THE QUALITY OF GROUNDWATERS IN THE INTERFLUVE TIMIS - BEGA CHANNEL DOWNSTREAM OF TIMISOARA - CASE STUDY COMMUNE PECIU NOU

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Abstract: *Study of groundwater quality assessment refers to the area studied in the interfluve Timis-Bega Canal. The official statistics show that for half of the rural population, the only source of drinking water are the individual household wells. The case study was carried out on Peciu Nou commune from Timis county. The area is primarily known for the historical pollution caused by nitrates from pig complexes of former Comtim, which has led to soil and groundwater pollution. Currently the main risk factors for nitrate pollution of groundwater are septic tanks and stables that lead to infiltration with nitrates and ammonia of the groundwater,and another risk factor is the agricultural activity by applying organic and mineral fertilizers. Soil and water pollution by nitrates became a highly debated issue in recent years especially after the entry into effect of the Nitrates Directive in 1991. Romania, as a member of the European Union must report to the communitarian committees about the nitrate pollution situation that respects the Nitrates Directive for promoting a sustainable and durable agriculture. In Romania the areas vulnerable to nitrate pollution in the last 20 years were based on the natural conditions of soil, terrain, climate and hydrogeology on nitrate transfer to the groundwater bodies and surface water and the nitrogen balance (nitrogen product by animal manure - nitrogen extracted from vegetable culture) at: communes, towns, municipal.The aim was to monitor potential areas vulnerable to nitrates, using predetermined indicators. For evaluating the quality of groundwater in the Peciu Nou commune, several measurements were performed to track the following indicators:water temperature, depth of groundwater layer, content of nitrogen, ammonia, chlorophyll and dissolved oxygen contents. Together with the measurements and observations about the local conditions were recorded the type wells, distance of wells to the stables or other potential source of pollution. The paper presents also the environmental conditions in the area studied, and some relations between measured values.*

Key words: *groundwater, nitrates pollution, vulnerable area*

INTRODUCTION

Water is a renewable natural resource, vulnerable and limited, indispensable for life and society, raw material for productive activities, energy source and route of transmission and determining factor in maintaining ecological balance. The waters are part of the public domain. Protection, enhancement and sustainable development of water resources are measures of general interest.

At the European Union level, legislative instruments were promoted for protection and for sustainable management of water resources. Among them, of special importance is the Framework Directive 2000/60/EC, which defines water as a heritage to be protected, treated and the preserved as such.

In rural areas, it is considered that 50% of households have their own water wells as the primary source of drinking water. Public wells provide an additional 10%. Only 28% of households are connected to the public water supply system. On the other hand, many of those

towns have no sewage system or waste water treatment systems (DUMITRU et al.,.2008).

Nitrates Directive (91/676/EEC) issued on 12 December 1991, aims at for the protection of waters from pollution caused by nitrates from agricultural activities. Nitrates Directive (91/676/EEC) issued on 12 December 1991, aims at for the protection of waters from pollution caused by nitrates from agricultural activities. An area vulnerable to nitrate pollution (ZVN) is defined as "the agricultural land area within the country by which drains the water spillage or exposed to diffuse pollution caused by nitrates and contributing to the pollution of these waters" (HG. 964 of 2000). Delimitation of areas vulnerable to pollution by nitrates from agricultural activities was one of the requirements for returning our country's accession to the European Union. In the area the commune Peciu Nou there is a historical pollution caused by nitrates from livestock farms and complexes (COMTIM, IAS, CAP), which has led to soil and groundwater pollution (BORZA et al.,2010).

The area of research is located in the Timis Plain part of the the Banat Plain. Timis Plain normal characteristics have low fluvial plains of accumulation ramble, called by V. MIHAILESCU (1966) recent flood plain. Digression plain character is given by a very low slope of drainage (0.15 to 0.45 m / km), very low depth of groundwater, which causes wetlands, valley marshes and brooks abandoned. The Timis Plain is situated at the interference of continental air masses, with origin and character western continental, eastern origin, plus the warm air masses, south, crossing the Mediterranean Sea. This kind of air masses imprints a temperate climate with a moderate degree of continental (IANOŞ G., 1995, 1997, POSEA G., 1997). Average yearly temperature is situated between 10-11^{0}C(10,8^{0}C in Timişoara). The value of yearly rainfall is 597.7 mm. Evapotranspiration value is higher than the rainfall, making it a vulnerable area, that increases the risk of pollution caused by nitrates.

