


## EVALUATION OF BASIC SANITATION CONDITIONS IN THE DISTRICT VILLAGE OF APÉU, CASTANHAL, PARÁ

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### ABSTRACT

Sanitation is one of the pillars of sustainability, its importance in health promotion is notorious, but it is necessary that such measures are considered effective by public managers. This paper discusses the conditions of the basic sanitation system in the district of Apeú – Castanhal – Pa. The results of this work are based on a bibliographic framework and on-site investigation, because from this information, it was possible to send a diagnosis, which served to propose the pertinent solutions regarding the theme. The methods used in the environmental assessment were the application of a questionnaire, on-site visualization and collection of geographic coordinate points, for use in the Geographic Information System – GIS, in order to obtain more precision about the investigated location, in addition to photographic records. At the end, the propositions regarding the measures to be taken to solve the identified deficiencies in the four axes of basic sanitation are presented.

**Keywords:** Sanitation. Sanitary Sewer. Solid Waste. Water Supply. Urban Drainage.

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## INTRODUCTION

Sanitation is the control of all factors in the physical environment of man, which exert or may exert harmful effects on physical, mental and social well-being (World Health Organization – W.H.O.).

Based on these assumptions, it is understood that to ensure a healthy environment, it is necessary that sanitation measures be implemented, as a prevention tool. It is important to emphasize that the W.H.O. defines health as the state of complete physical, mental and social well-being and not just the absence of disease.

Speaking about the four axes of sanitation, Heller (2010), emphasizes the important role of water, according to him, water has an essential role for human survival and development of society, allied to this, is its vulnerable availability in nature to meet the demand required in many regions of the planet.

Other axes of great importance in sanitation are the sanitary sewage system, which has the function of collecting, transporting and treating wastewater, from domestic sources. Also noteworthy is the rainwater drainage system, which is defined as the set of measures that aims to minimize the risks that the population is subjected to, as well as to reduce the damage caused by floods and enable urban development in a harmonious, articulated and sustainable way. (BROWN COMMITTEE, 2004).

In this discussion, it is important to highlight solid waste, which in turn, when poorly managed, can constitute a favorable means for the transmission of diseases directly and indirectly by various vectors and vehicles, in addition to being an obstacle to the efficiency of the other axes of basic sanitation, mainly due to its obstructive interference.

Considering the previous definitions, it is necessary to define public health, as it is certain that one of the main objectives is to achieve quality health for the population of the district of Apeú, in addition, health and sanitation are always linked, because sanitation is the promotion of health. Thus, Amory (1920) defines public health as, "The art and science of preventing disease, prolonging life, promoting health, physical and mental efficiency, through the organized effort of the community. These goals include sanitation, infection control, education of individuals in the principles of personal hygiene, the organization of medical and nursing services for the early diagnosis and prompt treatment of diseases, and the development of a social structure that ensures each individual in society a standard of living adequate to the maintenance of health." (ROUQUAYROL; ALMEIDA FILHO, 2003).

It is important to ratify that, according to the Instituto Trata Brasil (2011), access to quality water and a good sanitation system prevents the appearance of diseases that overload the health system, such as diarrhea, which are very common in countries with a hot climate, such as Brazil.

According to the National Health Foundation (FUNASA, 2013), although the relationship between water quality and health is evident, there is still a large gap in Brazil with regard to studies that support an accurate assessment of the multiple factors intervening in this relationship and their socioeconomic, cultural and environmental particularities.

Therefore, this work aims to present a diagnosis of the sanitation conditions in the district of Apeú, municipality of Castanhal, state of Pará, and to make the relevant propositions, as a solution to the problems and relate them to the respective axes of basic sanitation.

## **MATERIALS AND METHODS**

Initially, bibliographic surveys were carried out to support the pertinent information about the basic sanitation system and public health, in order to understand more clearly its definitions and its functioning through the necessary measures.

To collect the necessary information, the methods of on-site visualization and application of questionnaires to the residents were used, in order to obtain more consistent data to be used in the discussion of the theme. Then, the data were systematized using the Excel software, as a means of ensuring better visibility to those interested in the information and to the general public.

