Water supply sources in the neighborhood city of Lobo in Porto Velho – Rondônia, Southern Amazon

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ABSTRACT
The objective of this work is to characterize the sources used to obtain water destined for residences in the Cidade do Lobo neighborhood in the city of Porto Velho, State of Rondônia - Southern Amazon. The methodology employed was descriptive, using the inductive method, and the procedures adopted consisted of bibliographical research, field verification, production and analysis of graphs and characterization of the water supply scenario in the neighborhood during the second half of 2018, through the application of a form with objective questions, in 58 residences, chosen by convenience sampling. It was possible to identify the predominance of two types of wells: the semi-artesian and the amazon, the latter as the main source of water supply for this population. The general network plays an important role in people's lives, but the supply of treated water is limited to some homes in this neighborhood, forcing residents, who do not use well water for direct consumption, to seek alternative solutions to have access to better water. quality, including the purchase of water using a water tank or mineral water available in shops, in addition to collecting water using jerrycans in places that have piped water, demonstrating that a large part of the neighborhood's population is excluded from policies offered by the government, regarding the supply of treated water through protected springs.

Keywords: Spring, Water supply, Wells, Cidade do Lobo.

1 INTRODUCTION

Water is an essential natural resource for the survival of human beings and is one of the problems faced by a part of the population of Portovelhense. There is also a lack of sufficient infrastructure to supply essential services, such as the supply of treated water through the general supply network to serve the homes of all neighborhoods of the city of Porto Velho, State of Rondônia, located in the southern Brazilian Amazon. Water is found in different physical states, they are: liquid, solid and gaseous. Temperature is the factor responsible for maintaining or transforming the physical state of the same.

The hydrological cycle is the movement of water on the planet, occurs in the oceans, continents and the atmosphere. The water is subject to evaporation, turning into clouds, where the process of condensation occurs and returns to Earth in the form of rain. This process and dynamics characterizes a constant cycle of compound movement between several stages, by precipitation, evaporation, surface

runoff, infiltration and groundwater (BRASIL, 2018). The water, to be consumed, is that destined to the ingestion, preparation and production of food and also for personal hygiene, must comply with the standards of potability in force, such as: microbiological standard, turbidity, organoleptic standard, among others.

Due to technological advances arising from scientific research and better knowledge of the reality of the country, this legislation undergoes frequent revisions and updates, such as Ordinance No. 2,914 of December 12, 2011 of the Ministry of Health (BRASIL, 2011) partially amended by Consolidation Ordinance No. 5, of September 28, 2017 (BRAZIL, 2017). The latter had its Annex XX modified more recently by Ordinance GM/MS No. 888, of May 4, 2021 (BRAZIL, 2021). It is worth noting that these documents present the competences attributed to the Union, the States and Municipalities.

The standard of potability established by these official documents also mentions the microbiological standard that has as its main objective:

> Provide support regarding its potability, that is, the absence of risk of ingestion of disease-causing microorganisms, usually from contamination by human feces and other warm-blooded animals. It is worth mentioning that the microorganisms present in natural waters are, for the most part, harmless to human health (BRASIL, 2013, p. 09).

When contamination by sewage percolation occurs, microorganisms present numerous health risks. The consumption of contaminated water manifests itself in different ways, from activities carried out daily such as food and beverage intake, or even amid exposure in environments of collective use, such as swimming pools, baths, among others. The implementation or improvements in the water supply is one of the important factors for the maintenance of the health of the population and reduces the number of diseases of transmission directly through water (OLIVEIRA, 1987).

The objective of this work is to characterize the springs used to obtain water for residential purposes in the Cidade do Lobo neighborhood, located in the South Zone of Porto Velho, capital of Rondonia, describing the situation found in the second half of 2018, the period that was carried out the research, through a survey in bibliographic materials, data related to the subject at the Brazilian Institute of Geography and Statistics - IBGE by the Automatic Recovery System - SIDRA (IBGE, 2018) and through the application of an interview form, "obtaining the answers of the residents surveyed to verify information obtained through the previous bibliographic survey" (LAKATOS; MARCONI, 1992, p. 107).

It is important to highlight that the definition presented by Oliveira (1987, p. 2) was adopted:

> By source is conceptualized the source of water supply, which can be, for example, a river, a lake, a spring or well, coming from the water table or the deep sheet" and as for the sanitary conditions, the same author classifies the springs in "protected and unprotected.

