

THE MANAGEMENT OF THE WATER RESOURCES IN THE GILORT HYDROGRAPHIC BASIN

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Abstract

A study upon the underground waters in a hydrographic basin is based on two aspects, each with equal importance: the physic-geographical aspect is represented through the direct influence of the surface underground waters on the flowing and the economical aspect represented by the potential of the fresh and mineral waters. The surface underground waters are very abundant in the mountain area, where the precipitations are above 1200 mm/year. This is the origin of the main river sources in the Gilort hydrographic basin. In the piedmont and the subcarpathian area, the surface underground waters which are intercepted through the wells depend on the rains, a lot of them being dry during the summer and the autumn. The deep underground waters represent the main source of fresh water and industrial water for the population and the economy of the studied area. Until today there have been made 98 drills (50-350 meters deep) with a potential volume of 624 l/s. The deep aquifer deposits belong to the Pliocene period and are composed from sand and gravel. There are three main areas with deep drills: Tg-Carbunesti, Socu and Turburea. The water from these drills is of the first category of quality. In the area of the subcarpathian hills of interior (Ciocadia and Sacelu) there are mineral water springs with therapeutic properties known and used since the roman period.

Keywords: subterranean waters, drills, mineral water springs

The issue of the management and the exploitation of the water resources became important for the interested institutions after the year 1950 and has been determined by the industry progress, the appearance of the irrigation systems and the fresh water demand, especially in the urban area (Gâştescu, 2010).

1. THE EXPLOITATION OF THE HYDRO ENERGETIC POTENTIAL

During the years 1963 and 1973 appeared the first systematized plans for a national hydrographic network. The building of the artificial lakes and the complex exploitation of the water potential, the appearance of the great hydro energetic systems, with a lot of dams and connections between the hydrographic basins have determined very important changes in the liquid and solid flow. The elaboration of the Lotru hydro energetic system (Vidra dam) also included in the project dams from the other basins: Jiul de Est, Galbenu and Oltet. Because of the management of the volumes from the upper basin of the river Galbenu (average exploited volume of 1m³/s), the natural flow at the hydrometric station Baia de Fier has decreased by 50% from an ecological and hydrological point of view, the negative aspect of this dam is the fact that it does not insure a minimal volume and because of this the river is dry downstream from the Galbenu and Musetoaia dams for over 1 km (foto 1).

The absence of the minimum volume appears on the Gilort river in the Novaci city area, on a 9.2 km length, where the function of the 5 micro hydro electric power plants is insured by an underground exploitation on the Gilort river. The hydro energetic potential of the Gilort river is exploited in a small percentage through the 5 micro hydro electric power plants which have an installed power of 8.49 MW (table 1).

Table 1 – Micro hydro electric power plants on the Gilort river

Micro hydro electric power plant	Year PIF	Q _{med.} (m ³ /s)	Q _{inst.} (m ³ /s)	H _{brut} (m)	P _{inst.} (kW)	E _{estimated} (MWh/an)
Novaci 1	1939	3,4	2,5	50	840	2000
Novaci 2	1985	3,8	6,4	48	2200	6000
Novaci 3	1986	3,8	6,4	46	2160	5600
Novaci 4	1987	3,8	6,4	45	2160	5.200
Novaci 5	1992	4,6	5,2	33	1130	3.800
Sum	-	-	-	-	8490	22600

During the Second World War, the germans have built the first hydro energetic power plant on the Gilort river (during 1939) with a power of 0.89 MW, which has been functioning continuously until today. Between the years 1985-1992 four more hydro electric power plants have been built in a string. In this way

the low and medium volume of the Gilort river, is taken by a metal pipe protected by concrete, on a 9.2 km length. Upriver from Pesteră Muierii, on the Galbenu river, there is micro hydro electric power plant without an artificial lake and dam, which does not have a great impact on the flowing conditions of the river (photo 2). The hydro energetic potential of the Gilort river has not been very much exploited, but nowadays there are a lot of projects to build some hydro energetic power plants on the Gilort river and its affluents from the mountain area. A group of Italian investors from the Trento region are going to build a number of micro hydro electric power plants on the Gilort river, upriver from the Novaci city where the potential offered by the volume and the slope is important. The fact that the terrains are close to the private areas is a problem for the concession of the river sections towards the companies interested in building the micro hydro electric power plants. In time, the water force, especially in the subcarpathian area and when leaving the mountain area has been exploited by the numerous mills that can be found almost in every village. Nowadays there is only one water mill that is still running, on the Blahnița river in the Crasna village, in the area where the river exits the mountain area (photo 3).