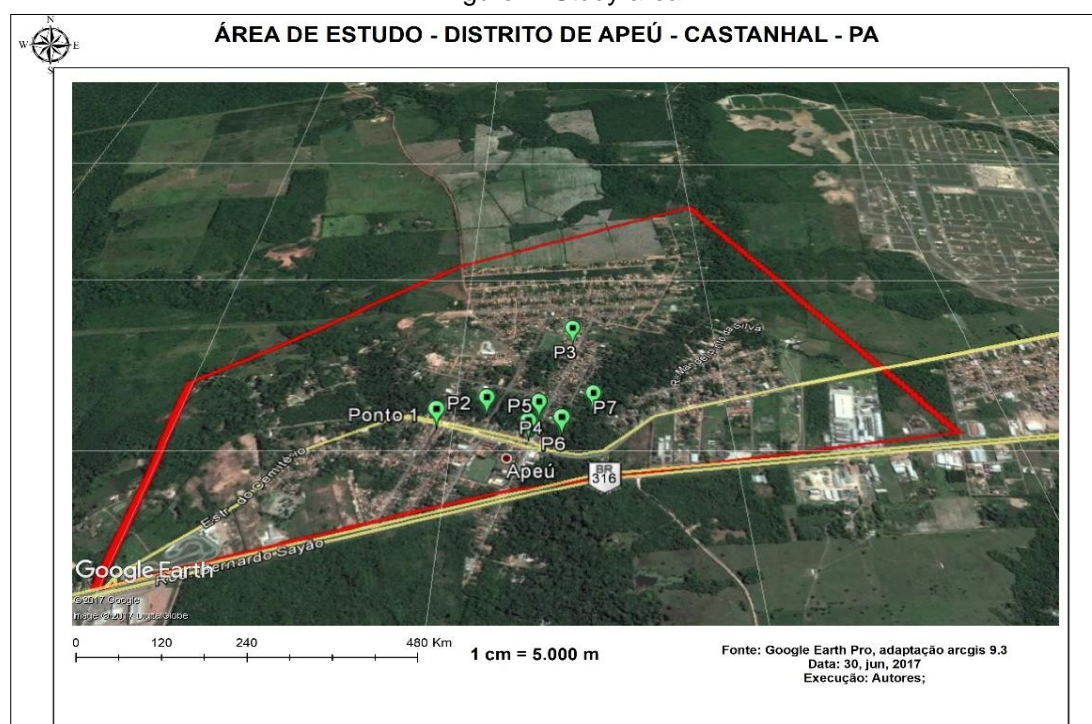
The work addresses a diagnosis regarding the conditions and functioning of the basic sanitation system, such as the water supply system, sanitary sewage system, rainwater drainage system and the solid waste management system.

Based on the evaluations carried out, it was possible to make necessary analyses of the current conditions, with a discussion about the possible environmental damage to the soil, water, floristic and faunal resources.

## FIELD OF STUDY

The study area is the District of Apeú, located in the municipality of Castanhal, state of Pará. Figure 1 presents the points of investigation of the basic sanitation conditions in the district.

Figure 1: Study area.

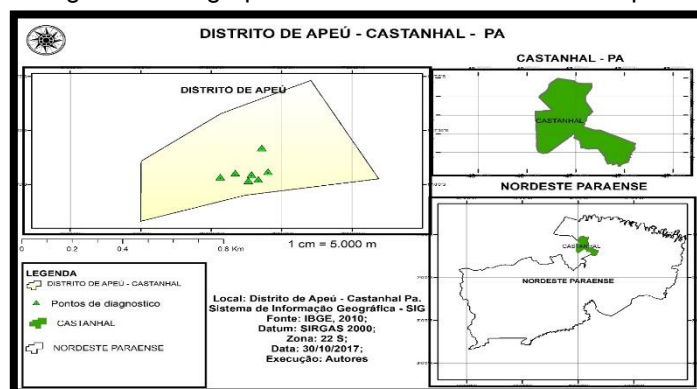


Source: Google, adapted to ArcGis 10.5 software, 2017.

