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DRAINAGE OF THE LOCATION OF THE WATER CLEANING PLANT IN THE PREJMER COMMUNE, BRAŞOV COUNTY

Nicolae DĂSCĂLESCU*, Ion VULCAN**, Dumitru BĂRBERIU**

*Transilvania University of Braşov, Faculty of Civil Engineering, Department of Buildings Services,
** Internationale Gesellschaft fűr Umwelt und Technik, I.G.U.T. S.R.L. Braşov

Corresponding author: Nicolae DASCALESCU, E-mail: nicolae_dascalescu@unitbv.ro

Abstract: The water cleaning plant in Prejmer was conceived in a modular system so that each module for biological treatment to function independently. The placement of the water cleaning plant in an area where the flow of groundwater accumulates and generates problems in putting the first module of the plant into practice. For the lowering of the phreatic level a draining system was projected which proved its efficiency. The article presents the Prejmer water cleaning plant, the studies which were at the basis of the draining system as well as its constructive characteristics.

Key words: water cleaning plant, draining syste, filtration coefficient

1. INTRODUCTION

In the Prejmer commune there has never been a centralized system for the collection of the sewage waters. Because of this, domestic sewage waters and the ones resulting from livestock activity from the above mentioned commune and from the nearby communes (Tărlungeni, Budila and Teliu) represented a potential pollution danger of the surface and phreatic water.

Thus, building a modulated water cleaning plant became a necessity, due to the fact that the investment was to be implemented in stages throughout several years.

The water cleaning plant, which is currently under construction, is situated in the northern part of the Prejmer commune, near the Valea Neagră rivulet.

Fig. 1 Location of the Prejmer water cleaning plant

2. THE DESIGN SOLUTION THAT WAS PROPOSED

The designer of the water cleaning plant is the company Internationale Gesellschaft fűr Umwelt und Technik (S.C. I.G.U.T. S.R.L.) from Braşov.

The flow of the sewage water foreseen to be treated in the water cleaning plant are: $Q_{uz\ day\ med} = 137{,}34$ l/s; $Q_{uz\ day\ max} = 171{,}19$ l/s; $Q_{uz\ day\ o\ max} = 308{,}08$ l/s [1].

The proposed technical solution took into consideration the development perspective of the above mentioned communes until 2031. It presupposes a modular system so that, depending on further development, the capacity of the plant could be easily extended, without influencing the functioning of the already working modules.

Taking into consideration that the sewage network which is connected to the Prejmer water cleaning plant will be carried out in stages, the capacities of the biologic treatment modules were dimensioned so that each module could function with two independent treating lines. In this way, as the flow of sewage water increases by new connections, after reaching the maximal capacity of the module carried out in the first stage, the second module will be build and then the third one. Each module was projected for the equivalent of 20.000 inhabitants.

The main assets and installations of the future water cleaning plant are: grate compacted installation, sand-cleaner and aerated fat separator; biologic cleaning installation; blower installation; buffer tank for excess mud; mud-treating warehouse; dehydrated mud repository and sewage water pumping station.

The grate compacted installation, the sand-cleaner and the fat separator by floating with dissolved air which constitutes the mechanic stage of the water cleaning plant that is of the Ro5 type and which is of German origin (Huber) and has a capacity of 80 l/s.[1].In the first stage, the assemblage of one installation of this type is stipulated in a warehouse built for this purpose.

In this installation, the coarse materials, sand and fat, will be removed.

The biologic water cleaning installation BIOCOS is made of two airing basins with activated mud and four sedimentary basins.

The BIOCOS system (Biological Combined System) is a last generation, biologic cleaning process patented in Austria. This process eliminates the disadvantages of the classic biologic cleaning, especially as far as the secondary decantation and the mud recirculation are concerned. By the use of this proceeding, the mechanic installations will be reduced to minimum and the volumes of the basins are reduced. Equally, by using modern compressors and refined bubbles airing installations, the necessary of energetic consumption of the plant is reduced to minimum.

By the use of this proceeding, it is estimated that the total degree of cleaning of the station can go up to 98 – 99 % [1].

The air necessary for the functioning of the biologic cleaning installation is provided by the blower station.

