

ECOLOGICAL ASPECTS OF TRADITIONAL DRINKING WATER SUPPLY BY SHALLOW WELLS IN NORHTWEST BOSNIA

Dinka Pašić-Škripić
Faculty of Mining-Geological-Civil engineering
University of Tuzla
University Street 2, Tuzla
Bosnia and Herzegovina

Izet Žigić
Faculty of Mining-Geological-Civil engineering
University of Tuzla
University Street 2, Tuzla
Bosnia and Herzegovina

Dado Srkalović
Faculty of Mining-Geological-Civil engineering
University of Tuzla
University Street 2, Tuzla
Bosnia and Herzegovina

ABSTRACT

*Blood, Water, Oil
Man, Earth, Civilisation*

The learning about groundwaters is not only an investigational challange, but also a demand without the future of civilisation is going to be uncertain. The man always seeks to settle down near a big river or well of drinking water. By absence of natural springs, man recoured to dig wells, so we are able to find developed water supply systems by the oldest civilisations on Earth. In this paper the investigations of water quality by diged wells from the area of Srebrenik, Gračanica and Gradačac were presented. Respect to diged wells as a important source of water supply of the population as like today so in the future, we wanted to indicate the requirement and importance of investigation and monitoring of qualilty of these water.

Keywords: diged well, groundwater, quality of water, physical-chemical analyse of water.

1. DIGED WELLS

The bigger part of Bosnia and Hercegovina regardless of existing big waterbodies of groundwaters, has no qualitate drinking water supply. In most cases only the urban areas have organized water supply, by big systems. Rural and suburban areas have the water by local pipelines and more often individual diged wells. A well represents diged or drilled places in the ground, which from is extracted water, and if it is bacteriological correct, then it can be used for demands in the household. It's depht, because of the digging technology, ususally twenty metars. In the literature these wells are clasified on the one by which the water baring layer is in the rockmass till 8m

(Northon Well), and the other one where the depth is bigger than 8m which is in the most cases sheathed by rocks to prevent crumbling of walls. On the area of north-western Bosnia is present long-termed tradition of digging wells. Public wells were places of people assembling, communication and meetings, but fights too. The elder people of these areas were talking about their wells and neighbours wells, about happenings and dry years and about dry out wells. Wishing to give importance to digged wells in our time, in this paper we presented some results of investigating water quality of some wells in north-western Bosnia. In most cases the „digers“ digged the wells by hand and then sheathed it with stones. Water capture has been performed by cans with a jenny. Common instance is if the well has good profusion and if it's located near the road than it is a public well (rora-hajr voda), by which the water from the well is overflowed. Today the main part of digged wells is by mechanical drilling and incorporated concrete pipes and pumps. These wells still have big importance in crises in water supplying. Considering the quality of waters in public water supply systems and considering that the big area has no perspective to be supplied from the public water supplier, population choose to dig wells with healthy water, by which is necessary to take quality controls of these waters.

2. HYDROGEOLOGICAL CHARACTERISTICS OF NORTH-WESTERN CANTON TUZLA

Wider area of municipality of Gračanica is characterised by tight and sparse wells, formed in rocks of different character of porosity. Tight springs of freatic type, formed in rocks with intergranular porosity, accumulated in open hydrogeologic structures. This type of spring can be found in aluvial valley of river Spreča. Artesian spring as a second type of tight spring, is formed in special geologic conditions where the water flow upwards by the fault line, so the water is under pressure. On the area of Gračanica the common phenomena is spurting of water on the surface under pressure and huge profusion.

Within the shattered spears, on the territory of municipality of Gračanica, a karstific-fissure spears are present, particularly in limestones and sandstones.

According to present investigation works, on the area of this municipality, four notable aquifers were formed: aquifer in aluvium, in miocene limestones, in pliocene sands and paleocene-eocene limestones, where the thermomineral waters are formed.

The bigger part of Srebrenica area (northern perimeter of Majeвица), in hydrogeological sense is represented by jurassic diabaz-hornstone formation, cretasian limestones, eocene and burdigal-helvetic, tortonic and sarmatic sediments. These stones have a different hydrogeologic function, from the impermeable to the cavern-fissured porosity. The hydrogeologic function can be characterized as a hydrogeologic aquifer and hydrogeologic insulator. The diabaz-hornstone has the characteristics of a hydrogeologic insulator, which permeability depends by the fractured rocks in the masive, and by a contact with sediment rocks which are permeable, so the appearance of springs is more often on these contacts. In the formation of diabaz-hornstone formation sandstones, limestones, slates, conglomerates and vulcanic rocks. But the vertical alteration of these rocks is often, so by the hydrogeological function this formation is impermeable. The areal relationship and the sedimentation sequence has conditioned the forming of waterbearing layer in fissured badenic limestones.