## Geographical location, geological aspects, vegetation and climate

The district of Apeú is located in the northeast of Pará, specifically in the metropolitan mesoregion of Belém, in the municipality of Castanhal, on the banks of BR 316. From a geographical point of view, the location is  $1^{\circ} 17' 55.70''$  S latitude and  $47^{\circ} 39' 32.12''$  W longitude, with an elevation of 23 m. Figure 2 shows the geographic location of the district of Apeú in the municipality of Castanhal, northeast of Pará, in the state of Pará. The study covered stretches of two streams where there is a greater population concentration, consequently, a higher incidence of domestic effluent discharge in the region, which is worrying because water resources perform other social functions.

Figure 2: Geographical location of the District of Apeú.



Source: Authors, 2024, adapted from IBGE, ArcGis 10.5 Software.

## COLLECTION OF INFORMATION

The collection of information was through on-site visualization and through the application of a socioeconomic questionnaire, in order to ratify the information and obtain comparative data.

## RESULTS AND DISCUSSION

### CURRENT SANITATION CONDITIONS IN THE DISTRICT OF APEÚ

From the *on-site* visualization it was possible to establish a more consistent diagnosis on aspects related to basic sanitation, as well as land use and occupation, as sanitation conditions produce consequences on these natural resources, quality of life and public health.

#### Current conditions of the sanitary sewage system

The district of Apeú does not have a sanitary sewage system, that is, it does not have collection networks, transport or treatment station, therefore, wastewater is released *in natura* into gutters and rainwater drainage systems, and fecal sewage is mostly released in individual systems known as septic tanks, which are systems designed without engineering criteria in their construction and operation. Figure 3 shows the discharge of domestic sewage into gutters and drainage systems.

Figure 3: Untreated sewage was thrown into the gutter.



Source: Authors, 2024

### Conditions of the rainwater drainage system

The district of Apeú has some deficient and obsolete microdrainage devices, there are few rainwater galleries and other relevant hydraulic devices. According to figure 4, some existing devices are often in a state of abandonment, in addition to receiving rainwater, along with wastewater (domestic sewage), which is not recommended by Law 11.445/2007, which instituted the National Basic Sanitation Policy, which recommends the collection and transportation of rainwater in an individual system or absolute separator.

Figure 4: Damaged rainwater gallery.



Source: Authors, 2024

### **Current conditions of solid waste management.**

The management of solid waste in the district of Apeú should be an integral part of the municipal solid waste management plan of the municipality of Castanhal. In the diagnosis, it was possible to identify collection and storage containers, mainly on the banks of the Apeú River, figure 5.

However, it is necessary to actually implement a solid waste management plan, along with environmental education programs, with the objective of keeping the environment as a whole, free from improper discharge of solid waste, and thus avoiding the proliferation of etiological agents and waterborne diseases due to pollution and contamination of water, of the soil and the air.

Figure 5: Solid waste collection containers on the bank of the Apeú River.



Source: Authors, 2024

### **Analysis of the questionnaire applied**

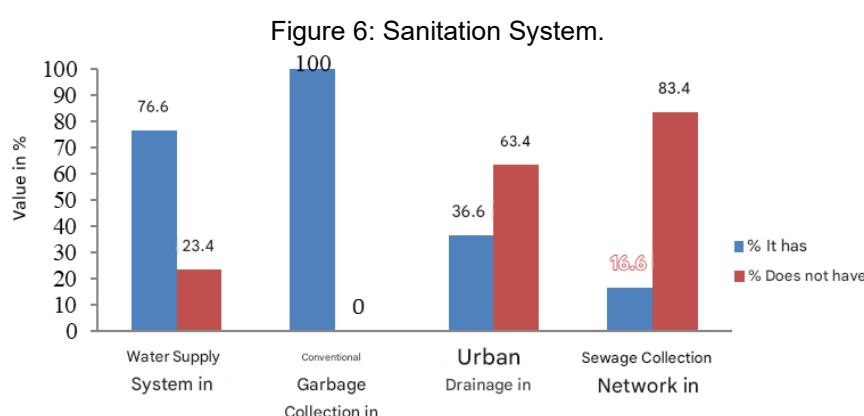
The results presented here are based on interviews with residents of the district. Based on the information collected, the sanitary infrastructure around the Apeú and Capiiranga streams was analyzed.