The form application was performed in 58 residences in the Cidade do Lobo neighborhood, chosen by convenience sampling. According to the data obtained, the line of methodological research developed is the descriptive, with the inductive method, which aim to "study particular situations, aiming not only at the identification of the problem, but the relationship that it has with factors that directly influence the current situation, then the comparison is made to discover the correlation between the factors presented" (GIL, 2008, p. 10).

2 HISTORICAL CONTEXT OF THE CIDADE DO LOBO NEIGHBORHOOD

The urban space is articulated, each of its parts always relates to the others, directly or indirectly, causing all to get in sync and develop in an egalitarian way, although they have different intensities. This articulation in a concrete way is defined:

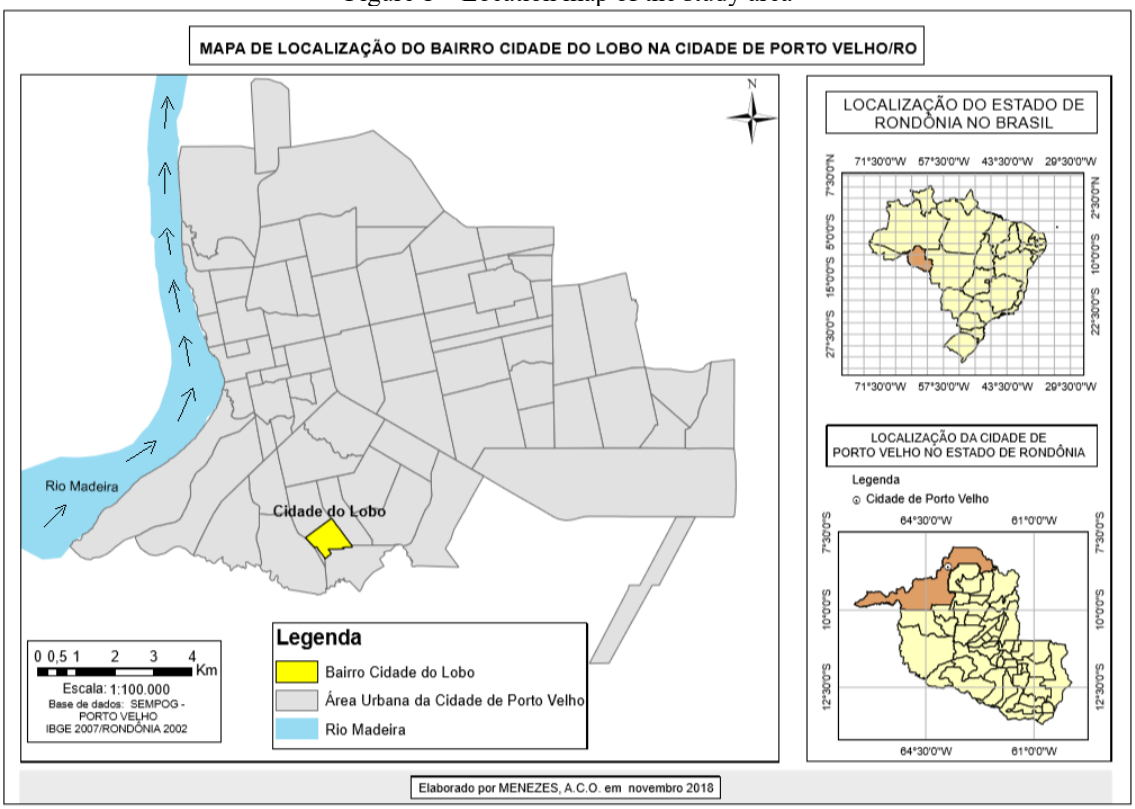
> [...] through flows of vehicles and people associated with the loading and unloading of goods, the daily commutes between residential areas and the various workplaces, less frequent trips for shopping in the city center or the shops of the neighborhood, visits to friends and relatives, and trips to the cinema, religious worship, beach, parks, squares (CORRÊA, 1989, p. 7).

It is also characterized according to its spatial organization, "distinguishing the different forms of land uses, whether they are intended for commercial, industrial, services, residential or leisure areas, always aiming to interact socially with the rest of society" (CORRÊA, 1989, p. 7).