The buffer tank for mud stockpiles the excess mud, aerobic stabilized, evacuated from the sedimentary basins. It is equipped with a mixer for the homogenization of the mud before pumping and for not allowing the aerobic fermentation of the mud between two pumpings in the dehydration installation.

3. THE HYDRO – GEOLOGIC AND GEOTECHNICAL CHARACTERISTICS OF THE LOCATION

From a geo-morphologic point of view, the Braşov depression is made of three units: Săcele piedmont (which is a vast dejection cone with a smooth relief, having a south-north orientation), the Câlnic plain (alluvial plain with a slightly undulated relief) and the meadows of the rivers Olt, Râul Negru and Târlung, which morphologically do not differ much from the alluvial plain [2].

The location of the water cleaning station is in the Câlnic plain, a geomorphologic unity of the Braşov depression, where most of the waters from the depression gather. A substantial contribution of subterranean waters originates in the piedmont area. Thus, in the Târlung dejection cone area, the phenomenon of water loss from the Târlung River is evidenced starting with the river meadow at its getting out from the mountainous area. The phenomenon accentuates as it draws closer to the water storing area (at the north of the communes Hărman and Prejmer) [2].

The hydrologic area for water storing (where throughout the time, a series of hydro-geologic studies were made for achieving the subterranean water catching for the city of Braşov) is limited in the south by the level curve of 540 m in the direction of the Prejmer and Hărman communes and in the north in the direction of the Hărman and Lunca Câlnicului communes. In this area, there are almost continuous impermeable strata made of sandy clay and clay alternating with gravel.

The circulation of the groundwaters happens in the direction south-west-north-east, with high speed, due to the impermeability of the aquifer strata and of the hydraulic slope of 4-7‰ [2].

The measurements that were taken between February – April 1991 highlighted an abundant subterranean flow (originated in the depth leaking of the water from the Târlung river and its tributary, the Gârbou valley and the Durbav valley) of 1,79 m^3/s [2]. These measurements were done after an extremely dry period (1985 – 1991).

In the area of the Prejmer commune, the permeability coefficient is of 60 m/day, which leads to a medium transmission of about 5400 m^2/day (on a strata of 90 m of coarse deposits of gravel and sand alternating with clay patches), a very good transmission of the gravel and sand deposits, rarely met in our country. The subterranean leaking is produced with a medium gradient of 5‰, which results in a specific flow of the subterranean leaking of about 0,3 l/s.m [2]. The values of the transmission and of the specific flow were contested by an subsequent examination [3] on grounds that the thickness of the patch of permeable strata that was calculated was too big, 90 m instead of maximum 35 m. In this conditions, a transmission of 2100 m^2/day results and a specific flow of 0, 12 l/s.m.

Subsequent to the studies done for the catching of the subterranean water for the city of Braşov, between 1990 – 1992, in 2006 at the location of the plant three drillings were carried out and which were situated on the axis of the surface which will be taken by the plant in the direction S.E. – N.V. paralel to an existent draining ditch which borders this surface in its south.

The drillings emphasized the following stratification [4]:

- Vegetal soil 0,00 ÷ 1,00 m;
- Sandy clay 0,40 ÷ 4,00 m;
- Coarse gravel with blocks and coarse sand 0,80 ÷ 4,00 m.

The depth of the gravel stratum increases towards S.E. , towards the Târlung rivulet.

These studies did not research into the hydro-geologic regime, modified as a consequence of the catching and draining works that took place in the location after 1990.

4. THE DRAINING OF THE LOCATION OF THE WATER CLEANING PLANT

The geotechnical studies demonstrated that in the location where the first module is built in the first stage, the stratum of coarse gravel with blocks and coarse sand is situated at a depth of 1,80 m. The level of the groundwater during the studies was 1,80 m depth, and subsequently, at the beginning of the excavations for the first module of biological treatment, a year later, in 2007, it was situated at 0,80 m depth from the surface of the land. Because of that, the issue of changing the location of the plant was taken into consideration, but it is not possible due to the complexity of the system's project divided into packages of networks and branchings for the end-users which the water cleaning plant was part of.

