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Contaminants Action on Groundwater from a Placement from Baciu Commune, Cluj County

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Abstract

The purpose of this work is to identify the action of contaminants on groundwater by determining the physical quality indicators of groundwater related to the site located in Baciu Commune, Cluj County. The smallest variations in temperature values, depending on the sampling area, highlight the tendency of this parameter to become uniform at depths greater than 10 m.
Regardless of the depth, the minimum temperature values are related to the samples taken from the west direction, and the maximum to those taken from the south direction. This suggests the influence of terrain positioning on temperature levels. The groundwater conductivity determined according to the sampling depths has values in the ranges of 2.5 mS – 2.9 mS at a depth of 5 m, 62.6 mS – 3 mS at a depth of 7 m and 2.6 mS – 3, 1 mS at a depth of 10 m. Regarding turbidity, depending on the sampling depths, it presents values in the ranges of 0.85 UNT - 1 UNT at a depth of 5 m, 1 UNT - 1.4 UNT at a depth of 7 m and 1.3 UNT and 1.7 UNT at the depth of 10 m.

Keywords: environment, pollution, exploitation, sampling.

1.Introduction

Groundwater can be found almost everywhere. The water table can be deep or shallow, depending on several factors, such as the physical characteristics of the region, weather conditions, and rates of recharge and exploitation. Heavy rains can increase recharge and lead to rising water tables. But on the other hand, a long period of dry weather can cause the water table to drop [1, 3, 7]. When groundwater reaches an aquifer, it doesn't sit still. It will normally continue to flow, but much more slowly than before it reached the aquifer. How fast groundwater flows depends on the characteristics of the aquifer. The direction in which it moves is normally from high levels to lower levels governed by gravity, unless there is some anthropogenic impact such as pumping wells [6, 8].

Groundwater will move until it discharges into another aquifer or body of water, such as a lake, river, ocean, or until it is extracted by a well. To be able to store and produce groundwater, an aquifer must have certain physical characteristics [8]. It must have void space (pores or fractures) where groundwater can be stored and the spaces must be connected to allow it to flow.

Technically speaking, when spaces exist and are interconnected, the geological formation is permeable. When there are no spaces or they are not interconnected, the geological formation is impermeable. The higher the porosity and permeability of the aquifer, the more groundwater is stored and produces more than one aquifer [9]. The purpose of this work is to identify the action of contaminants on groundwater by determining the physical indicators of groundwater quality (temperature, conductivity, turbidity) related to the site located in Baciu Commune, Cluj County.

2.Material and Method

The experiment was located in Baciu Commune, Cluj County. The studied location has an area of 24,061m^2 and is located in the western part of Cluj-Napoca, on the left side of the European road E 81 from Cluj-Napoca - Baciu Commune. Groundwater samples were taken using a frequency-controlled submersible pump, Grundfos SPE. This is part of the category of groundwater pumps made of stainless steel. The pump motor is a permanent magnet type with high energy efficiency and operates with frequency regulation [5].

The physical indicators of groundwater quality quantified in the present study are: temperature, conductivity and turbidity. The samples were taken from three depths: 5 m, 7 m and 10 m, from 17 locations located on the site. Samples collected with the submersible pump with frequency control, SPE Grundfos were collected at the surface in plastic containers. Temperature, pH, conductivity and turbidity were determined in situ, with the help of a specific portable equipment for each parameter, during the period 9 – 22 May 2022. Temperature was quantified using the thermometer. The turbidity was quantified using the refractometric method [3], while conductivity was quantified using the electrochemical method [4], HI93703 turbidimeter was used for determination of turbidity, and HI 9829 Multiparameter was used for determination of conductivity, in the Laboratory of Groundwater Quality from UASVM Cluj-Napoca. The results of the analysis were compared with limits mentioned by national standards [2].

3. Results and Discussions

The average temperatures recorded on all three depths from which the samples were taken are in the range of 7.33°C - 10.67°C, with a difference of 3.34°C between the maximum and minimum values. This difference in temperature means exceeds the maximum difference of 3°C obtained for the 5 m depth, which we consider to be due to the stronger decrease in temperature with increasing sampling depth (Fig. 1).