Rondônia is a state that has been growing at a fast pace in recent years, mainly due to the coming of large enterprises such as the construction of the hydroelectric plants of the Madeira River. The expressive flow of migrants provided some socioeconomic growth in the city, these people came from various parts of the country in search of employment and better quality of life, so new neighborhoods were created and others regularized. The housing search has grown in a disorderly way, forcing the municipality to create public policies to assist essential services to serve the entire population.

Figure 1 shows the location map of the city of Porto Velho and identification of the study area that has its boundaries established between the following neighborhoods: to the north with the Conceição neighborhood, to the south with the New City, to the east with Caladinho and the west with the Novo Horizonte neighborhood. It is also part of zone 3 along with the neighborhoods Aeroclube, Areia Branca, Caladinho, Castanheira and Cohab (PORTO VELHO, 2018).

Figure 1 – Location map of the study area



Prepared by Menezes (2018).

According to the 2010 IBGE census (IBGE, 2012), the neighborhood had 1,179 households and about 4,433 people. It emerged in mid-1984, without planning, sanitation, urbanization or any other form of infrastructure. It had its name in allusion to the surname of the former owner "*João Leal Lobo*", who made in the place rice plantations and over time, had his property invaded by people in search of a land to establish housing.

In 2011 the residents were contemplated with the Usucapião Program, which is the right that a citizen acquires about the possession of a movable or immovable property as a result of the use of this for a certain time, "the program was conducted by the city and gave the right of possession to the resident who was on the land for at least 5 consecutive years and that the owner had not shown interest in the lot" (BORZACOV, 2016, p. 133).

Because its creation came from invasions, the Cidade do Lobo neighborhood was expanding outside the proper standards and without any form of planning, hindering the isonomic implementation of the treated water supply service.

The research was conducted by the importance that water plays in people's lives and how those who do not have access to the general network of treated water do to dispose of the service even in their way, as is the case of wells, and what diseases have water as a source of transmission and even diseases of water origin, that put public health at risk if there is direct contact with the contaminated

source. Soon after the definition of the theme, the search for official data such as the censuses released by the IBGE began.

In the stage of evaluation of the data obtained, it was identified that during the censuses of the years 2000 and 2010 the neighborhood was with a considerable number of residents who had wells, as a form of water supply in the residence, the remainder, about 193 houses in the year 2010, had the general network as the main maintainer of the water supply in the property, represented by Figure 2, as follows:

Figure 2 – Comparison between the water supply data obtained through the censuses of the years 2000 and 2010 in the Cidade do Lobo neighborhood

Source: Census 2000 and 2010 (IBGE, 2012). Organized by Menezes (2018).

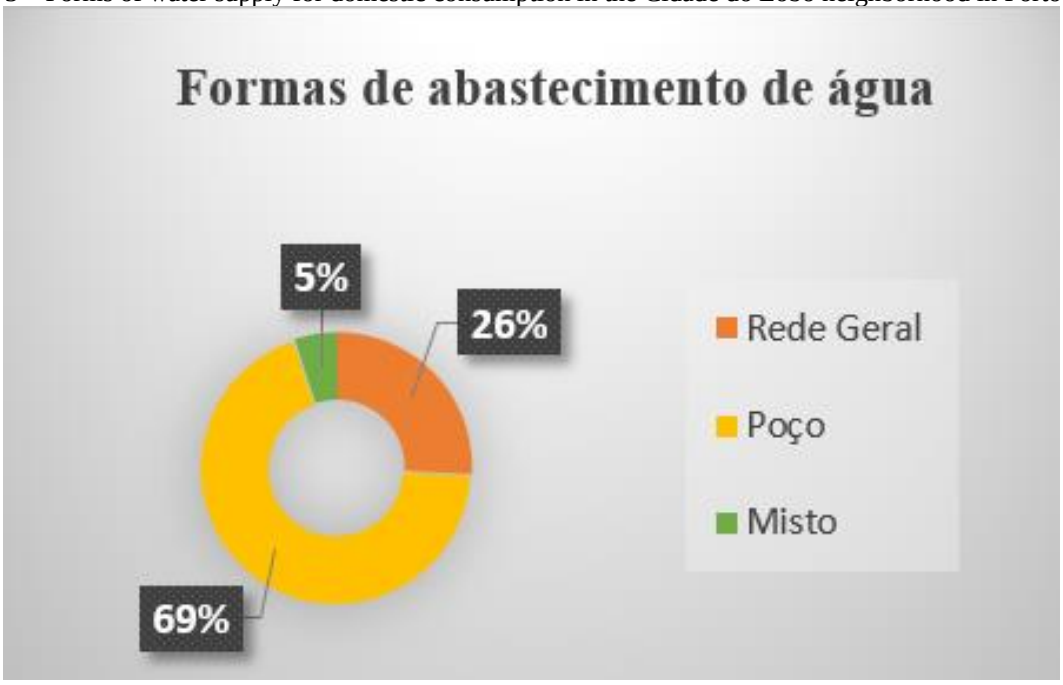
We went through the entire perimeter of the neighborhood's delimitation, between the main streets in search of residents who were willing to answer the form, composed of 15 questions that had objective alternative questions and justifying questions that required a better detailing of the situation. In all, 58 forms were answered with objective questions regarding the identification of the residence, the main source for the water supply in the house and the physical characteristics of the water and the quality of the service provided by the company responsible for the water supply in the capital, thus contributing to the achievement of the results achieved.