Fig. 2 The level of the groundwater at the beginning of the excavations

Fig. 3 Infiltrations in the sandy clay stratum

In these conditions when the gravel stratum represented a good founding ground and the presence of the shallow groundwater constituted a risk factor in execution, a series of variants for the building of the foundation were analyzed.

The solution that was chosen was to lower the groundwater level by the building of a draining system

The approximate determination of the filtration coefficient by tracking down the increase of the groundwater level in the foundation ditch led to a lower level of the filtration coefficient (1,0 m/day) taking into consideration that on the bottom of the foundation there is predominant sandy clay unlike the average established in the hydro-geologic studies in the coarse gravel stratum of 60 m/day.

By using this value in the calculations on the basis of V.S.Kozlov's relation, quoted by P.G.Kiselev [5] for a draining system with the drains situated inside the thick aquifer stratum, values of the specific flow of 0,15 l/sm were obtained. Similar results were obtained with Hooghoudt – Ernst's generalizing relation [6].

The coefficient of water release by earth can be determined with W.F.J.van Beers' relation, quoted by V.Pietraru [7].

The designed draining system is made of draining tubes with diameters of 1000 mm and 300 mm.

The tubular drains with the diameter of 1000 mm drain the surface on which the sedimentary and mud mixture basins will be built as well as the airing basins. The drains with the diameter of 300 mm drain the surface on which will be built the mud-treating warehouse, the mud repository, the grate compacted installation, sand-cleaner and fat separator as well as the exploitation pavilion.

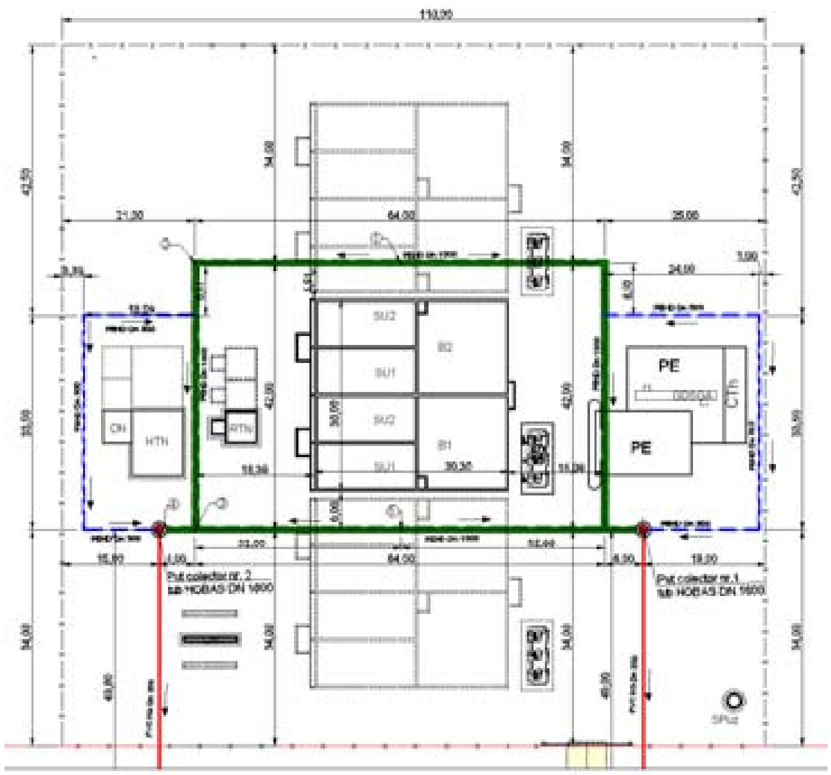

Fig. 4 The draining system in the location of the water cleaning plant in Prejmer

The drained water flow estimated at 60 l/s, is guided through tubes of a similar diameter to two collecting wells made of Hobas tubes, with the diameter of 1500 m located symmetrically to the axis N.E – S.V. of the plant's location.

The collected water is pumped by a submersible pump with a flow of 60 l/s and evacuated in the existent draining ditch nearby the location which flows into the Valea Neagră rivulet.

The draining tubes were covered with geo-textile on which a reversed filter was suggested.

The level measurements of the groundwater throughout the execution demonstrated the efficiency of the draining system that has been made.

Fig. 5. Prejmer water cleaning plant, current situation

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