Analysis of The Basic Sanitation System of Black Land Earth in Manacapuru-Am

Anne Kellen Batista Martins[1]

[1]Centro Universitário Fametro – Manaus - Amazonas

Alexandra Amaro de Lima[1,2]

[1]Centro Universitário Fametro – Manaus - Amazonas

[2]Instituto de Tecnologia e Educação Galileo da Amazônia – ITEGAM – Manaus - Amazonas

Mitriane Gomes de Souza[1]

[1]Centro Universitário Fametro – Manaus - Amazonas

Igor Felipe Oliveira Bezerra[2]

[2]Instituto de Tecnologia e Educação Galileo da Amazônia – ITEGAM – Manaus - Amazonas

ABSTRACT

Due to the adjunct population growth of the Industrial Revolution since the 70's, it has been thought and planned about the adequate urban infrastructure, which is taking into consideration the welfare of the population. From this line of thought, sanitation has become one of the alternatives for municipal development, because besides encompassing sanitation services, it also has interrelationship with other areas such as health, housing, leisure and others. Thus, this article aimed, through the analysis of the basic sanitation system, to facilitate the identification of the current problems in the sector of the black neighborhood in Manacapuru - AM. To this end, discussions were held on the structure of the Municipal Basic Sanitation Plan of the municipality and field measurements were collected for the development of diagnostic maps of basic infrastructure characteristics, such as drainage, water and sewage network, waste collection and junk dumps. Thus, the analysis of the previous and current sanitation situation was carried out. Increases were found in the junk dumps, and in the drainage system's mouths and in the absence of a sewage system. From this the adopted method was efficient for analysis of the basic systems, being able to be used for evaluation of the other districts of the city.

Keywords: Municipal Sanitation Plan, Municipal Master Plan, Geoprocessing, Basic Sanitation System, Terra Preta.

INTRODUCTION

Basic sanitation are actions of paramount importance to the health and quality of life of the population, being the infrastructure services and operational facilities for drinking water supply, sanitation,

urban cleaning and solid waste management, drainage and stormwater management. urban (LUDWIG *et al.*, 1999; LEONETTI *et al.*, 2011).

Early records of the use and importance of basic sanitation emerged in ancient Egypt, yet during the seventeenth century some countries in Europe such as Germany, Belgium, France, and England lived in poor hygiene conditions causing cases of diseases such as cholera and fever. typhoid (CAVINATTO, 1992). In Brazil this problem was no different. Since the arrival of the Jesuits, water-related diseases were common, but it was only in the twentieth century, after outbreaks of water-related epidemic diseases were first taken (PEZELLA e SILVA, 2011).

As a result, several agents hampered the development of sanitation in Brazil during its history over the years, when only from the 70's, the National Sanitation Plan (Planasa) was consolidated (SOARES et al., 2002; LEONETTI et al., 2011). Thus, legislation emerged that could mitigate the problems over the years, through appropriate guidelines, measures and infrastructures for the system (NERI *et al.*, 2009; DA COSTA *et al.*, 2019).

In attention to the disordered urban growth associated with the Industrial Revolution, policies have been devised for basic sanitation, so that municipalities can diagnose their needs. And associated with these needs, Federal Law No. 11,445 / 07, called the National Basic Sanitation Law - LNSB, entitles municipalities to manage these guidelines, which are intended to identify short, medium- and long-term objectives and goals. to adjust and expand the basic sanitation system for the population, so in the municipality of Manacapuru / AM is no different (BRASIL, 2007).

In order to discuss approaches related to basic sanitation, Bovolato (2015) presents as one of the problems that can affect the environment the lack of investment in basic sanitation. While Ludwig et al. (1999) showed relationships between the basic sanitation situation and the prevalence of diseases caused by parasitic organisms in studies carried out in the municipality of Assis in the state of São Paulo. From this it can be assumed that the lack of investment in the system can directly affect the environment and the population.

The city of Manacapuru belongs to the metropolitan region of Manaus and is located on the left bank of Rio Solimões, 84 km from the Amazonian capital. Santos et al. (2018) showed that the population living in an unhealthy environment due to poor sanitation conditions is a sick society. Since the scarcity of the service has been generating diseases such as diarrhea, hepatitis, dengue, yellow fever, malaria and others, due to contaminated water, vector transmission and oral closure. In addition to harming the preservation of the environment, which is a parallel effect to the absence of the system, as it has been causing environmental degradation and has been contaminating several watercourses harming various species and the ecosystem itself.

