UNIVERSITY OF CRAIOVA **Series: Geography**
UNIVERSITATEA DIN CRAIOVA **Seria: Geografie**

Vol. 10 (new series) – 2007
Vol. 10 (serie nouă) – 2007

DISPARITIES IN THE WATER SUPPLY SYSTEM – WASTE WATER SEWERAGE IN FILIAŞI

Oana IONUŞ[1]

Abstract. Presently, the water supply and sewerage works in Filiasi town are operated by AQUATERM Filiaşi. But, due to some disfunctions in this system of infrastructure, the management of water resources at the level of the town is deficient. This fact is due, on one hand, by the quality of underground waters which do not comply because of the increase of the ammonia content over the admissible limits, and, on the other hand, by the quality of underground water which have a high content of iron and sulphur as they are in direct contact with the coil layers. Hereupon, the potable water supply for Filiaşi town is performed directly from the adduction pipe from Izvarna. The present paper aims to identify the disfuctionalities inside the water management system (under-dimensioning – the degradation of the existing networks and the low capacity of the waste water treatment plant) and in the same time to offer solutions for a better operation, because by improving the infrastructure for the water supply system, for the sewerage networks and waste water treatment plant will determine the rise of the quality of the environment factors and the life standards.

Key words: underground water, water supply, waste water, sewerage – discharge, waste water treatment plant, disfunctions, Filiaşi

INTRODUCTION

The administrative territory of Filiasi town (Filiasi and other six belonging villages: Uscăci, Branişte, Fratoştiţa, Almăjel, Răcarii de Sus and Bâlta) occupies the valley of the Jiu river downstream of the junction with its tributaries the Gilort and the Motru rivers and the adjacent interfluvial areas.

The system of terraces of the Jiu river are present only on the left side of the valley. At the meadow level the depth of the piezometric level (Np) of underground water ranges between 1.75 m on the right side of the river and 2.50 m on the left side.

The terrace of 15 – 20 m relative altitude enlarges as a broken step from the eastern limit of Filiasi town to Răcarii de Sus. Eastern of Cârneşti valley the terrace tightens and rise to 35 – 40 m altitude where it is made up by colluvials.

The terrace of 65 – 75 m relative altitude appears only in Răcarii de Sus and Răcarii de Jos. Between the Fratoştiţa and the Răcărele valleys, north-west of Răcarii de Jos. The passage to the lower terrace is generally smooth.

[1] The Faculty of History, Philosophy, Geography, University of Craiova

The terrace of 70 - 80 m is present only between Fratoştiţa and Filiaşi, being hardly fragmented by ramified gulches.

At the level of the lower terrace, where it lies approximately the entire administrative perimeter of Filiasi, the depths of underground waters are of 7.40 – 8 m, and on the upper terrace the depth goes up to approximate 15 m.

In this area (the Jiu meadow, the terraces and the front part of the interfluvials on both sides of the river), the relief evolves on a horizontal lithological structure of low hardness (sand, clay, marl and loess) where the characteristics are imposed by the rock and the complex processes which take place on their surface (pluviodenudation, land slides and collapses).

The permanent hydrographic network is represented by the Jiu river located westward of Filiaşi having a medium draining slope of 0.5%. There are added numerous hydrographic organisms having a semi-permanent character (most of them with springs in the area of the piedmont): the Fratoştiţa Valley, the Furrow Negraia, the Cioranu Valley, the Cârneşti brook and the Corbului Valley (tributaries on the left side of the Jiu river); the Bâlta and the Miclea Valleys (tributaries on the right side of the Jiu river).

Regarding the surface water flow, the Fratoştiţa, the Negraia and the Cârneşti valleys have a torrential regime and, under certain conditions, they can cause even flood which affect the industrial objectives and the dwellings located in the perimeter of Filiasi locality. Therefore, on the respective valleys are proposed to be built up dykes made up of local materials, in order to obtain three temporary accumulation lakes to reduce the possible flood waves (Fig. no 1).

Besides, the three valleys (the Fratoştiţa, the Negraia and the Cârneşti) in the perimeter of the meadow of the Jiu river were, in time, regulated in order to assure a drainage directed towards the collector.

To these there are also added the important modification concerning both the direction (flow direction), and as well as the antropic modifications of the water surface quality on the the Fratoştiţa, the Negraia, the Cioranu rivers and the Cârneşti brook, which in the area of meadow, although regulated, take over from the urban area a series of waste waters which they discharge directly into the Jiu river.