MATERIAL AND METHODS

Two NUTS4 administrative units, vulnerable to nitrate pollution, from Timiş Country, have been chosen as case studies Peciu Nou. For this paper, the Peciu Nou measurements were done for 11 locations (wells, drills and public water system) in April 2011(Table 1). Most wells are used for agricultural purposes, especially for irrigation of home vegetable gardens and few for drinking water.

The objective of study was to determine the physico-chemical indicators of water from wells and drills located in the commune Peciu Nou. Parameters followed were: water temperature, groundwater depth, groundwater thickness, ammonia and nitrates amounts, water pH, chlorophyll content and dissolved oxygen content. It was taken into account the type of construction of the wells, the distance from the stables or other potential sources of groundwater contamination. The mentioned indicators were directly determined with the help of multiparameter probe of type Hydrolab DS5 Water Quality Multiprobes Sonde.

Table 1

Number of wells for each village in Peciu Nou Communa

Nr. crt.	Village name	Number of measurements				
		Total	Field wells	drilling	personal wells, unused well	public water system
1	Peciu Nou	11	1	3	6	1

Interpretation of ammonia and nitrates content from groundwater has been made according to the Low no. 458/2002 of Romanian Parliament regarding the quality of potable

water and establishing the Maximum Contaminant Level as being 50 mg/l NO_3 and 0.5 mg/l NH_4.

RESULTS AND DISCUSSIONS

Peciu Nou is situated in a vulnerable to nitrates pollution area. The Action Plan estabilished by The Ministry of Agriculture and Rural Development, recommends for this commune maximum 3.2 UVM/ha. The nitrates balance, defined as difference between the input nitrogen amount from organic fertilizers and that extracted by crops from soil is -267.043t/year, representing -33 kg N/ha/year. The corrected nitrates balance (due to households input) is -204.721 t N/ha, or -25 kg N/ha/year (SIMOTA, 2008). A main cause of nitrates pollution of soil groundwater is its relative slow gradient of flow and its relative small depth, the groundwater table being near the surface.

The main parameters measured for the 11 locations are presented in Table 2, being accompanied by some notations regarding evry location and owner, distances from a potential source of pollution, respectively if the water is drinkable or not.

Table 2

Nitrates Measurements in the wells for Peciu Nou

No	Village	Elevation	Ground water thickness (m)	Depth to WT (m)	Temp (°C)	NH_4 (mg/l)	NO_3 (mg/l)	pH	CHL	Notes
1	Peciu Nou	88	1.68	4	9.70	0.22	1.75	8.24	4.570	field well
2	Peciu Nou	88	0.88	3	9.76	0.13	86.32	8.89	2.290	personal well, near the road
3	Peciu Nou	88			12.09	0.15	>100.00	7.83	0.230	drill
4	Peciu Nou	88			10.96	0.08	6.23	8.21	0.950	public water system
5	Peciu Nou	95	1.35	2	9.87	0.24	28.06	9.19	2.540	unused well
6	Peciu Nou	87	0.78	2	10.30	0.23	>100.00	8.16	1.320	personal well
7	Peciu Nou	89	1.80	3	9.72	0.89	53.35	8.30	1.120	unused well
8	Peciu Nou	89			12.18	1.72	>100.00	7.60	0.040	drill, 15m
9	Peciu Nou	91	1.00	4	9.35	3.73	>100.00	9.30	3.980	unused well, with bricks
10	Peciu Nou	94	1.31	4	10.71	4.07	>100.00	8.88	0.890	personal well, with bricks
11	Peciu Nou	87	2.08	3	11.78	0.88	71.95	8.30	0.520	drilling; poultry

Analytic values obtained and presented in Table 2 show that water is more contaminated in the lower locations than the highest points. The body of water level has a range betwen 2-4m, and the thickness varies between 0.78-2.08m of water in 11 locations. The water temperature is within acceptable limits for consumption in all sampling points.

Maximum Contaminant Level of NH_4 (Fig. 1) is exceeded in five locations, they are from unused drills, and one of them is a private well.

Table 2 shows that the pH indicates a slightly alkaline reaction to alkaline, that lies between 7.60 to 9.30. It should be noted that in the public supply system there were no recordings about the exceding values of nitrates and amonnia and the values are below the level of Maximum Containtement Limit (Law 458/2002).