With this in mind, the use of tools such as geoprocessing for analysis of the basic sanitation system is an alternative that can facilitate the identification of problems in the sector, due to their use for monitoring and control (BORJA, 2014; ALMEIDA et al., 2009; PEREIRA and MORAIS, 2015). Thus, with the knowledge of these aspects and where they occur, it is possible to visualize them through maps that can identify and reveal probable solutions (SANTOS and WALDEMAR, 2007). Thus, a good management of the basic sanitation system allows the population to enjoy the environment with quality, and at the same

time, the municipalities will save on public health expenses directed to the treatment of diseases caused by lack of service (CARVALHO, 2010).

This paper analyzed the basic sanitation system of the Terra Preta neighborhood in the municipality of Manacapuru through geoprocessing, where environmental diagnostics, mapping of sanitation services to locate them in the neighborhood perimeter and comparing the basic system before and after the plan were obtained. director of the municipality, to observe its development over time. Since the service does not only involve the sanitation system, it has been bringing benefits to other areas as well, so it should be properly implemented. Therefore, the Sanitation Law imposes measures to facilitate this service in the municipality, one of the main ones being the Municipal Basic Sanitation Plan that serves as a management tool for the sector (CORRÊA, 2018).

The analysis of municipal sanitation systems leads to a control of the progress and expansion of municipal services. Thus, to support municipal management, analyzes of this type of service can assist in the progress of the development of sanitation plans, bringing improvements in public health and the environment. Thus, this work has its importance for growing city populations, where it will be possible to study the current municipal sanitation plan, the places that are being affected by its lack and propose improvements in its management.

MATERIAL AND METHODS

This research was conducted in the Terra Preta neighborhood of Manacapuru / AM, being one of the most inhabited neighborhoods in the city, where CENSO (2010) pointed out an average of 5,389 inhabitants. Initially, analyzes were carried out on the structure of the municipal basic sanitation plan of the municipality of Manacapuru, which was approved in 2012. After analyzing the plan, the relevant sections of the following topics were highlighted and discussed: Diagnostics of sanitation services; Planning parameters; Demands; Prognosis; Programs, projects and actions; Investment Forecast.

To obtain the results, field measurements were carried out over a period of three months throughout the neighborhood. Thus, for the development of the analysis of the diagnostic maps, field information was surveyed using a GPS receiver (GPSMAP 78S GARMIN). The latitude and longitude coordinates of each point of the municipal sanitation infrastructure were collected, in order to produce the maps of the respective services.

After field measurements the data were processed in a georeferenced cartographic base with the aid of the tool, ARCGIS version 10.3. Initially the coordinates were stored in a spreadsheet in Excel 2013, which had two columns with the coordinates of latitude (X) and longitude (Y). Soon it was necessary to convert the GMS coordinates to decimal cranes, because Arcgis Software does not accept import in GMS format (degrees, minutes and seconds). The document was then saved in Excel XLS format.

Subsequently, the cartographic base of the study area was added and then the coordinate points stored in the spreadsheet. Thus, the points of the basic sanitation system services were distributed on the map. Comparison analysis was performed through maps of the current sanitation services generated during the execution of the work. Afterwards, comparisons were made through a visual analysis of the activities existing today with the maps prepared in the Municipal Master Plan of 2006.

After the visual analysis, it was verified if the municipal sanitation services expanded or stagnated during the period. At the end of the previous stage, a new visual analysis was performed to observe in both maps the number of wolf mouths in each street of the neighborhood, and in parallel, it was identified which neighborhood streets have regular solid waste collection. among them, which ones have junk dumps and also, which streets in the neighborhood have water and sewage system.

RESULTS AND DISCUSSIONS

Municipal Plan of Basic Sanitation

Beginning with Law No. 445/07 with its guidelines and definitions of basic service planning, the Municipal Basic Sanitation Plan (PMSB) has become a tool for expanding access to the system.