#### **Analysis of sanitation services**

Figure 6 shows that 76.6% of the interviewees have a water supply system, while the remaining percentage prefers not to use these services, as they claim that the service of the concessionaire is of very poor quality. According to the interviewees, garbage collection at the studied site is regular, with results close to 100%.

## Analysis of the rainwater drainage service

Regarding urban drainage, 63.4% of the inhabitants say they do not have these services, and according to the information, which was ratified through visualization, rainwater is dumped directly into the streams, which contributes to siltation, by sediment carrying. Regarding the sewage collection network (mixed system), 83.4% say they do not have one.



Four Axes of Sanitation  
Source: Authors, 2024

## Analysis of the sanitary sewage service

Figure 7 deals with the destinations of waste from households that show the lack of a sanitary sewage system, a receiver of wastewater, (water from sinks, bathing, washing clothes), as well as fecal sewage or black water, which is fecal waste from households. In this case, according to the interviewees, the destinations are as follows:

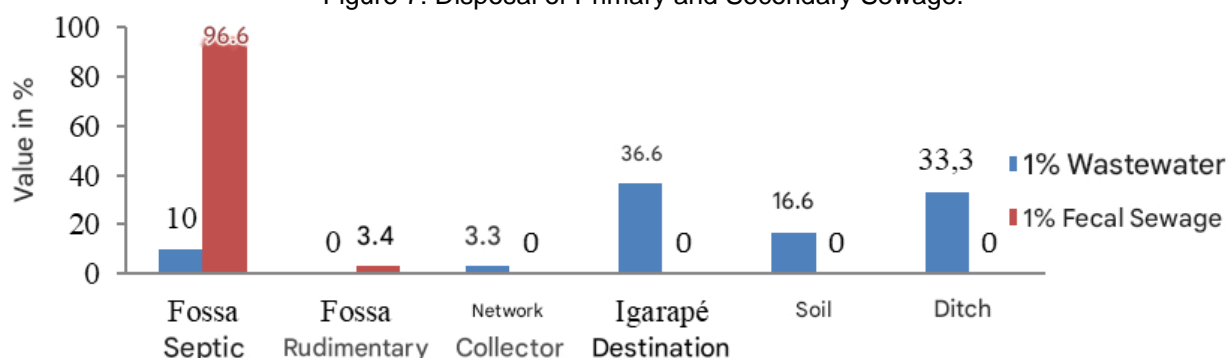
### PRIMARY SEWAGE (wastewater).

- 10%, for septic tanks.
- 36.6% were destined for the stream.
- 16.6%, destined for the soil.
- 33.3%, ditches
- 3.3%, collection networks

### SECONDARY SEWAGE (fecal sewage or black water)

- 96.6% for septic tank
- 3.4%, rudimentary pit

Figure 7: Disposal of Primary and Secondary Sewage.



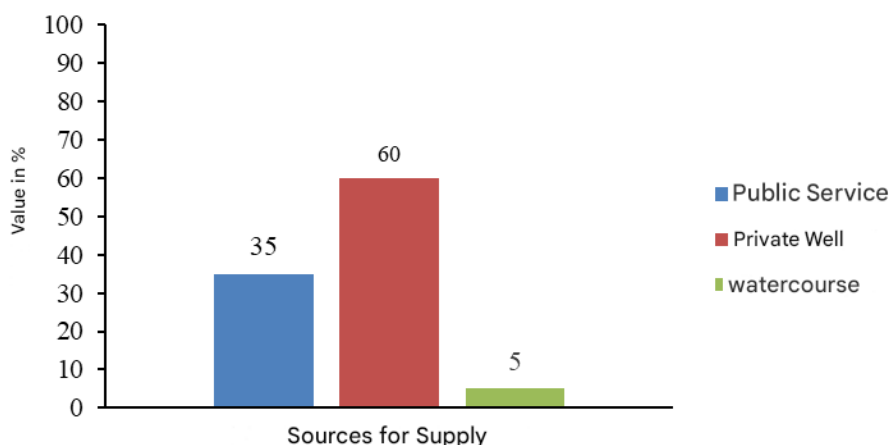
Source: Authors, 2024.