Foto 1. „Anthropic drying ” on the Galbenu river



Photo 2. Water deviation for the micro hydro electric power plant at Baia de Fier Photo 3. Crasna water mill on the Blahnița river

2. THE USE OF THE FRESH AND THE INDUSTRIAL WATER

In the year 2008 was finalized the Management plan for the river Jiu hydrographic basin, which contained 13 chapters, including the general presentation of the basin, the description of the surface and subterranean waters, the monitorisation and the characteristics of the state of the water, the environment objectives, an economical analysis, a projects plan, quantity aspects and climat changes.

Regarding the the access to fresh water it is important to mention the fact that the system of water exploitation is expanding. The management plan is focused on the different types of polution on the water courses and because of this the implementation of a sewage system in every town, of a purification station for used water become difficult to realize until 2015, which id the deadline for the project. The diversity of the landscape, the fact that some towns are at the limit between two hydrographic basins cause more difficulties for the realization of the sewerage systems.

The environmental objectives for the water resources of the Gilort hydrographic basin have not shown a deterioration of the ecological and the chemical state; it also didn't reveal water courses that have been dramatically changed. The fresh water resources offered by the area in which the Gilort hydrographic basin exists are above the population's and the economical needs. If we consider the figure of 150 l/day person as an average quantity, we find that the existing drills alone provide a volume of 0.624 m³/s and a quantity of 735 l/day person. The Gilort river, together with the rivers Galbenu, Ciocadia and Blahnita produce at the exit from the mountain area a volume of 7 m³/s (220,8 mil m³/an) of fresh water which is of very good quality. The only community that takes it's fresh water from the hydrographic resources is Crasna, where a feed pipe has been built on the Blahnita river, before it comes out of the mountain area.

Fresh water supply systems, relying on sources coming from the mountain area have been built in Novaci, Baia de Fier and Ranca. The town of Novaci (6105 inhabitants) takes its water from the sources Cerbu, Tolanu and Bercești, which have together a volume of 20 l/s. The water from the three sources reach the reservoirs in the North part of the town, at 700 m of altitude, from where it is distributed with the help of the gravitation.

The mountain resort Ranca, where during the last 10 years the number of hotels, motels and villas has increased a lot, takes the fresh water from the sources located in the Tidvele glaciary valley. Because the old installation was too small, three years ago a new one has been built, doubling the quantity deposited in the reservoirs. The biggest problem of the Ranca resort is the fact that a sewage and a purification station will be very hard to build. The position of the buildings on the left side of the Galbenu river and on the right side of the Gilort river, the absence of a systematization plan until 2005 makes it impossible to connect a lot of motels and villas to a sewerage system. Apart from the impact upon the environment caused by the existence of the access roads and the buildings, the fact that the garbage is being dispersed in the environment, together with the used water is a phenomenon that has to be stopped. The towns situated in the middle and lower basin of the Gilort river depend for their fresh water on the drills and fountains. Sacelu takes the fresh water from the 2 intakes located in the Crasna Depression, which come from the interception of the underground course of the Blahnita river (photo 4).

The only village that doesn't have yet a fresh water supply system is Jupanești, where the inhabitants use the water provided by the 522 wells. The drills made underground (50-350 m) between Campu Mare and Tantareni provide high quality fresh and industrial water for the entire area (photo 5).



Photo 4. The water reservoirs used by the Sacelu village Ciocadia village)