Analyzing the situation and the quality of services through the diagnosis of the sanitation system provided by Manacapuru PMSB, it was observed that the water supply system uses surface and underground springs, and 70% of the municipal demand is It is supplied by underground wells and is explored by 29 tubular wells with depths between 110m and 220m, which includes the Terra Negra neighborhood containing two distribution reservoirs. Physicochemical analyzes are performed once a year. Regarding the sewage system Manacapuru is among the municipalities of Amazonas that do not have sewage treatment, so the population opts for septic tanks or even simple holes that serve as untreated sewers.

According to the plan, the drainage system is located in almost all its urban extension, but the rainwater has its final destination only through the channels being the mouths of the wolf to the bodies of water. With regard to solid waste management and management, the former responsibility was formerly the Secretariat of the Environment, today it is being administered by the Municipal Secretariat of Public Works and Services. Home collection services are done once a day, while public street and street sweeping is done three times a week, except for the Center, which is daily, and hospital collections were done once a week and buried in the dump. a company responsible for the final disposal of waste from the hospital, clinics, health post and pharmacies.

According to the planning parameters adopted for development, the planned PBMB implementation can be seen in Table 1. These parameters were constructed from hypothetical data and are therefore not accurate and reliable. At the same time, the city does not have micrometers for the analysis of the water supply system, as well as the absence of scales for trucks, which does not allow the records of daily travel numbers of these vehicles through the city. Thus, it was possible to obtain them through IBGE, DATASUS, SNIS, CETESB, ABRELPE and IPAAM.

Table 1: Year of activities for the implementation of the Municipal Basic Sanitation Plan in the city of Manacapuru-AM.

ACTIVITY	YEAR
Plan start	2013
End of plan	2032
Short term works	2013 a 2017

| Medium term works | 2018 a 2022 |
| Long term works | 2023 a 2027 |

Source: Manacapuru Municipal Sanitation Plan.

The planning of the urban drainage system and stormwater management were not performed in the original plan, which contradicts Tucci and Silveira (2001), who show that the adequacy of the development of the cities with the environmental situations are necessary attitudes to plan and control these. impacts that can cause more frequent flooding, flooding and environmental devastation.

According to the demands, two population growth scenarios were considered until the end of the plan in 2032, with a 1-optimistic scenario with a geometric growth rate of 2.70% per year and a 2-less optimistic scenario with declining growth rates ranging from 2.02% per year and 1.46% per year, however both pointing to a higher average growth than the recent Demographic Census, the local potential and mainly by the greatness of the State of Amazonas. In addition to these factors, the municipality is in a state of growth in relation to its easy accessibility, after the construction of the journalist bridge Felipe Daou, Highway AM-070. Subsequently, it was observed that the demands surveys ruled out the urban drainage system and rainwater management.

For a probable future development or the result of a process based on observations of the present, it was observed in the prognosis that one of the greatest difficulties encountered in preparing this PMSB was obtaining a cartographic base and cadastral elements. Therefore, it is suggested to perform topography services, planialtimetric surveys and registrations of existing units. Due to the water supply system to meet the short, medium and long-term needs of the city, it is more viable to explore the surface spring, in this case the Solimões River, since it has a year-round capacity to supply the municipality. although its water has a high turbidity index. Knowing that in rivers for water supply turbidity will affect water disinfection as it may contain organisms in the suspended material that will make disinfectant action difficult. Another deduction would be the formation of excess sludge in the treatment plants. Thus it will be necessary to define the characteristic, origin and grain size of the turbidity, making it easier to choose the most effective treatment method.

During the elaboration of the basic design of the supply system, it is recommended to develop studies aiming at the use of the existing wells, aiming at the control, since the uncontrolled use of the underground aquifer can cause lowering of the water table affecting several segments. And noting that there is currently no sanitary sewage system in operation and planning to meet the provisions of current legislation, it is recommended to prepare a basic project and an executive to implement this system in the shortest possible time, providing a network collector, change collectors, interceptors, pumping stations, sewage treatment plant and outfalls.

According to urban cleaning and solid waste management, due to the lack of scales in the municipality, there are no reliable estimates regarding the quality of solid waste collected daily, an essential parameter for the calculation of the surface area required to install the landfill with minimum service life of 20 years. For Manacapuru it was adopted as an area to be found. It is recommended that the City Hall carry out appropriate suitability studies of the chosen area, according to the current Brazilian standard, together with the competent environmental agencies. Consequently the urban drainage system and

stormwater management according to the information obtained from the City Hall, Manacapuru had approximately 91 km of street, for the Host District that should have a short and medium term drainage system. For this purpose, the basic project should be prepared so that the works to be auctioned for its expansion.