The quality of phreatic waters taken captured from the Jiu meadow complying as potable water at the beginning of the exploitation for Filiaşi water supply, in time they became improper because of the high content of ammonia over the limits tolerated by STAS 1342, a fact which led to the abandoning of the respective wells and pass to the water supply from the Izvarna pipe.

The ground waters are generally under pressure, some of them becoming artesian waters in the area of the meadow. The quality of ground waters complied as drinking water, only for those located above lignite layers, the others, as they come into contact with the coal beds, have a high content of iron and sulphur.

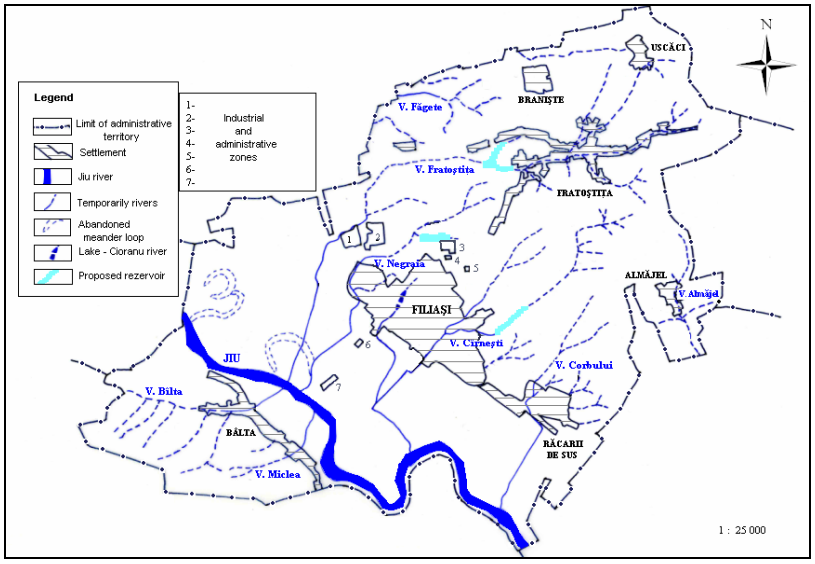

Fig. no 1. The hydrografic network from the administrative territory of Filiaşi town
(Processed after the PUG of Filiaşi town, 1:25 000)

METHODS

Using an economic-territorial model (based on POPOLE Model - "The Politics of Water Polution" *Ioanid V., 1991*), adapted to the specific of water protection and their management in an urban environment, the following aspects can be identified in Filiaşi area:

1. the characteristics of water supply (the existing quantity of potable water; the possibility to increase the quantity of available water);
2. the characteristics of water demand (variation in time, peak consumes, territorial repartition, the density of consumers and their evolution);
3. the external restrictions (technical factors – the level of catching, pumping and treatment techniques and the demographic factors – the urban environment and its evolution).

The analysis of water supply system in Filiasi town

The water supply system of an urban centre encloses the following stages: catching, transport, treatment, pumping, storage and distribution. Regarding the Filiasi locality, presently, the water supply and sewerage works are being exploited by AQUATERM Filiaşi.

The first water supply works for the town (drilled wells, repumping station, pressure pipe, distribution network) were performed during 1978-1981.

Until 1990, the water supply of Filiasi was provided by 5 wells from the phreatic horizon of the Jiu meadow together with water form the Izvarna pipe.

In 1990, The Sanitary Inspection forbade the use of the water from the respective wells and the town water supply has been provided since then only from the Izvarna pipe.

To this pipe are connected only a part of the individual households, the blocks in the central area, the objectives of public interest and the industrial units (Fig. no 2). The rest of the individual households are being supplied from the phreatic horizon through their own wells.