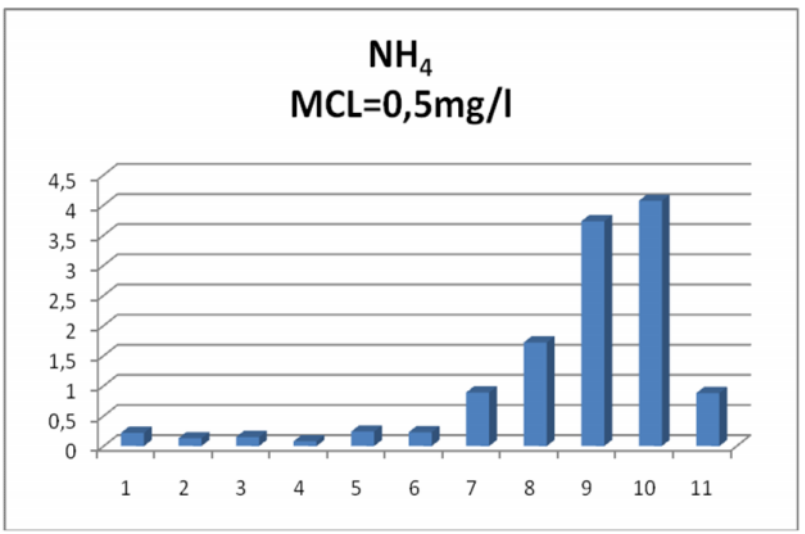

Fig. 1 NH_4 value for Peciu Nou commune, Timis County

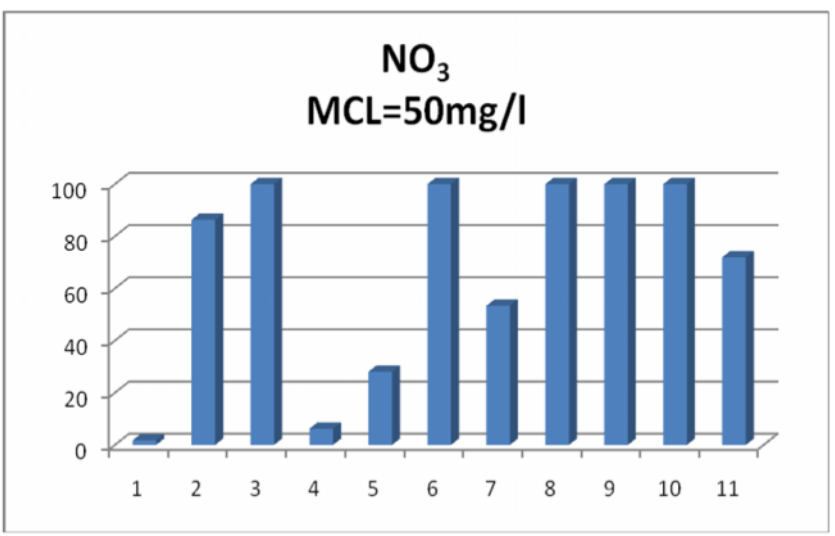

Fig. 2 NO_3 value for Peciu Nou commune, Timis County

The main problem is at NO_3, of 12 locations (Fig. 2), eight presents exceeding and five wells has values over 100mg / l. These drills are located near pollution sources (stables, latrines, etc.). The high level of NO_3 is much over the Maximum Contaminant Level (50mg/l), at the majority of the sampling points which makes the water from these drills undrinkable.

From Table 2 also results that the pH of water in many wells is slightly alkaline.

CONCLUSIONS

From the measurements made at NO_3 and NH_4 in most of the locations these indicators have exceeded the maximum admissible limit (50mg / l) of nitrates, respectively (0.5mg / l) for ammonia in groundwater.

Nitrates have very high values in five location (over 100 mg / l), knowing that the the maximum admissible limit is 50 mg / l, and ammonia with high values with values between 1.72-4.07mg / l in three locations.

The commune Peciu Nou is vulnerable to nitrate pollution, from this results that it is necessary a plan of action to protect groundwater and their decontamination. It should be noted that the drillings on the agricultural land, nitrates have a low value in groundwater, it is between 1.75-11.46mg / l. Low levels of nitrates on the agricultural land is due to the fact that in recent years it was poor fertilized, with both organic and chemical fertilizers as well. The problem of ammonium and nitrate pollution is more evident within the village, where in most locations the source of pollution are septic tanks and stables which lead to ammonium nitrate infiltrating in the groundwater.

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