As an alternative to improvements in the basic sanitation system, programs, projects and actions are suggested, aiming at water quality control, water safety plan-PSA, control and reduction of water loss, environmental education and social communication.

According to the investment forecast for the development of the PMSB, table 2 shows the survey of all sanitation services. The short, medium and long term needs of the districts and communities are included in the Municipal Basic Sanitation Plan, which foresees investments of R $ 85,000.00 per district or community aiming at the implementation of simplified water supply systems. which also foresees investments of around R $ 150,000.00 per district or community aiming at the implementation of simplified sewage systems.

Table 2: Investment Forecast (2013–2032)

Description	Investment (R$)		
	2013 a 2017	2018 a 2022	2023 a 2032
Water supply system			
Localized works	27.379.170,00	7.371.315,00	7.371.315,00
Linear works	4.547.749,14	3.410.811,85	3.410.811,85
Sanitary sewage system			
Localized works	11.197.109,62	3.014.606,44	3.014.606,44
Linear works	19.255.680,00	14.441.760,00	14.441.760,00
Urban cleaning and solid waste management system			
Implementation of Integrated Solid Waste Center	4.301.891,40		
Dump Recovery	345.000,00		
Urban drainage system and stormwater management			
Linear works	8.268.634,80	16.537.269,60	16.537.269,60
Riverside Population Removal and Resettlement	9.091.200,00	18.182.400,00	18.182.400,00

Source: Manacapuru Municipal Sanitation Plan.

Diagnostic Maps

Understanding that public cleaning and solid waste management services in the state of Amazonas are predominantly the responsibility of municipal governments for their administration and operation. Figure 1 shows in the current diagnosis a higher concentration of junk dumps compared to the survey conducted by the Municipal Master Plan (PDM), with a total of 26 identified junk points, 15 more than indicated in the PDM. Manacapuru is one of the municipalities of the Manaus Metropolitan Region that has been awarded the Municipal Plan for Integrated Solid Waste Management since 2012, but the

municipality still has difficulties in its final destination, contributing to the increase of the locations of incorrect and disorderly solid waste disposal.
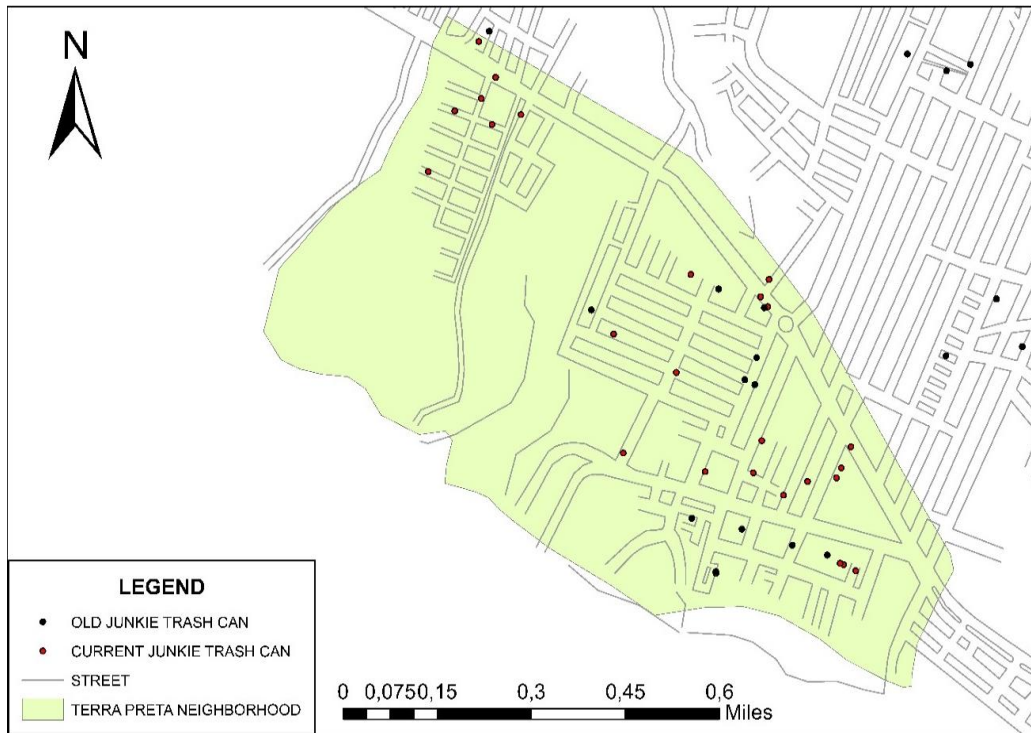

