Proposal for a sewage system for the village of Junco, in Areia Branca, Sergipe

Santos, H. K. S.*, Santos, T. B.**, Lima, D. M. F.***

***Hellen Karine Sales dos Santos, civil engineer, master's student at the Federal University of Sergipe.**

****Thauany Batista Santos, civil engineer by Federal University of Sergipe.**

*****Daniel Moureira Fontes Lima, civil engineer, lecturer at the Federal University of Sergipe.**

Highlights:

- **The village of Junco in Areia Branca/SE does not have a sewage system;**
- **The sewer network was dimensioned with a total length of 9004.48 m of PVC pipes;**
- **The estimated cost was R$1,242,348.11 (favorable soil) and R$1,535,533.97 (unfavorable soil);**
- **It is suggested that the other costs of the construction and maintenance of the sewer network be included.**

Keywords: Basic sanitation; rural community; sizing.

INTRODUCTION

Assis, Costa and Gontijo (2024) recognized the importance of addressing forms of sewage treatment for communities further away from urban centers with the use of "appropriate technology". This encourages the use of techniques and processes that take into account local and regional peculiarities.

From this perspective, the water supply in the village of Junco, in Areia Branca/SE, is made up of 4 community tube wells administered by the town hall, from which water is extracted and taken to the supply without preliminary treatment (SEPLANTEC, 2022). This scenario, combined with the uncertainty of effective sanitation in small communities such as Junco, can lead to infiltration and contamination of water bodies, groundwater and supply wells.

The aim of this study was to identify the reality and challenges of sanitation in the community of Junco in Areia Branca/SE, as well as to size a sewer network and estimate the costs of implementing it in the region.

METHODOLOGY

The study area was the village of Junco, which according to EMDAGRO (2019) is the second most populous community in the city of Areia Branca, Sergipe, with a population of 1,590 inhabitants.

Initially, a preliminary survey was carried out to ascertain: the delimitation of the study area, the population density, the characteristics of the sewage generated and the basic sanitation structures already in place. In this way, the future population was calculated according to the methodology of Von Sperling, 1996, and the planialtimetric data was obtained using Google Earth Pro software.

Next, parameters such as flow rates, collector heights and depths, diameter, slope and fluid velocity were calculated using electronic spreadsheets and the necessary inspections were made in accordance with standards NBR 14.486 (ABNT, 2000) and NBR 96490 (ABNT, 1986). Finally, the way to lay out the network and position the fittings was carried out according to the methodology of Alem Sobrinho and Tsutiya (2000).

RESULTS AND CONCLUSIONS

According to the data collected from the town hall, there is no sewage system in Junco/SE, and the form of treatment consists of individual systems for each house. In this context, the layout of the sewage network and the allocation of a sewage treatment plant (STP) were defined (Figure 1). The sistem was organized into 152 sections (defined by the spaces between the fittings) which were compiled into 11 main sections. The total length of the network was 9,004.48 meters of PVC pipes.

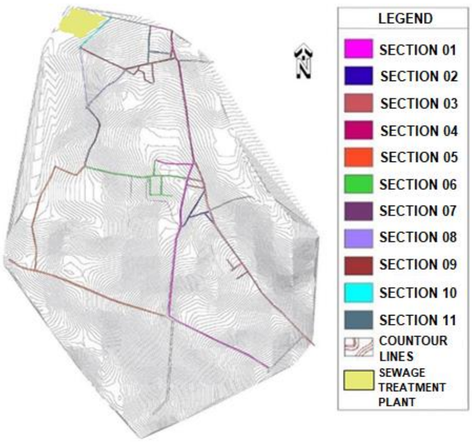

Figure 1 - Layout of the sewage network divided into 11 sections.

Source: Authors (2024).

The location of the STP were defined in such a way as to prioritize gravity flow and so that the treated effluent can be released in the nearby watercourse called Riacho das Pedras. The STP was designed with treatment for domestic sewage, since the village in its portion of the populated area is predominantly residential, with only a few commercial enterprises, such as supermarkets, beauty salons, workshops mechanics, a school and a basic health unit.