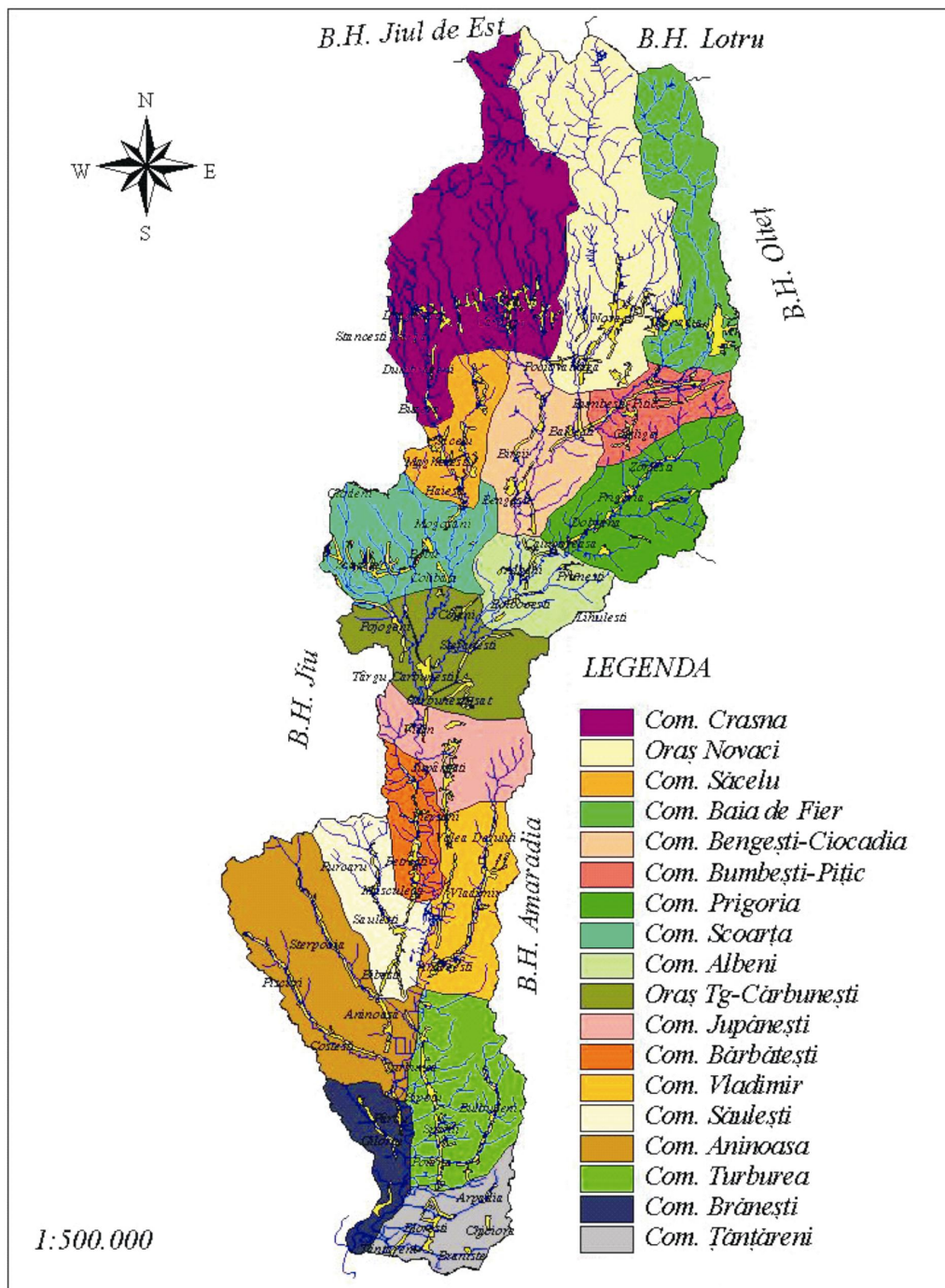


Photo 5. Water basins from Câmpu Mare (for Bengești-

The industry is represented almost exclusively by mining and extractions(coal, oil , natural gas) and the total number of inhabitants is 73367, with an average density of 54 inhabitants/km². The station where the gases are transformed in Turburea (that uses water from the drills) is the only one with a constant activity that does not have the possibility to recycle the water, an because of this it evacuates in the environment the used water (10 l/s) that has a lot of chemicals (Na, Cl, S). The city of Târgu Cărbunești (8699 inhabitants), which depends on the water from the drills and does not have a recycling water station, uses a volume of 25 l/s. The used water coming from the houses, the hospital, car washing are being evacuated directly into the Gilort river.