It was decided to keep the focus mainly on the characteristics of the springs, due to the resistance of people to talk about the subject of possible diseases caused by the use of inadequate water for consumption, when the questions were directed to the subject, the interviewees avoided passing on any type of information, especially the residents who have in their properties the characteristics of wells prone to contamination.

3 FORMS OF WATER SUPPLY IN THE CIDADE DO LOBO NEIGHBORHOOD

With the choice of the inductive method, when doing the case study and application of form in the neighborhood, it was possible to verify the situation that pointed out the census of 2010 (IBGE, 2012), which is the predominance of wells that are used as a form of water supply for domestic use in the Cidade do Lobo neighborhood in Porto Velho, indicated by Figure 3, which shows the percentage of respondents who make use of water in their homes having its origin through the general network, wells and mixed, which are those who have both forms of supply to meet the needs of their homes, the data represent the results through the field survey conducted in the neighborhood.

Figure 3 – Forms of water supply for domestic consumption in the Cidade do Lobo neighborhood in Porto Velho



Prepared by Menezes (2018).

At that moment, the confirmation of the data obtained through the SIDRA of the IBGE was clear, when of the 58 forms applied, the total of 40 were answered by people who have the residence only supplied by water from wells, 15 residents still stated that they have access to water provided by the general network not having a well in the residence and 03 interviewees have both forms of supply, where with the lack of one of the alternatives for an indeterminate reason, the other maintains the activities developed in the residence normally.

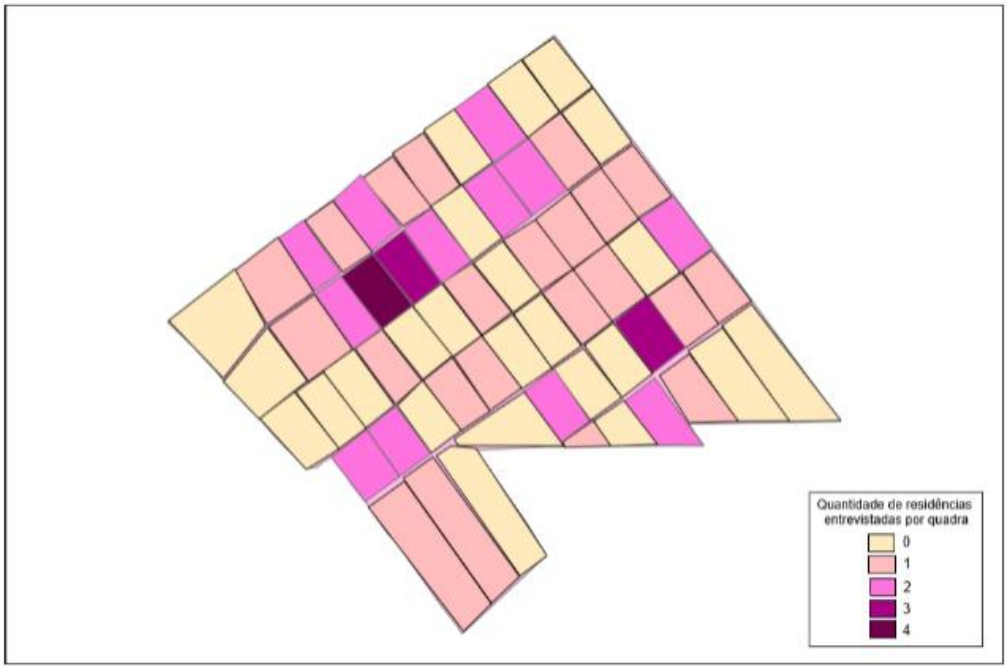
It was noticed during the fieldwork that people were afraid to answer the questions, because they thought that behind the form would be involved other intentions, of inspection for example, as said by some, who at first thought that the objective was to survey the houses that have wells, to request the future the closure and force them to use the water provided by the general network.

