

SOURCE PROTECTION OF GROUNDWATER IN URBAN AREAS

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ABSTRACT

Water supply and protection of water sources is a significant problem in most urban areas of Bosnia and Herzegovina. Groundwater sources were mainly formed outside populated areas, but the illegal building of settlements, came in the immediate vicinity of the source. In such situations, the provisions of the sanitary protection of existing water sources, it is necessary to record and analyze the existence of potential contaminants, and to define the safety of sources.

Problems are complicated by the fact that in Bosnia and Herzegovina there are currently only six of the vessels for the treatment of municipal wastewater, which included less than 3% of the settlements, and that the zone of sanitary protection in many cases, inadequately performed

This paper analyzes the complex issue of the protection of groundwater sources in populated areas.

Key words: groundwater sources, urban environment, pollution, sanitary protection zones

1. PROTECTION OF GROUNDWATER

At the Federation of Bosnia and Herzegovina (FBiH) 73.2% of the population is connected to a central water supply system where water is continuously reviewed for safety. Central City water supply in all the municipalities are the largest part of water infrastructure. Most of the central source of water supply has regulated first and second zone of sanitary protection, as well as modern way of chlorination. However, a central water supply facilities in the Federation have defined only the first zone of sanitary protection. Traditionally, local and mostly rural, are supplied from our own wells and local water supply. In these areas, chlorination of drinking water is not satisfactory. The second zone of sanitary protection is generally not defined, and individual water supply facilities (wells, cisterns), are often not regulated by any strict sanitary protection zone. Control of drinking water is usually reduced to a periodic review of the basic physico-chemical and microbiological parameters. Because of this, the law defines the obligations to be

done for all source zones of sanitary protection. Definition and implementation of sanitary protection zones of springs, as well as the implementation of protective measures in the catchment area to achieve the reduction of pollution and degradation of water and achieving good status of water. The same measures to protect ecosystems, and encourage social and economic development. In implementing these measures would ensure public participation in decision making, where to meet the obligations under international agreements that are binding on BiH. The law stipulates that the Protection Zone (zones of strict protection regime), protective zone II (a limited zone of protection), and Justine zone III (mild zone of protection). In the area of the Sava River Basin in the Federation of Bosnia and Herzegovina were identified by small bodies of groundwater for: Una River sub-basin, sub-basin of the river Vrbas, the Bosna River sub-basin with the immediate basin of the river Sava and the Drina River sub-basin. These waters are the basis for water supply 80% of the population of these areas. The sub-basin of the river Una, were established reserves amounted to 14000 l / s. The sub-basin of the river Vrbas were established reserves amounted to 6600 l / s. The sub-basin of the Bosna River, in the Federation, were determined balance reserves of 7300 l / s, and sub-basin of the river Drina, were established reserves amounted to 120 l / s.

2. EXAMPLE REHABILITATION MEASURES IN THE BASIN TO PROTECT SOURCE "BARICE"

Measures implementing the decision on source protection "Barice", were determined based on analysis of actual and potential pollution sources in the immediate catchment area, as well as analysis of the qualitative characteristics of water at the source. Appear above the allowed values of some chemical and bacteriological parameters in water, especially pronounced in the hydrological maximum, indicating the possible hot spots and determine priorities for implementation of rehabilitation measures. Therefore, based on the appearance of nitrite, iron and manganese, and defined the most important pollutants in the watershed. It is the use of fertilizers in agricultural activities, and draw the way the drainage of waste water from households. The complexity of the source protection, increased by the existence of heavily polluted river, which occasionally showered in the wells. River accepts much of the pollutants that occur upstream of the mine and two urban sites, and more rural settlements. Also the immediate catchment of the river Bukovica accepts contamination originated from the surrounding villages. In this complex situation, the application of legal rules related to the sanitary protection zone, it could lead to erroneous conclusions, and the authors felt that it was previously necessary to assess the vulnerability of groundwater above the space. Vulnerability of groundwater conducted the GOD-method, with special attention to the wide area of the source or aquifer recharge zone. Due to the geological composition of the terrain and the spatial distribution of pollutants, it was estimated that lead in this area are vulnerable and that it is possible to apply the methodology of determining the sanitary protection zone in accordance with national legislation. Regulations on conditions for the determination of zones of sanitary protection and protective measures for water used or plan to use for drinking, there are four types of sources. Based on previously conducted research works, and based on geological and hydrogeological characteristics of the area, the source "Barice" belongs to a group of underground sources of water in aquifers of intergranular porosity, which is determined by three zones of sanitary protection. In order to implement source protection and rehabilitation measures in the catchment area and the source, suggests the following:

- completely enclosing the space and safety I zone at the source Barice,
- marking of individual protection zones,
- addressing the gathering, transportation, treatment and disposition of municipal wastewater,
- measures for the protection of agricultural activities,

- removal of illegal dumping of solid waste collection and addressing solid waste,
- project development and establishment of monitoring of groundwater and surface water,
- implementation of specific controls in the area of.

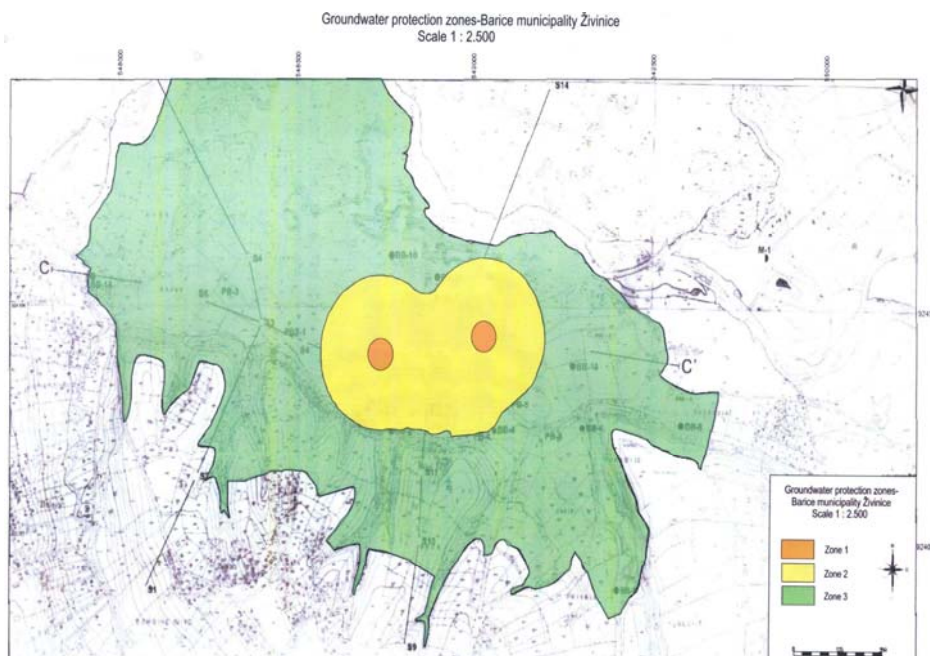


Figure 1. Groundwater protection zone s-“Barice” municipality Živinice

Due to the highly complex care conditions Basin rivers and streams Bukovica in order to change the constant monitoring of the quality, the water intake should be set up automated observation station with continuous observation of quantitative and qualitative parameters. It is necessary to continuously monitor the five water quality parameters, and turbidity, pH, conductivity, oxygen content and temperature, and addition and water level / flow of the river Bukovica. At the same profile should be performed, and periodic measurements of discharge, in order to establish a water level-discharge relationships, and structure flow curves. Besides this, it is necessary to establish a database that relates to the quality parameters and which will serve to establish trends, changes in the quality of drinking water as a basis for determining the main causes of these trends. In addition to the previously described monitoring is necessary to carry out regular sampling of physico-chemical and bacteriological quality testing in accordance with the Regulation on hygienic quality of drinking water. These analyzes need to include 30 water quality parameters that could be detailed to monitor changes in water quality and indirectly monitor changes in the watershed. Permanent control is necessary to prevent or promptly disclose all activities and processes in a catchment change that threaten the qualitative-quantitative characteristics of water Bukovica.