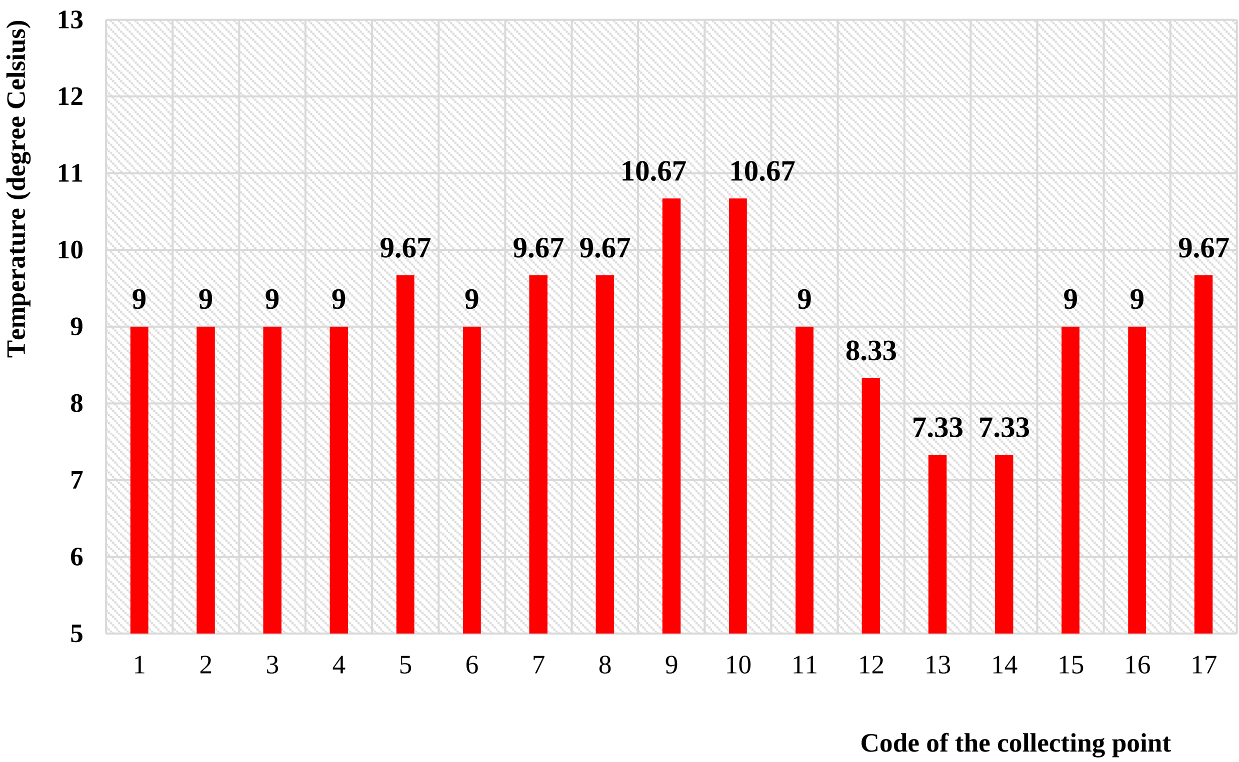

Figure 1. The mean of the water temperature (°C) recorded in 17 collection ponts located in studied area, for the 5 m, 7 m and 10 m depth

The average minimum temperature equal to 7.33°C is reported in two sampling points, respectively 13 and 14, corresponding to those located in the west direction. The average maximum temperature recorded in the experimental site is equal to 10.67°C and corresponds to sampling points with codes 9 and 10, which are located in the south direction. Out of all the sampling points, for 8 the average temperature corresponds to 9°C (Fig. 1).

The average conductivities recorded on the set of the three depths from which the samples were taken are in the range of 2.5 mS - 3.1 mS , with a difference of 0.6 mS between the maximum and minimum values. This difference in conductivity means exceeds the maximum difference of 0.4 mS found for the 5 m and 7 m depths, which we consider to be due to the accumulation of pollutants over time at this depth. The minimum average conductivity equal to 2.57 mS is reported in two sampling points, 13 and 14 respectively, corresponding to those located in the west direction.