At this stage of the work it was necessary to describe in more detail about the objectives of the research and try to convince them of the importance of bringing the subject to be exposed in the future

before the community itself, since water is indispensable in all activities performed by the human being and requires great attention, because of the way it can bring numerous benefits to the body, It can also be harmful to health, and may even cause irreparable damage.

As people made themselves available to answer the questions, the results began to take shape. In some blocks, it was not possible to obtain results from the application of the form, since the sample type of convenience survey was followed and some residents chose to abstain. Figure 4 below represents the results obtained through the indicative classification of the number of properties in which the respective residents answered the form.

Figure 04 – Result of the application of the form by blocks of the Cidade do Lobo neighborhood



Prepared by Menezes (2018).

3.1 HOMES SUPPLIED THROUGH WELLS AND OTHER SOURCES

Drinking water is defined as water that meets the standard of potability established by the legislation in force and that does not pose health risks. Through the convenience sample survey, 40 people who own and make use only of the water from the well in the residence and 03 who also have access beyond the well to the general network as a form of supply to perform daily activities were interviewed.

It was found the predominance of residences that have wells supplying the houses in the Cidade do Lobo neighborhood in Porto Velho, starting from this point, the form brought a very important item to be observed that are the types of wells that perform this supply.

The number of households that have the well of the Amazonas/Cacimba type is equivalent to 36 interviewees, which is the type of well that has the cheapest cost about the construction, presenting

shallow depths, but it is the type of well that contains the greatest risks of contamination, because it is the water table.

The residences that use the semi-artesian well type are equivalent to 07 interviewees, and this is the type of well recommended for the capture of water from the underground table above 20 meters deep, using filters and pre filters to eliminate various types of impurities, such as dirt. Figure 5 shows the result obtained in the form of a graph, where it represents the percentage of the types of wells predominant in the study area.

Figure 5 – Types of wells predominant in the neighborhood Cidade do Lobo in Porto Velho – RO

Prepared by Menezes (2018).

After identifying the types of wells, it was possible to point out the average depth of the same, item of question No. 13 of the form, an important data to be verified, because most of the wells of the Amazon type in the neighborhood presented shallow depths for water capture, with results ranging from 06 to 20 meters deep. In this case it is important to guide the residents who have this type of well to observe their conditions, if there is the presence of insects and animals in the interior and the vicinity, if the fence is under the standards, carry out the cleaning and disinfection in an appropriate way, the construction of a box over the mouth of the well is fundamental, this can be made of concrete or bricks, with a height between 50 and 80 centimeters from the ground and mainly, close the mouth of the well with concrete or wood structure, leaving an opening for inspection and maintenance of the well, as represented in Figure 6.

Figure 06 - External view of an amazon-type well located in a residence in the Cidade do Lobo neighborhood in Porto Velho – RO

Photographed by Menezes (2018).

The biggest aggravating factor occurs with the arrival of the dry season in the middle of the year, popularly known in the Amazon as "summer", when the wells begin to have variation in their water level and some even dry up completely, forcing residents to look for various options to keep the house supplied, avoiding on average, the lack of water for three to four months in a row.

Figure 7 below identifies some of the main diseases related to inadequate water supply and consumption, such as wells with shallow depth that are more prone to various types of contamination, mainly by sewage percolation, this figure also specifies the forms of transmission and prevention.

