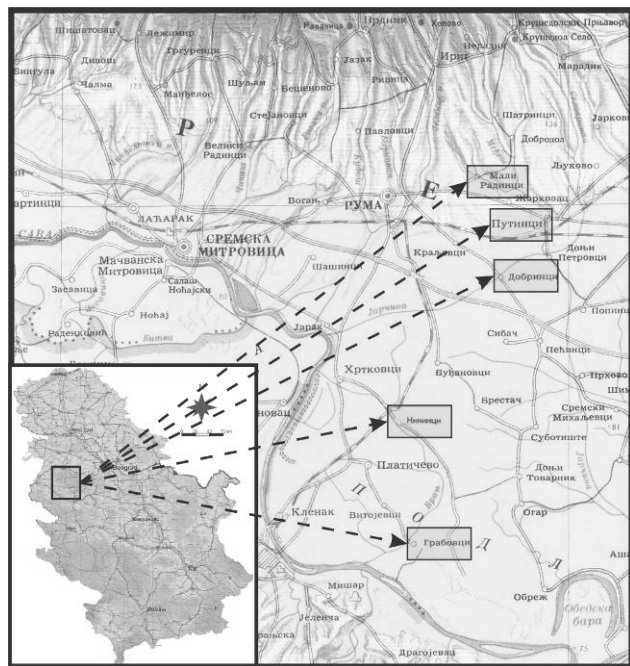

Fig. 1.: Map with locations of research areas

In this paper, the development of five local water supply systems is presented. (Fig. 1.). Settlements Dobrinci, Grabovci and Nikinci use water from local wells for supply, while Mali Radinci and Putinci are parts of a regional system, but still have own wells for supply in case of a need. Groundwater exploitation is performed using vertical wells. All local water supply systems are equipped with the necessary infrastructure (tanks and piping). Treatment is done in situ with chlorine insertion through the chlorinator.

Research consisted of several operations: observation of fluctuations of groundwater levels and yields over time as well as the determination of the chemical composition in order to determine the reserves of groundwater and to establish the water protection zones.

Geology: Researched formations are of Quaternary and Holocene age. Beneath of this sediments are the older formations starting from the Neogene sediments and on. Through the geological history, with deposition of sediments of Panonian Sea, water also stayed trapped. This water was, up to date, under the influence of a number of geological processes in time and space, and went through various changes. That is the reason why we today have different types of water at different depths.

Aquifer: All well screens are located in layers of sand and gravel, one layer at 55-75 m and other at about 80-90 m depth.

Regime: Biggest week average yield was 9.3 l/s and was measured in Mali Radinci, while smallest yield was in Nikinci and averaged 3.4 l/s. The biggest fluctuations in groundwater level were observed at Mali Radinci (16.53 m) while smallest were at Grabovci (4.38 m).

Chemistry: Groundwater from the local water supply systems is low-mineralized, with HCO_3-Na and HCO_3-Mg composition

The main problem of the examined water quality is the content of ammonia, iron and manganese (NH_3, Fe and Mn) with the exception of water in Dobrinci which meet all the requirements for drinking water quality.

Taking into account that the iron and manganese in the water appear under anaerobic conditions, their elevated concentration in groundwater from artesian horizons were expected. Ammonia in groundwater occurs mainly as a product of decomposition of organic matter. Together with the elements of nitrogen triad is an indicator of organic pollution of groundwater. But, ammonia may have an inorganic origin because this compound frequently occurs in the deeper parts of artesian and sub-artesian horizons. Given the absence of coliform bacteria and low consumption of $KMnO_4$, with low concentrations of nitrate and nitrite, it can be concluded that ammonia in these waters occurs as their natural ingredient and is not the result of pollution.

To summarize, when there are a large number of settlements within a municipality, centralized water supply system is not the best solution. Main pipelines are major investments, and there is alwast the risk of breakdowns and accidents which could lead to interruptions of water supply. Also, bigger demand for water could lead to overexploitation and well aging in main water supply systems. When the groundwater resource is not an issue, like in the case of municipality of Ruma, the optimal solution is that all the remote settlements have autonomous water supply system.