The average maximum conductivity recorded in the experimental site is equal to 3 mS and corresponds to the sampling points with codes 8 and 9, which are located in the southeast inward and south outward directions (Fig. 2).

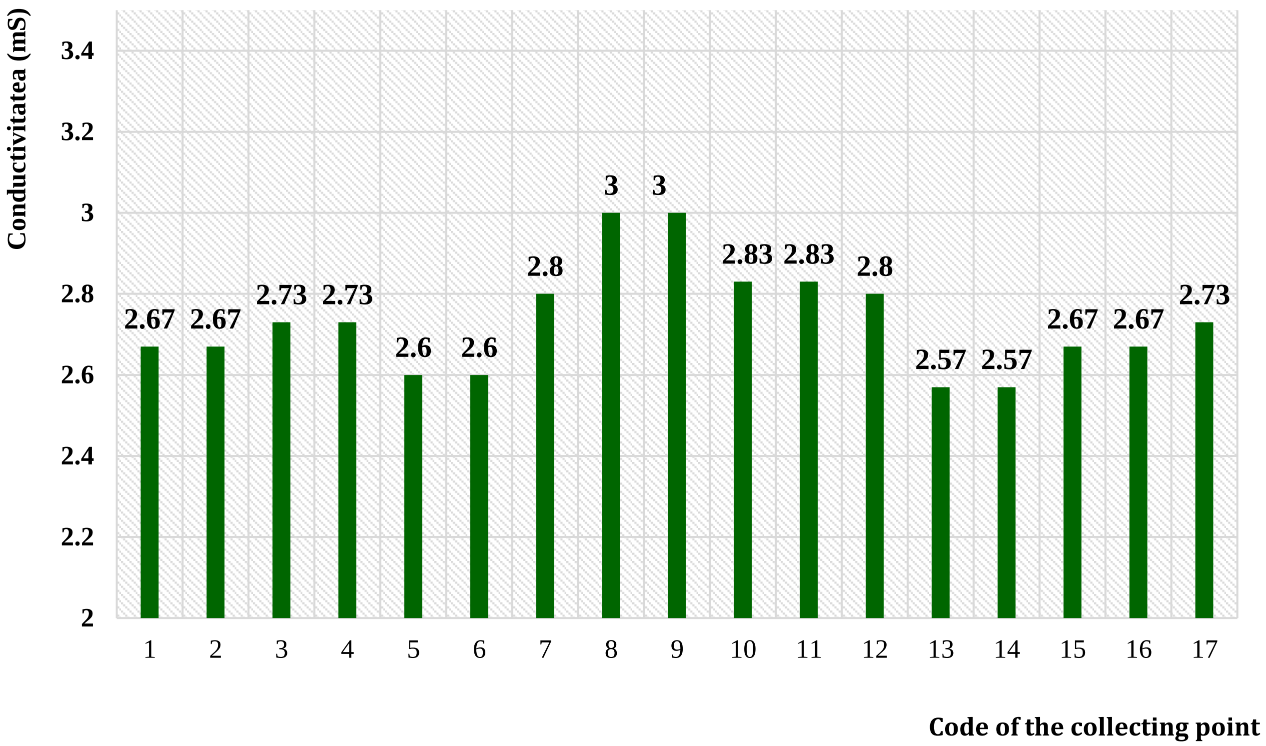

Figure 2. The mean of the water conductivity (µS/cm) recorded in 17 collection ponts located in studied area, for the 5 m, 7 m and 10 m depth

From the total sampling points, for 4 the average conductivity corresponds to 2.67 mS (Fig. 2). The turbidity averages recorded on the set of the three depths from which the samples were taken are in the range of 1.05 UNT - 1.36 UNT, with a difference of 0.31 UNT between the maximum and minimum values. This difference in turbidity means exceeds the difference of 0.15 UNT found for the 5 m depth, but is lower than that reported for the 7 m and 10 m depths, respectively 0.4 UNT (Fig. 3).

We believe that this fact is due to the stronger increase in the degree of pollution, which leads to the appearance of turbidity, along with the increase in the sampling depth, where over time, through leaching, more pollutants accumulate than at a shallower depth, where they are more easily removed by the penetration of meteoric waters.