Figure 7 – Diseases related to water supply

Grupo de doenças	Forma de transmissão	Principais doenças e agente etiológico	Formas de prevenção
Diarréicas e verminoses	Ingestão de água com contaminantes, má higiene dos alimentos e a forma de tratamento dos dejetos.	Cólera (*Vibrio cholerae*) Giardíase (*Giardia lamblia*) Criptosporidíase (*Cryptosporidium parvum*) Febre tifoide (*Salmonella typhi*) Febre paratifoide (*Salmonella paratyphi* dos tipos "A", "B"ou "C") Amebíase (*Entamoeba hystolitica*) Hepatite infecciosa Ascaridíase (*Ascaris lumbricoides*)	A educação sanitária, o saneamento e a melhoria do estado nutricional dos indivíduos. Implantar sistema de abastecimento e tratamento da água, com fornecimento em quantidade e qualidade para uso e consumo humano. Proteção de contaminação dos mananciais e fontes de água.
Pele	Relacionadas com os hábitos de higiene.	Impetigo (*Staphylococcus aureus*) Dermatofitose e micoses (fungos dos gêneros *Trichophyton, Microsporum e Epidermophyton*) Escabiose (*Sarcoptes scabiei*) Piodermite (*Sarcoptes scabiei*)	Não permitir banhos de banheira, piscina ou de mar. Lavar frequentemente as mãos com água e sabão.
Olhos	A falta de água e a higiene pessoal insuficiente criam condições favoráveis à sua disseminação.	Conjuntivites (vírus e bactérias)	Evitar aglomerações ou frequentar piscinas de academias ou clubes e praias. Lavar com frequência o rosto e as mãos, uma vez que estas são veículos importantes para a transmissão de micro-organismos patogênicos.
Transmitidas por vetores	As doenças são propagadas por insetos cujos ciclos possuem uma fase aquática.	Malária (*Plasmdium vivax, P. falciparum, P. malariae*) Dengue (DENV 1, 2, 3 e 4) Febre amarela (vírus do gênero *Flavivirus*) Filariose (*Wuchereria bancrofti*)	Eliminar os criadouros de vetores com inspeção sistemática e medidas de controle (drenagem, aterro e outros). Dar destinação final adequada aos resíduos sólidos.
Associada à Água	O agente etiológico penetra pela pele ou é ingerido.	Esquistossomose (*Schistosoma mansoni*) Leptospirose (Bactéria do gênero *Leptospira*)	Evitar o contato com águas infectadas. Proteger mananciais. Adotar medidas adequadas para disposição do esgoto. Combate do hospedeiro intermediário. Cuidados com a água para consumo humano. Cuidados com a higiene, remoção e destino, adequados de dejetos.

Source: Brazil (2015, p. 93).

The alternatives pointed out by the residents as a solution to keep water stored for use in the residence, were two: through the purchase, either by kite car or mineral water available in shops and through the solidarity of the neighbors, who make their wells available to supply the houses nearby.

Among the problems found by the residents, related to the arrival of "summer" is the remarkable change in the physical aspect of the water obtained through the well, it becomes muddy and sometimes even has a strong smell, when not used the water from the well in a rational way, this comes to dry completely, forcing the resident to perform the cleaning process of the same, claimed by most of the interviewees as the main factor for the execution of the well maintenance process; Among the answers, a large risk factor for contamination was verified, 10 interviewees reported that they do not clean their well.

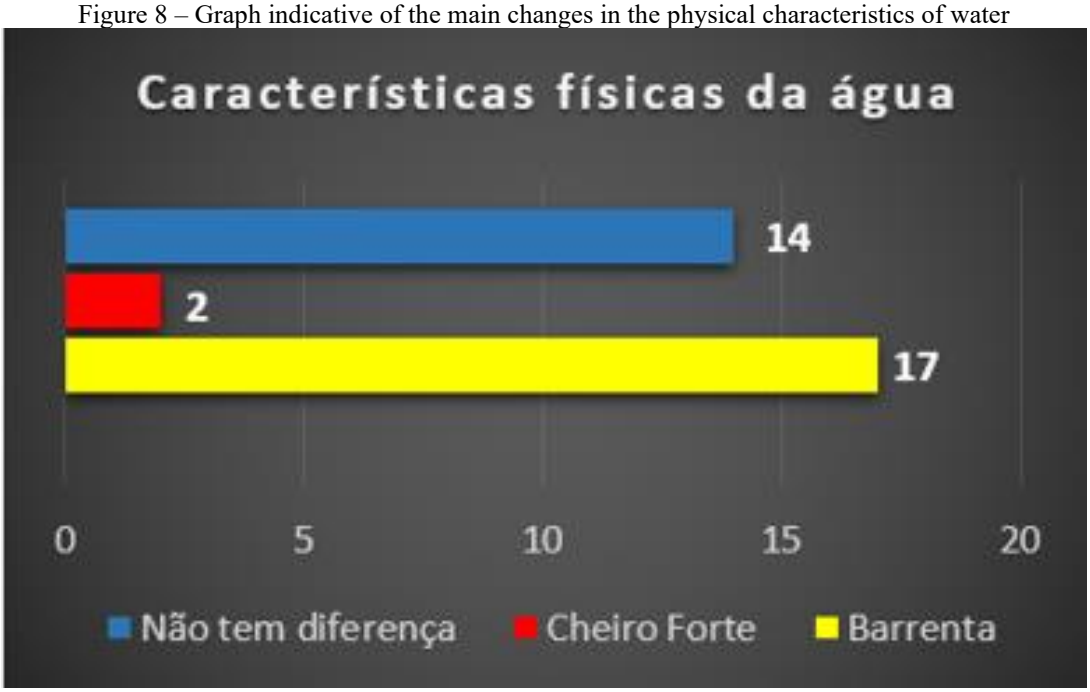
The disinfection process is done through some products derived from chlorine, mainly bleach and hypochlorite, this is made available by health units free of charge used by residents at home to disinfect the well, especially when significant changes in the color and smell of the water are perceived.