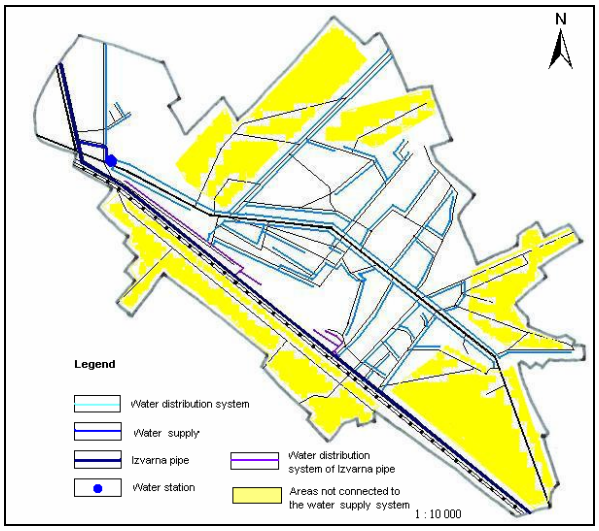

Fig. no 2. The water supply network of Filiaşi town and the non-connected areas
(processed after the Documentation for the the management of water in Filiaşi town – Water supply network, 1:10 000)

An water supply of an urban centre must satisfy the household, public and industrial needs and the necessary quantity for fire extinguish (Trofin P., 1972).

In the case of Filiasi locality, the requests of water flow were determined analytically, differentiated for each use, for the following categories of consumers (Aquaterm Filiaşi):

1 the household needs of the population:
   - population living in block of flats – 5 500
   - population living in individual houses;
     - already connected to the water network 2000
     - who is going to be connect 1000

2 public needs
   - the prosecutor's office, the law court, the town hall etc – 200 employees
   - schools and kindergardens – 3500 students
   - hospital – 70 employees, capacity/ number of beds – 100

3 production units – 350 employees

The demands of water flow calculated for consumers, as presented above, are:

$$Q_{s\ day\ app} = 1390\ m^3/\ day = 16{,}10\ l/\ s$$
$$Q_{s\ day\ max} = 1\ 810\ m^3/s = 21,\ 00\ l/\ s$$

The water flow taken from Izvarna pipeline is:

$$Q = Q_{s\ day\ max} + Q_{small\ reff} = 21,\ 0\ l/\ s + 6,53 = 27,\ 53\ l/\ s$$

The water is distributed directly from Izvarna pipeline:

1 under normal consume – 31,70 l/ s
2 during fires – 53 l/ s.

From the Izvarna pipeline, the water goes into the water distribution network of the town as follows:

- during summer time, when water consumption is higher and the pressure losses raise, the water from the Izvarna pipeline the water gets into the buffer basin located in the premises of the pumping station. From the buffer basin, the water is exhausted and pumped into the storage tank located in the north side of the town. The decontamination of water, using chlorine solution, is made inside the buffer basin. The supply of the distribution network, from the storage basin is made by free fall.
- during the rest of the year, when water consumption is smaller, the pressure in the distribution network is assured by the pressure inside the Izvarna pipeline. In this situation, the buffer basin and the pumping station are taken out of operation by operating certain slide valves, the water taken from the Izvarna pipeline is sent into the pressure pipe of the pumping station. By operating other slide valves located inside a manhole on 24th of January Street, it is blocked the water access toward the storage tank and provides its direction toward the distribution network.

The analysis of the sewerage – waste water discharge system from Filiaşi town

Within an urban system, the major components of water balance aims the water source for the town water supply and the water coming from precipitations or other sources of the draining surface, in the context of establishing the elements of interdependence with the efficiency and the capacity of the waste water sewerage (Stănescu A. V., 1995). The waste water are represented by the waters resulting from the multitude of human activities (domestic, industrial, cleaning of streets etc.) to which are also added the waters coming from precipitations.

The first sewerage works in Filiaşi had been performed as a result of the location of the Transformers Plant in the western part of the town. The sewerage system adopted was a separation one (divisor).

During the 1971-1974, there were performed two collectors for domestic waste waters (one for the industrial area and one for the town) and a collector for storm waters, for the industrial area.

The route of the collector for water waters, foreseen for the industrial area, starts in front of the Transformers Factory precinct, goes almost parallel to DN Filiaşi - Tg. Jiu, untill the under crossing with the railway C.F. Filiaşi – Tg. Jiu, continuing untill the under crossing of the railway lines in Filiaşi railway station. To this collector it was subsequently connected the sewerage from the Mechanical Factory, the Thermal Power Plant and the one from Filiaşi Hospital.

Because the connection works for the Thermal Power Plant in the area were not properly performed, the collector clogged upstream the connecting point, blocking the discharge of waste water, resulted from I.M. and S.C.T.M. S.A. Filiaşi.

Presently, this collector functions only downstream the connecting point of the Thermal Power Plant.