It can be concluded that these destinations used for wastewater are not adequate, and this contributes to the increase in the contamination of natural resources and the proliferation of diseases and the imbalance of the ecosystem, there is also another aggravating factor, which is the advanced topographic slopes, which enables the surface flow of sewage (thrown into the ground and ditch) towards the thalwegs. In relation to the septic tank, as this system is at a depth approximately from the level of the water table, its effluents tend to contaminate it by percolation.

#### Analysis of the water supply service

Figure 8 represents the sources of water supply used by the population of the district village of Apeú, according to the interviewees, the consumption of water through the public service represents 35%, and the largest portion, that is, 65%, uses private sources, according to the interviewees, this is justified by the quality of the water offered to the population, which reaches the consumer, with color and strong chlorine odor. The third source of supply is the creek itself, more precisely the Capiiranga, where residents draw water for various daily activities (bathing, washing clothes) and so on.

Figure 8: The water supply sources of the Apeú District.

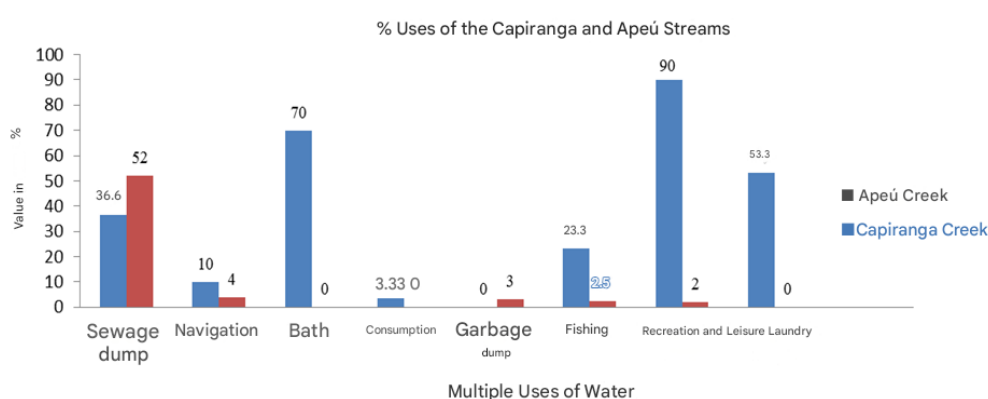


Source: Authors, 2024

### Analysis of the relations between the community and the streams of the district

The relationship of the residents with the water use of the two streams studied was also analyzed. 52% of domestic sewage is dumped into the Apeú stream, and 36.6% into Capiranga. The use for recreation of the Capiranga stream, according to the research, constitutes 90% and only 2% in the Apeú, which may indicate better bathing conditions in the Capiranga stream. The use of water for washing clothes is higher in the Capiranga stream, totaling 53.3% of the interviewees, while in Apeú there is no use for this activity. A strong relationship between the inhabitants and the streams can be perceived, and this is shown in figure 9.

Figure 9: Uses of the Capiranga and Apeú streams.



Source: Authors, 2024

## **PROPOSITIONS FOR BASIC SANITATION**

### **PROPOSAL FOR THE SANITATION SYSTEM**

Basic sanitation measures are essential for the promotion of health and also contribute to the guarantee of environmental health. According to the diagnosis carried out in the district of Apeú, many deficiencies were identified with regard to the basic sanitation system, with greater emphasis on sanitary sewage, urban drainage and solid waste management. In order to contribute to the community and public management, we will present here the necessary propositions. Thus, it is proposed the implementation of sanitation structures that can meet these needs, as will be presented below.

#### **Implementation of a sanitary sewage system**

For the correct management of wastewater from households, it is recommended the implementation of collection and transportation networks, as well as a sewage treatment plant (ETE), with the necessary treatment steps to meet the peculiar characteristics of the effluents to be treated, that is, in the removal of pollutants and contaminants in the physical, chemical and biological aspects and in the post-treatment.

#### **Rainwater management**

According to the survey carried out, it was possible to conclude the need to install hydraulic microdrainage devices, such as: gutters, manholes, junction box, manhole and rainwater galleries. These measures have as their main objective, to provide the correct management of rainwater and to contribute effectively and efficiently to the reduction and/or elimination of various consequences that the lack of this management causes and has caused over the years in the district of Apeú.