The change in the physical aspects of water can be indicative of the presence of metals such as iron and manganese, causing bad smell and also stains on tissues, fouling in pipes and if consumed in excess, over time can cause damage to the body, increasing the risk of heart, liver and pancreas diseases.

The presence of organic matter also contributes to color change and one of the most harmful factors to human health is contamination by sewage percolation, which can present changes in both color and smell.

This hypothesis by sewage contamination is considered by the fact that the city of Porto Velho is almost devoid of a general sewage network, thus forcing the population to resort to cesspools, which when built irregularly and without planning can contaminate the water table, making the water from nearby wells inappropriate for use. In Figure 8, the results obtained regarding the physical characteristics of the water are presented in the graph, indicating the quantity of responses obtained.

Figure 8 – Graph indicative of the main changes in the physical characteristics of water



Prepared by Menezes (2018).

The ideal before using the water that presents this type of characteristic is to look for the water treatment unit of the city and request the performance of examinations thus obtaining the certification that it has quality for residential use or not. The total of 06 interviewees verbally informed that they had already performed these tests with the treatment unit and obtained positive results, but these tests were performed a long time ago and allowed the use of this water in practically all daily activities, except for ingestion, where all claimed that they do not use the water for consumption itself, Because there is the fear in making food and drinking from it, since according to information passed on among

the neighbors themselves, some wells have already had problems with gases and had to be closed completely.

As stated by the Ministry of Health: "the wells of the Amazon type are built in free aquifers or groundwater, the static level of water in these wells coincides with the regional water table, once the water table is reached, it is recommended to deepen a little more to obtain its best use" (BRASIL, 2015, p. 93).

According to the answers obtained in the form, there is a variation concerning depth, the results found were between 06 and 20 meters for wells of the Amazon/cacimba type and between 18 and 25 meters for semiartesian wells, according to Figure 9, which depicts the variation of this depth in the form of a comparative line graph, identifying the greatest depths found.