3. CONCLUSION

The problem of pollution of groundwater and geological environment, and their remediation, occurs as a part of the problem of protecting and preserving human environment. Groundwater that is widely used by us, as represented in the total water supply in a large percentage (80%), have in this regard special significance. Their protection from pollution and to protect the environment in which they exist and are renewed, it is very complicated because it is multidisciplinary. This is an important factor in urban planning, to construction of various types of objects, not to cause adverse impacts on groundwater quality. Therefore, the protection of water resources, particularly in urban areas, primarily obligations, which allows to identify possible risks, and thus determine the adequate protection. The environmentally complex areas, which have not yet been adequately addressed waste water in urban and rural areas, the authors suggest that pre-evaluate the vulnerability of ground water, and after that, with respect to the obtained score, performed to determine the zones of sanitary protection.

The sources of groundwater in urban areas are exposed to various negative influences, and it is necessary to implement a continuous monitoring of their quality.

4. REFERENCES:

- [1] Mešković M., Pašić-Škripić D., Sarajlić M., Bleković H.: Kvantitativno- kvalitativne karakteristike podzemnih voda, lokalitet Zatoča-Stupari , Zbornik radova RGGF Tuzla, br.XXXIII,ISSN 15127044, str.13-19, Tuzla, 2009.,
- [2] Pašić-Škripić D., Žigić I.:Ugroženost podzemnih voda kod izgradnje i eksploatacije saobraćajnica, VII Naučno-stručni skup sa međunarodnim učešćem "METALNI I NEMETALNI MATERIJALI" Zenica, ISBN 978-9958-785-10-8, COBISS.BH-ID 16628486, str.611-615, Zenica, 2008.,
- [3] Pašić-Škripić D., Žigić I., Srkalović D.: Ranjivost podzemnih voda područja sjeveroistočne Bosne, 38.konferencija o aktuelnim problemima korištenja i zaštite voda, VODA 2009, ISBN 978-86-904241-6-0, COBISS.SR-ID 16754124, str.243-249, Zlatibor-Srbija, 2009.,
- [4] Pašić-Škripić D., Žigić I., Srkalović D.: Ecological Apects of Traditional Drinking Water Supply by Shallow Wells in Nordwest Bosnia, 14.International Research/Expert Conference,Trends in the Developoment of Machinery and Associated Technology TMT 2010, ISBN 1840-4944, str. 333-337, Mediterranean Cruise, 2010.,
- [5] Pašić-Škripić D., Žigić I., Srkalović D.: Karakterizacija podzemnih voda sliva rijeke Save na teritoriji Federacije Bosne i Hercegovine, Zavod za vodoprivredu d.d. Sarajevo, 2009.
- [6] Pašić-Škripić D., Žigić I.:Elaborat vodozaštitinih zona izvorišta „Barice“ Općina Živinice, vodoprivredno preduzeće „Spreča“, Tuzla, 2011.,
- [7] Žigić I., Mešković A., Pašić-Škripić D.: Bodies of Groundwater in Trias Limestones in the Area of Kladanj, Technics Technologies Education Management, Vol.3, ISSN 1840-1503, str.2-6, Sarajevo, 2008.,
- [8] Žigić I.,Pašić-Škripić D.: Ranjivost podzemnih voda u stijenama intergranularne poroznosti tuzlanskog bazena, III Savjetovanje geologa BiH sa međunarodnim učešćem, ISSN 1840-4073, str.531-535, Neum, 2008.,
- [9] Žigić I.; Pašić-Škripić D., i drugi: Studija ranjivosti prostora Tuzlanskog kantona, (hidrogeološki dio), Bosna-Soil Services company, 2009.,
- [10] Žigić I., Pašić-Škripić D.: Ranjivost vodnog tijela podzemnih voda sjeverozapadnog dijela Tuzlanskog područja, 6.Naučno-stručni skup sa međunarodnim učešćem "KVALITET 2009", ISSN 1512-9268, str. 541-547, Neum, 2009.,