Out of the 18 towns in the Gilort hydrographic basin (fig. 1), only the towns of Novaci and Târgu Cărbunești have a sewerage system. Jupânești village is not included in this statistic because it does not have

a fresh water system. The other 15 villages did not have fresh water systems as a priority until today, even if they have achieved that in almost all the communities. There are a lot of projects and the work has started for the impementation of a sewage system. In Aninoasa village 2 water recycling stations have been finished and will be functional soon. (photo 6).



Until the year 1989, the terasses on the Gilort river, between Câmpu Mare in the North and Tântăreni in the South, there where a lot of irigation systems. Later on these systems were destroyed and the use of water in agriculture in a centralized system has disapperaed. A part of the underground volume of the Blahnita river in the Crasna depression, a river course that reappears in the Southern part of the depressionis being used by some owners of fish farms, because it is a cold water that has a high quality. For a better management of the flowing in the Jiu hydrographic basin, especially during the periods with a higher flowing quantity, during the last 2 years as part of the DESWAT programme, within most of the hydrometric stations (including the 6 ones in the Gilort hydrographic stations) automatic stations have been installed. They incorporate sensores that measure water level and temperature, air temperature and an automatic (photos 7 and 8).



Photo 6. Aninoasa water recycling station



Photo 7. Ciocadia automatic station



Photo 8. Săcelu automatic station

3. THE EXPLOITATION OF THE MINERAL RESOURCES IN THE GILORT HYDROGRAPHIC BASIN – THE IMPACT ON THE WATER RESOURCES

The mining industry, that has been expanding in the mountain area (graphite extraction) near the confluence between the Gilort river and the Jiu river (gas probes) has had the greatest impact on the underground waters. The exploitation of lignite in the central-eastern time of the Gilort hydrographic basin, underground (the Albeni mines) and above the ground (Negoișți, Seciuri, Ruget) has caused important modifications of the underground waters. Water infiltrations in the all the mines represented a major difficulty for the coal exploitations. Carierele pentru exploatarea lignitului, located on the limit between the Câlnic and Amaradia river basins, in Burlanilor Hill, have affected the underground waters and the flow down the hill because of the large surface and the depth of the excavations (photo 9).

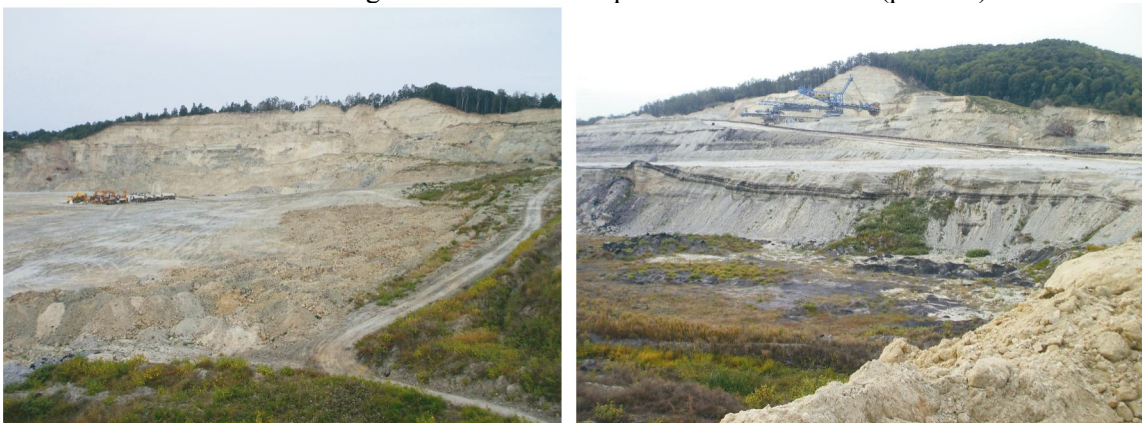


Photo 9. Lignite quarries in Ruget-Seciuri area

The accumulation of the sterile in the torrential valleys in the area has determined the appearance of several small lakes. The clay and the marl which are the dominant rocks have created the conditions for the apparition of land slides on large surfaces, including inside villages, a situation that has caused the apparition

of a new settlement in the Cămpu Mare depression where the inhabitants of the Seciurile and Burlani villages have been relocated. (photos 10 and 11).