The sewer network was defined along the axis of the road. This preference took into account rural areas, where sidewalks are unstable along roads. In addition, these roads vary in width, which underscores the previous decision and guarantees the functionality of the system. Furthermore, the network was not feasible in three locations (Figure 2). The reason was the unfavorable topography for gravity flow, which would require pumping. Thus, the planning and adoption of a decentralized treatment system is encouraged, since these are areas that do not have streets and are not densely populated. This scenario agrees with the view of Milićević, Milićević and Trajković (2024), who state that decentralized wastewater management is financially affordable, socially responsible and environmentally sustainable since wastewater can be reused.

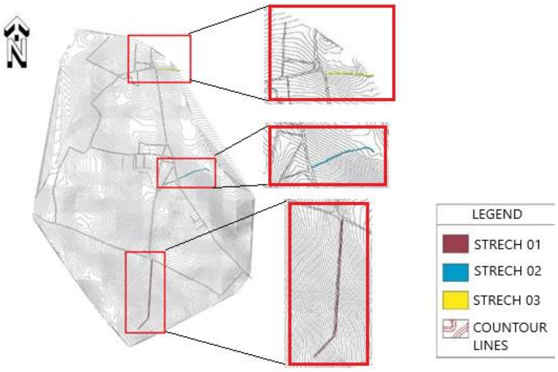

Figure 2 - Strechs without dimensioning the sewage network.

Source: Authors (2024).

The calculated population projection was 1,727 inhabitants with a 20-year project horizon. This scenario is derived from changes due to social, demographic and economic factors. As for the flow rates, most of the sections operate with a minimum flow rate of 1.5 L/s and the flow rate at the STP inlet is 4.55 L/s. The diameter used for all the pipes was 150 mm. All the tensile stress, final velocity and critical velocity values met the tests.

The cost of the network was calculated using slope level 3, according to Pacheco (2011), since the topography of the study area is not very hilly, but neither is it completely flat. Thus, the cost for favorable soil was R$1,242,348.11 and for unfavorable soil it was R$1,535,533.97. In view of the network dimensioned, Bazaanah and Mothapo (2024) state that the cost of maintaining a sanitation network in rural areas must be well planned, since the population must be able to afford the improved sanitation service over time.

Thus, the sewage network in Junco/SE was determined taking into account municipal characteristics and implementation challenges. The system was also designed to work by gravity, something important for an isolated area with possible electricity supply problems. It should be noted that the implementation of a sewage system requires community action and health education, ensuring the preservation of infrastructure, natural resources, and the balance between fees and maintenance. A future suggestion is to include the other costs of network installation and system maintenance works, as well as detailing the composition and costs of construction, operation and maintenance of the ETE.

ACKNOWLEDGMENTS

To the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the master's scholarship granted.

REFERENCES

Alem Sobrinho, P., & Tsutiya, M. T. (2000). *Coleta e transporte de esgoto sanitário* (2ª ed.). São Paulo: Departamento de Engenharia Hidráulica e Sanitária da Politécnica da Universidade de São Paulo.

Assis, K. K. V., Costa, J. S., & Gontijo, H. M. (2024). Saneamento rural: Estratégias para o esgotamento sanitário em comunidades do Município de Itaúna - MG. *Research, Society and Development*, *13*(1), 1–25.

Associação Brasileira de Normas Técnicas. (2000). *NBR 14.486: Projeto de redes coletoras com tubos de PVC*. Rio de Janeiro: ABNT.

Associação Brasileira de Normas Técnicas. (1986). *NBR 9649: Projeto de redes coletoras de esgoto sanitário*. Rio de Janeiro: ABNT.

Bazaanah, P., & Mothapo, R. (2024). Sustainability of drinking water and sanitation delivery systems in rural communities of the Lepelle Nkumpi Local Municipality, South Africa. *Environment, Development and Sustainability*, *26*(6), 14223–14255.

Empresa de Desenvolvimento Agropecuário de Sergipe (EMDAGRO). (2019). *Série informações básicas municipais: Areia Branca*.

Milićević, D., Milićević, M., & Trajković, R. (2024). Decentralized wastewater treatment - A sustainable solution for protecting water resources from pollution. *Journal of the Faculty of Civil Engineering and Architecture*, *39*, 35–46.

Pacheco, R. P. (2011). *Custos para implantação de sistemas de esgotamento sanitário* (Dissertação de mestrado). Universidade Federal do Paraná, Curitiba.

Secretaria de Estado do Planejamento de Sergipe (SEPLANTEC). (2002). *Diagnóstico do Município de Areia Branca*. CPRM.