The second collector for waste waters performed for the town, in the same period 1971-1974, was laid on the N. Titulescu and Horia, Cloşca and Crişan streets, being taken over by the Collector of the Industrial Area, upstream the under crossing of the railway lines in the area of Filiaşi railway station. Although this collector has been designed to take over only waste waters, subsequently, some storm waters collectors, draining the sewerage system, were connected to the former one. Also, for the residential quarter located in the area delimitated by Racoţeanu Boulevard and Stadionului and 24 Ianuarie streets, although the sewerage network was designed to be performed in a the separate system, it was performed in unitary system instead.

Because a stretch of the collector for the industrial area located on Avram Iancu street was clogged, the waste waters resulted from S.C. Transformers Factory S.A. and I.M. Filiaşi can not get into the waste water treatment plant of the town, being discharged into the storm network. This situation represents one of the reasons for reducing the flow rate of the waste waters which enters into waste water treatment plant of the town. Most of the dwellings located in the East of the town are not connected to the sewerage – discharging network (Fig. no 3).

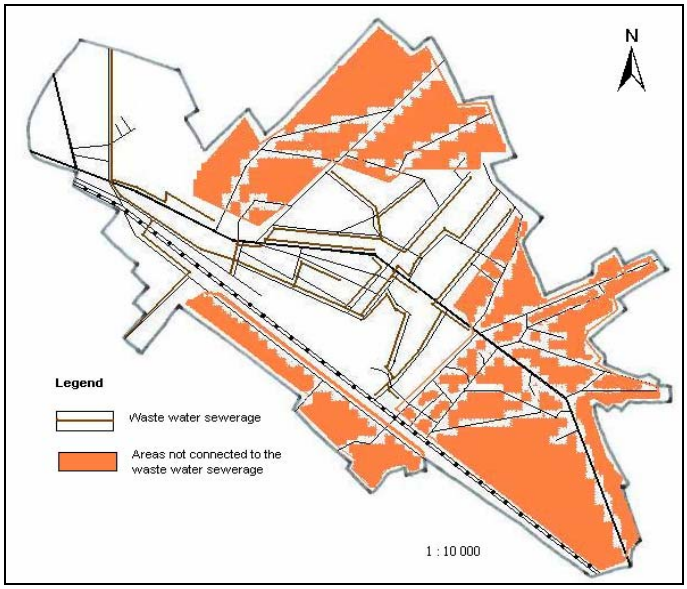

Fig. no 3. The sewerage network of Filiaşi town and the areas unconnected
(processed after the Documentation for the the management of water in Filiaşi town – Sewerage network, 1:10 000)

CONCLUSIONS

Taking into account the above mentioned facts, it can be noticed that the main disparities of water supply system – sewerage of waste waters aiming the under-dimensioning – the degradation of the existing networks and the low capacity of the waste water treatment plant.

The total length of drinking water supply network (including the networks inside the blocks precinct, the pressure pipe coming from the pumping station to the storage tank, as well as the connection pipe between the tank and the distribution network) is of about 23 km. The total length of the sewerage network is of only 16.5 km.

If these values are related to the surface of the area inside the town (99.72 km^2 - 997 ha), to the population (13590 inhabitants) and to the number of dwellings (6502)/ buildings (4288), it results importants disparities in respect to the degree of urban city endowment. Therefore, only 60% of the dwellings are connected to the water supply system, a very low percentage for an urban locality. A primary role in the elimination of these disparities comes to the areal strategic points presented in figure no 4.

The disparities of the water supply system are due to the fact that the extension of the distribution network, after 1990, was made mostly by small diameters, because it was mainly based on the population contribution. Other factors which should be taken into consideration are the wear state of the distribution pipes, as well as the overstressing of the water reserves from the Izvarna pipeline under the conditions of the subsequent increase of water demand.