Among the negative consequences of the lack of drainage structure we have the transport of sediments to rivers and streams, which contributes to the process of soil erosion and siltation of water bodies, reducing their flow capacity, caused by the decrease in the useful volume of the runoff section.

#### **Management of urban solid waste**

In this regard, it was possible to verify the need to implement and implement a solid waste management plan, which includes a management system, from generation, storage, transportation, treatment, to environmentally correct final disposal in landfills.

Managing solid waste is of paramount importance and contributes to avoid the increase in silting of the watercourses present in the district, thus preserving its social functions for the benefit of the local community.

## **FINAL CONSIDERATIONS**

The understanding of basic sanitation conditions is of great importance, in the sense of providing a framework, so that from then on, it is possible to make proposals for improvements to the community of the district of Apeú.

According to the discussion presented, this work sought to develop a consistent investigation of the conditions that the district of Apeú is in, with regard to the four axes of sanitation and with this, build an information base that will serve both the public power and society in general, as a tool for environmental management.

Within this line of reasoning, the necessary structural measures were proposed, to be implemented in the district, and from then on, to guarantee the residents the realization of the constitutional rights acquired, provided for in article 225, of the Federal Constitution of 1988.

However, it is known that structural measures alone do not guarantee efficiency to the system, it is necessary to implement non-structural measures, such as environmental education, as it is the basis for any action of environmental interest.

In this sense, environmental management presents itself as a guiding instrument of every environmental system, because from the implementation of its tools, the possibilities of building better paths are increased, so that the achievement of social, economic and environmental sustainability becomes a reality for all of us and not a utopia.

## REFERENCES

1. Heller, L. (2010). Abastecimento de água, sociedade e ambiente. In L. Heller & V. L. de Pádua (Org.), Abastecimento de água para consumo humano (2ª ed., Vol. 1). Belo Horizonte: UFMG.
2. Jacobi, P. (2003). Educação ambiental, cidadania e sustentabilidade. Cadernos de Pesquisa, 118, 189-205. Disponível em: <http://www.scielo.br/pdf/cp/n118/16834.pdf>. Acesso em: 27 de setembro de 2017.
3. Mucelin, C. A., & Bellini, M. (2008). Lixo e impactos ambientais perceptíveis no ecossistema urbano. Sociedade & Natureza, 20(1), 111-124. Disponível em: <http://www.scielo.br/pdf/sn/v20n1/a08v20n1>. Acesso em: 27 de setembro de 2017.
4. Mota, S. (2006). Introdução a engenharia ambiental (4ª ed.). Rio de Janeiro: ABES.
5. Martins, J. (2012). Gestão da drenagem urbana: Só tecnologia será suficiente? Escola Politécnica, Universidade de São Paulo, 1-11. Disponível em: [http://www.daee.sp.gov.br/outorgatreinamento/Obras\\_Hidr%C3%A1ulic/gestaodrenagem.pdf](http://www.daee.sp.gov.br/outorgatreinamento/Obras_Hidr%C3%A1ulic/gestaodrenagem.pdf). Acesso em: setembro de 2017.
6. Pereira, J. A. R., & Soares, J. M. (2006). Rede coletora de esgoto sanitário: Projeto, construção e operação. Belém: NUMA, UFPA, EDUFPA, GPHS/CT.
7. Philippi Jr., A., & Malheiros, T. F. (2005). Saneamento e saúde pública: Integrando homem e ambiente. In A. Philippi Jr. (Org.), Saneamento, saúde e ambiente: Fundamentos para o desenvolvimento sustentável (Coleção Ambiental, Vol. 2). Barueri: Manole.
8. Philippi Jr., A., & Martins, G. (2005). Águas de abastecimento: Coleção ambiental (Vol. 2). Barueri: Manole.
9. Programa de Pesquisa em Saneamento Básico – PROSAB. (2006). Gerenciamento de resíduos sólidos urbanos, com ênfase na proteção dos corpos d'água: Prevenção, geração e tratamento de lixiviados de aterros sanitários (Vol. 3). Rio de Janeiro: ABES.
10. Von Sperling, M. (2005). Introdução à qualidade das águas e ao tratamento de esgotos (3ª ed.). Belo Horizonte: DESDA/UFMG.