Photo 10. Seciurile village – houses affected by the land slides

Photo 11. Cămpu Mare depression – the houses of the people relocated from the Seciuri-Burlani area

The building of the railway on the left side of the Calnic river, the concrete roads, the coal deposits have all influenced the surface flow and the surface underground waters. The oil extraction, largely done in the Campu Mare Depression (photo 12), by the drilling process, by the transportation piping system, by the pollution of the soil, of the surface underground waters (photo 13), influences the water resources on the entire area. In the case of the pipes that are placed underground they represent important obstacles and influence, in this way, the evolution of the thalweg and the lateral erosion. (photo 14).



Photo 12. Cămpu Mare depression –oil wells field



Photo 13. Oil products pollution

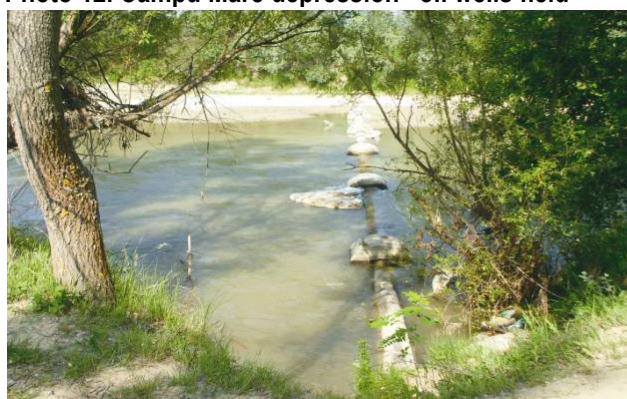


Photo 14. Gas pipe – crossing under the Gilort river at Turburea

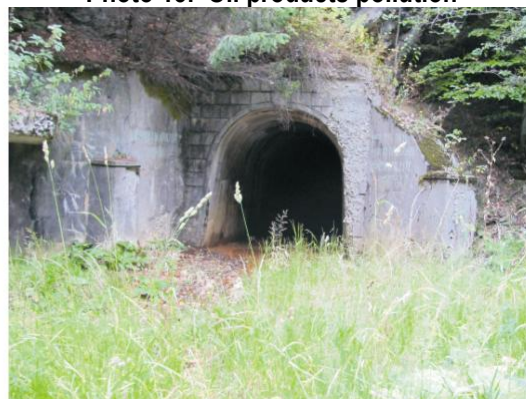


Photo 15. The entrance of the old mine (Baia de Fier)

The oil well gas deposits, together with the oil deposits and the salt water deposits are being exploited in the Jiului Hillocks and Amaradia Hills. The exploitation, the transport, the and especially the evacuation of the used waters have an impact upon the surface and the underground waters. The elevated pressure that exists within the deposits, sometimes leads to explosions during the drilling: in 1987 at Colțești in Amaradia basin occurred a true ecological disaster after an explosion when hundred of hectares were covered by water that was very salty. The equilibrium in the soil and vegetation are not yet regenerated after

all this time. In the mountain area, on the Galbenu river valley, North from Baia de Fier, between 1948-1994 was active the only graphite mine in the country (photo 15).

The washing of the graphite after being taken out to the surface represented an important environmental issue for the Galbenu river because of the high quantity of suspended silt (graphite dust) deposited on the river bed when the water level is low. The pits located on the Gilort river and its' main affluents have significant influences upon the evolution of the river beds and the flow. The great volumes of ballast (hundred of thousands of m³) extracted from the minor and major river beds and the deterioration of the margins and the vegetation because of the acces roads, accelerate the erosion of the margins and of the thalweg. The places where the aggregates are being exploited and sorted in the minor river bed modify a lot the turbidity of the river, increasing this way artificially the silt quantity (photo 16).



Photo 16. Deposit of sand extracted from the Gilort river bed in Cojani

CONCLUSIONS

Water resources in the Gilort hydrographic basin have an economical importance by the hydro energetic potential, by their use as fresh and industrial water and their role in the development of the balneary tourism. The Gilort river, in the mountain area has a high hydro energetic potential that has not been used until now, but there are projects and micro hydro energetic power plants that are being built. As far as the use of the fresh and used water is concerned, we notice that of the potential of the surface water and the underground water is above the social and the economical needs of the towns located in the Gilort hydrographic basin and the fact that the water belongs to the 1st quality group. The industrial activity (the extracting industry of lignite, oil and gas) influences in a negative way the underground water resources (by the surface and deep underground water) and the above the ground water (by accidental pollutions).

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