The minimum average value of turbidity equal to 1.05 UNT is reported in two sampling points, respectively 13 and 14, corresponding to those located in the west direction. The average maximum temperature recorded in the experimental site is equal to 1.36 UNT and corresponds to sampling points with codes 9 and 10, which are located in the southern direction. From the total sampling points, for four corresponds the average temperature equal to 1.2 UNT (Fig. 3).

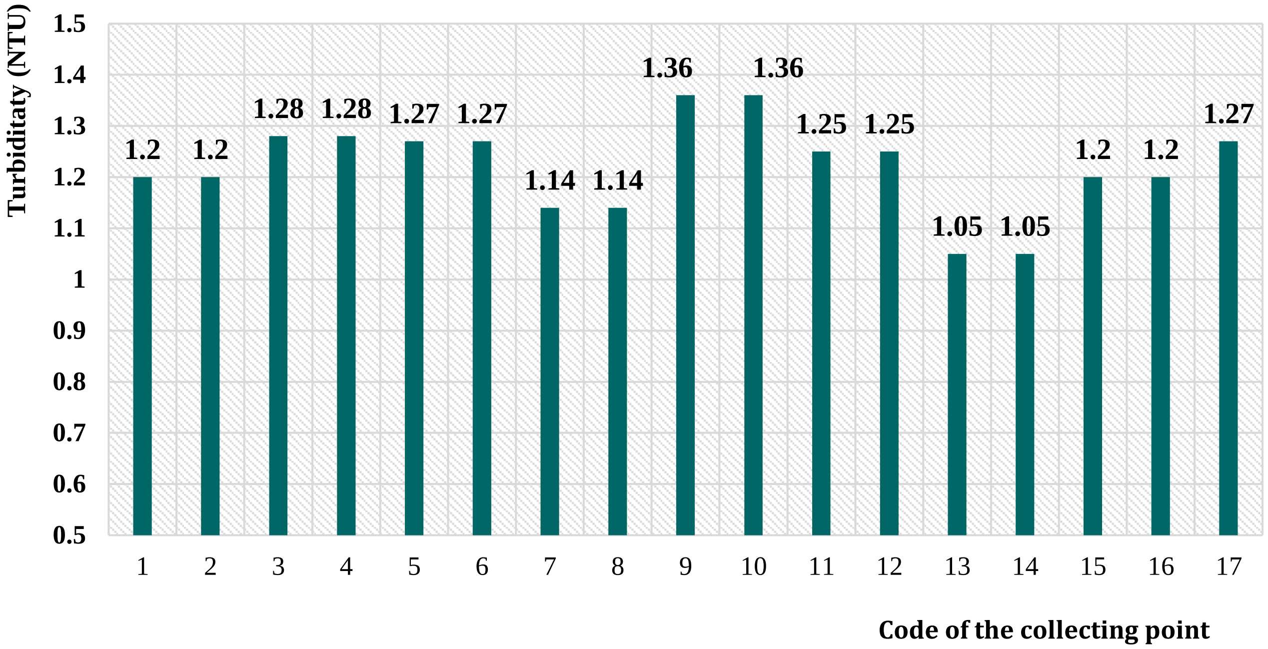

Figure 3. The mean of the water turbidity (NTU) recorded in 17 collection ponts located in studied area, for the 5 m, 7 m and 10 m depth

4. Conclusions

The determination in all sampling points of conductivity and turbidity values that exceed the maximum allowed limits (2.5 mS and 1 UNT respectively), we believe is due to a stronger increase in the degree of pollution with heavy metals, hydrocarbons and/or other pollutants, which leads to the appearance of turbidity with increasing sampling depth, where over time, through leaching, more pollutants accumulate than at a shallower depth, where they are more easily removed by the penetration of meteoric waters. Through the present study in which the physical indicators of water quality were identified from the site with an important history of pollution due to the operation of an industrial unit, it was concluded that turbidity and conductivity, for which values exceeding legal limits were reported, reflect the fact that the groundwater from the site studied are still under the influence of contaminants from the mentioned source.

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