Figure 1: Map of the old and current junk dumps of the terra negra neighborhood in Manacapuru-AM.

Despite the expansion and daily routes of solid waste home collection trucks (Figure 2), there is a visible accumulation of waste throughout the neighborhood (Figure 1). According to Ferreira and Anjos (2001), even though the importance of the efficiency of the urban public cleaning activity for the environment and the health of the population is undeniable, there is little positive action against this situation in which the water management system is located. municipal solid waste, including in Brazil. However, some people may be prone to being affected by environmental issues, leading to decreased quality of life and increased health problems.
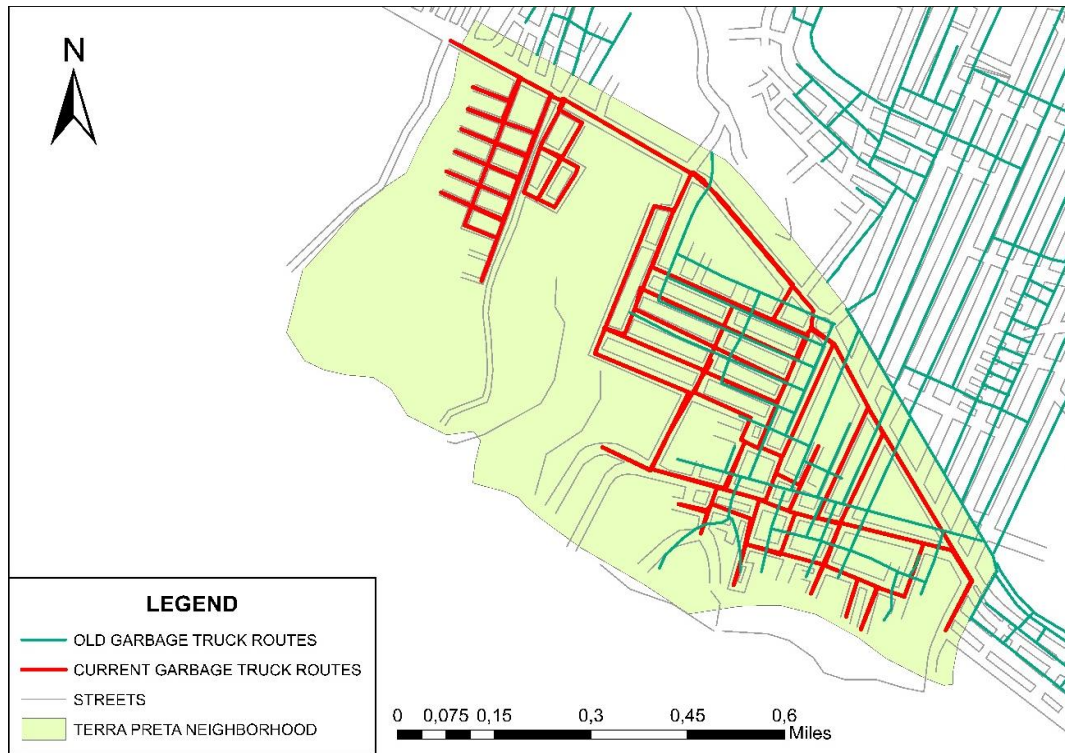
Figure 2: Map of the old and current routes of the home collection trucks of the terra negra neighborhood in Manacapuru-AM.

Subsequently, Figure 3 shows the enlargement of the drainage system lobes, which is currently 46 points, 7 more compared to that described in the PDM. However, there is an uneven distribution in this increase, since they are clustered in the main streets. According to Vinagre et al. (2017) urban drainage aims to control the risks of flooding, flooding and disease transmission through water. Thus the stormwater drainage system needs to be evaluated frequently, in order to obtain data highlighting emergency points, which may overflow, resulting in the creation of preventive measures for flooding.