The Gradačac municipality has been builded on the panonian and aluvial sediments in which we can divide: The Posavina hydrogeologic area with a unity northern from Gradačac and the hydrogeologic unity Turić-Zagoni. Each of them has its specifics in distribution and revolving of the lithologic units, and by that appearance of springs with higher or lower profusion.

3. WATER QUALITY OF DIGGED WELLS

In order to define the characteristics of karst-fracture collectors in northwestern part of the Tuzla Canton, and thus obtain a significant volume of data that indicate the occurrence of sufficient quantities of water for water supply, a investigations were performed on existing wells on area of 100 km². With the aim of defining more complete water quality exploration area, used the results of sampling and testing water at 21 site, and available results of water which were made in the past 15 years. In the aforementioned investigation area, and the research works were carried out by one-time sampling and testing of water, on the terms and determining the chemical and physical water

quality. Sampling was done on 25 samples of water, in accordance with the regulations for hygienic drinking water and standard methods for testing surface water. Applied both on the basis of analysis of groundwater quality of municipalities of Gračanica, Srebrenik and Gradačac, for 2006., 2007. and 2008., one can note the following:

- The temperature on all samples varies between 9,0 and 17,0 °C,
- The turbidity of the water on all samples is in the expected values (0,45 – 8,0 NTU),
- pH value is in the range 6,7-8,4,
- The KmnO_4 consumption is low and varies between 8,3 and 14,9, which indicates on low contamination by organic components,
- The water is without taste and odour,
- Remained mineralisation is for Gračanica 240-1336 mg/l, for Srebrenik 184,5-612 mg/l and for Gradačac 96-496,5 mg/l. In municipalities of Srebrenik and Gradačac, the water samples satisfy the requirements according to regulations for hygienic drinking water, while municipality of Gračanica do not satisfy the requirements,
- Nitrogen compounds, were determined in low concentrations, and on the most sites it varies by 0-0,25 mg/l. In municipality of Gračanica on more sites in diged wells a raised concentration of nitrates were determined, what indicates on inaccurate water on these sites. Nitrite content is under 0,013 mg/l,
- Iron content for municipality of Gračanica is 0,5-3,0 mg/l, Srebrenik 0-0,45 mg/l and Gradačac – mg/l,
- Chlorides are in range from 7 to 48 mg/l, until the manganese is range under 0,05 to 0,18 mg/l,
- Total hardness of the water in in the range 4,82 – 43,01 mg/l, and calcium 8,81 – 245,75 mg/l.

4. CONCLUSION

Based on the results of the water in tested diged wells and its exploration area, it can be noted that the results of chemical analysis of the tested waters indicate that these waters meet applicable regulations and standards for water quality. The exception is a small number of samples taken from wells located in shallow parts of the aquifer in the vicinity of potential pollutants. Analyzing the results of water tests, it can be concluded that the individual exploration area (area of Srebrenik and Gradačac), has no significant difference in the quality of the tested well water. This suggests that in general the quality of groundwater collectors is constant, whereas in the municipality of Gračanica, given the genesis of water and location of wells, some of these waters do not meet all the indicators of quality. All the test results of water in diged wells, indicate that the tested water can be classified as suitable for water supply of population with drinking water. Of course when it should take account of their constant analysis in terms of physico-chemical and bacteriological characteristics, and in this connection be made permanent monitoring in order to preserve the water quality of diged wells.

5. REFERENCES

- [1] Alić, F., Pašić-Škripić, D., Žigić, I.: Hidrogeološke karakteristike bunara „Sklop“ u Gračanici s prijedlogom daljih istraživanja, Geološki glasnik br.36, Sarajevo, 2006.,
- [2] Arsenović, Ž., Žigić, I., Pašić-Škripić, D.: Model podataka podzemnih voda uskladen s okvirnom direktivom o vodi (WFB.2000/60/E.C.), II Savjetovanje geologa BiH sa međunarodnim učešćem, Teslić, 2006.,
- [3] Žigić, I., Pašić-Škripić, D., Alić, F., i saradnici: Studija s programom hidrogeoloških radova na zahvatanju podzemnih voda u cilju poboljšanja vodosnabdijevanja općine Gračanica (hidrogeološki dio); Sarajevo, 2008.,
- [4] Žigić, I., Pašić-Škripić, D.: Kolektori podzemnih voda tuzlanskog područja, Zbornik radova RGGF-a br. XXXI, Tuzla, 2007.,
- [5] Dokumentacija Zavoda za javno zdravstvo Tuzlanskog kantona, Tuzla 2008.