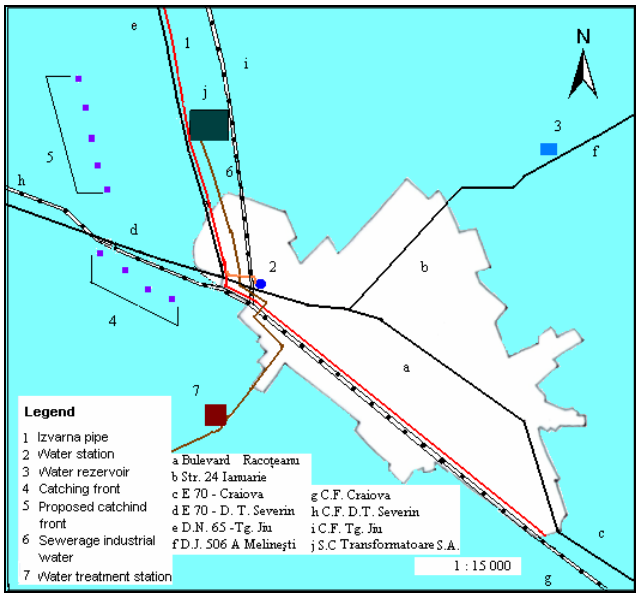

Fig. no 4. Strategic points for the water supply network and the sewerage network of Filiaşi town (processed after the PUG of Filiaşi town, 1:15 000)

As measures for eliminating these disparities, there are proposed, first of all, the replacement of pipes which operation influence the quantity and the quality of the distributed water, including the extension of the street network of water supply and the construction of a catching front in the North-West part of the town (5 wells). Regarding the treatment stages, pumping and storage of drinking water, it is foreseen the extension of the treatment and pumping station and, beside the doubling of the pressure pipe from the pumping station to the storage tanks.

In the operation process of the sewerage system – discharge of waste water, one of the disfunctionalities is generated by the clogging of a collector stretch for the industrial area located on Avram Iancu Street, so that the waste water resulted from S.C. Transformers Factory S.A. and I.M. Filiaşi can not reach the waste water treatment plant of the town, being discharged into the sewerage network.

The respective phenomenon happened also in the case of the collector performed for the town, which is clogged on most of its part, a fact lead to the discharge of water over the lids of the manholes and its stangnation in the ditched along the road and on the fields (in time, this will determine a possible complete clogging up of small collectors). Moreover, to the sewerage network were also connected the storm water collectors, although the sewerage system initially foreseen was separated, these modifications disturbed the operation of the sewerage network and the operation of the waste water treatment plant during rain.

In order to eliminate the respective disfunctionalities it is recommended the reconstruction of the clogged section of the collector for the industrial area and the collector for waste waters on Avram Iancu Street, in order to be able to take over the waste waters coming from S.C. Transformers Factory S.A. and I.M. Filiaşi. And for a better function of the existing sewerage network, it is foreseen the separation of the storm waters from the waste waters, in the quarters were the sewerage network was performed in a unitary system, including the perfomance of some new storm collectors which can take over the existing storm water channels presently connected to the sewerage system. Regarding the discharge of the treated waste waters, it is proposed the doubling of the discharge pipe for the treated water from the waste water treatment plant into the emissary. It also must be taken into account the disfunctionality which results from the calculation of the flow rates for the waste water, so that, only 50% of the individual dwellings connected to the water network are connected also to the sewerage network. Most of the dwellings which are to be connected to the water network are located in the East part of the locality, an area which does not have sewerage networks, the resolution of this problem is the extension of the sewerage network.

In order to eliminate the disfunctionality of the last link of the sewerage system, namely the waste water treatment plant, and more precisely the low capacity of the waste water treatment plant it is proposed beside the construction of an efficient chlorination station inside the perimeter of the waste water treatment plant, the increase of the efficiency of the mechanical, biological and chemical treatment of the waste waters.

By improving of the infrastructure for the water supply, the sewerage system

and the waste water treatment plant, it will determine the increase of the quality of the environmental factors and the living standards in the Filiaşi locality.

REFERENCES

IOANID, V., (1991), *Urbanism şi mediu*, Edit.Tehnică, Bucureşti;

GÂŞTESCU, P., (1998), *Ecologia aşezărilor umane*, Edit. Universității din Bucureşti, Bucureşti;

STĂNESCU, A. V., (1995), *Hidrologie urbană*, Edit. Didactică şi Pedagogică, R. A., Bucureşti;

TROFIN, P., (1972), *Alimentări cu apă*, Edit. Didactică şi Pedagogică, Bucureşti.

***(1997), *Plan Urbanistic General al oraşului Filiaşi*

***(2004), *Documentație pentru autorizație de gospodărire a apelor în oraşul Filiaşi, S.C AQUATERM S.A. Filiaşi.*