Figure 3: Map of the old and current wolf's mouths of the terra negra neighborhood in Manacapuru-AM.

Water is certainly the most important natural resource for man, among the many natural elements accessible to him, as established in Article 3 of the Universal Declaration of Human Rights. Thus, knowing that the black earth neighborhood is supplied by the underground source, Figure 4 shows the same amount of reservoirs in the area, but we can see a difference in one of the points currently identified in relation to the one diagnosed in the PDM, due to is disabled and currently in another landmark.
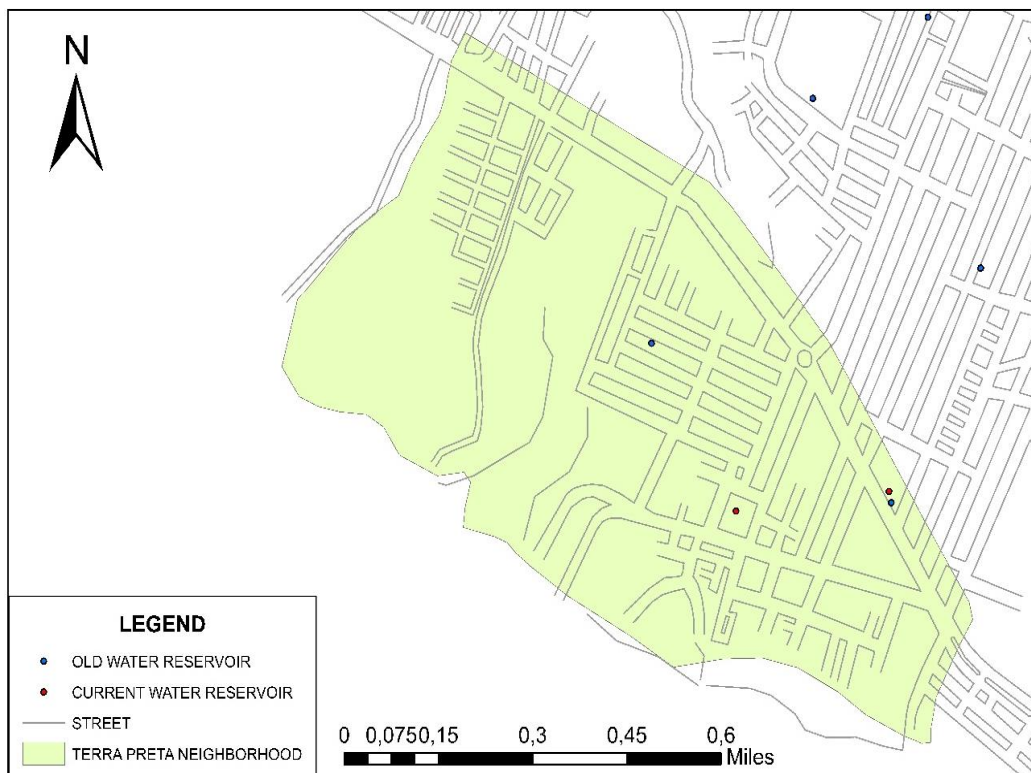

Figure 4: Map of the old and current water reservoirs of the Terra Preto neighborhood in Manacapuru-AM.

As pointed out the absence of a sewage system in the city, given the fact that the solution alternatives, for the definition of the type of treatment are technically feasible, in the elaboration of the basic project should be developed environmental and economic feasibility studies. definition of alternative solution for sanitary sewage treatment system.

FINAL CONSIDERATIONS

From the understanding of the negative impacts generated to the health of the population and the environment due to the lack of basic sanitation, one must understand the real socioeconomic condition and the local infrastructure, because without good management the public authority has difficulty in corrective actions.

Thus, according to the assessments of the conditions of the basic sanitation system, carried out in the terra negra neighborhood in the city of Manacapuru - AM, and the current and previous verification of this situation, the use of this method was efficient and can be recommended for analysis of other neighborhoods. of the municipality. Since it allowed the visibility of 15 new junk dumps points and 7 new cake mouths, as well as the deactivation and exchange of one of the neighborhood reservoirs. As well as the lack of sanitary sewage system in the municipality to date.

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