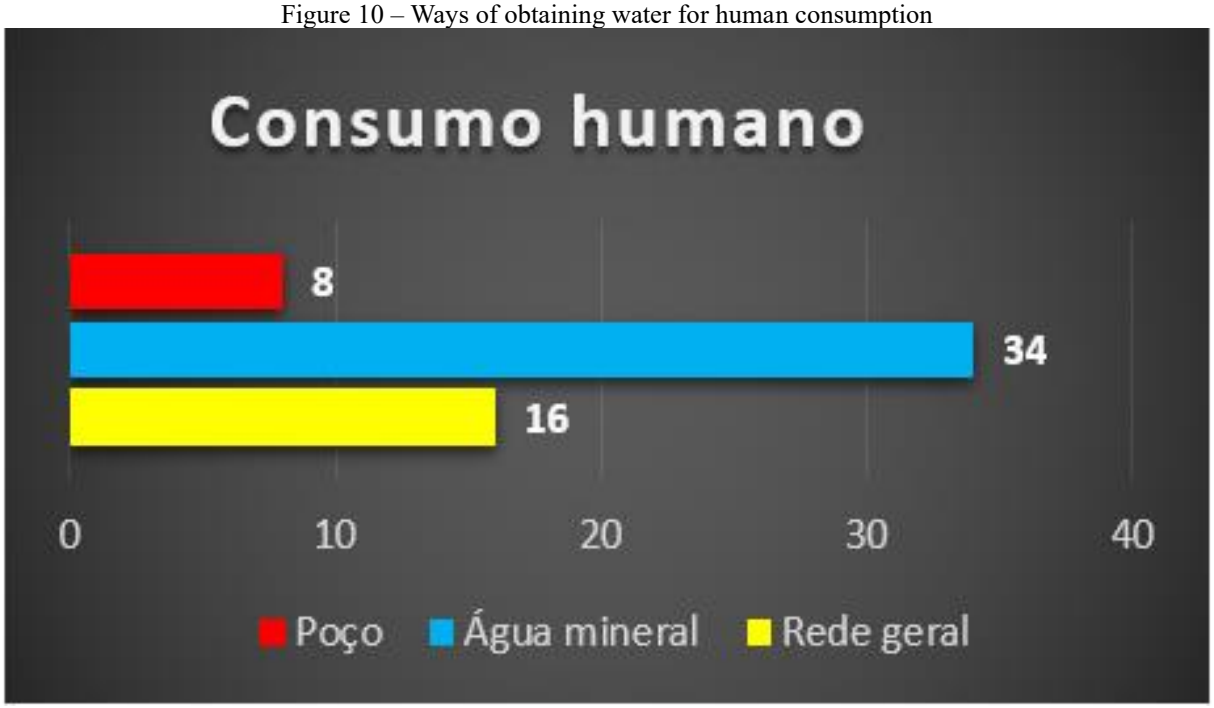
Figure 9 – Graph identifying the declared depth of the wells used in the neighborhood

Prepared by Menezes (2018).

The representation of the Amazon type wells is made using the blue line that remains almost constant, obtaining few changes and oscillating mainly between 06 and 10 meters, very low depth, conducive to high levels of contamination. The semi-artesian wells represented by the orange line show results between 18 and 25 meters, maintaining the continuous traces between the points, a little greater depth, but can still receive contributions from the percolation of surface waters, subject to contamination.

Regarding the way water for human consumption is obtained, in the form, three alternatives were made available: 1) Through the purchase of mineral water, 2) Water provided by the general network, with complementary treatment to eliminate impurities and 3) the option Others, leaving residents free to express answers not contained in the form, having specific situations, as shown in Figure 10, where the identification of ways of obtaining water for consumption, used in essential activities such as food preparation and human consumption, is made.

Figure 10 – Ways of obtaining water for human consumption



Prepared by Menezes (2018).

The predominance of households that make the purchase of mineral water for consumption represents approximately 59% of respondents, because they believe that the waters of the residences, both from the well and the general network are ideal for other purposes and not for human consumption, about 27% reported that they use water from the general network, making complementary treatment to eliminate impurities and 14% of respondents confirmed that they use well water for all activities developed at home, including for direct consumption. Both residents who consume water from the general network and the well said they use filters, citing the clay filter as the most reliable and efficient.

As identified, some people claimed to use water from wells in the preparation of food and for their ingestion, a fact that brings concern, since the wells have low depths and capture water from the water table, increasing the risk of serious diseases.

Of the total of interviewees who claimed to make use of water from the general network for ingestion, some alternatives used by residents were identified as a temporary solution, such as the provision of joint action by neighbors, where households that have treated water provide others with access to it through 20-liter gallons. An alternative solution found by many residents and indicated by them for verification, was the existence of a water registry located on Aquiles Paraguassu street, near the entrance of a house, which receives treated water from the general network and that the community of the neighborhood and even people from the vicinity, move to the site, seeking access to treated water provided by the Water and Sewage Company of Rondônia – CAERD. As shown in Figure 11,

which portrays the reality of some people who have wells, but who make daily efforts in search of treated water in the so-called "CAERD Pipe".

Figure 11 – Record of people taking treated water for human consumption in the pipe supplied by the general network

Photographed by Menezes (2018).

It was not possible to make the most accurate identification of the time of existence of this point of collection of treated water, but according to the residents themselves, for a long time, this plumbing with sufficient force supplies dozens of houses.

According to data obtained from CAERD in 2018, the Cidade do Lobo neighborhood is not fully covered by the general supply network, so residents look for alternatives that meet the needs of water consumption in homes.

4 FINAL CONSIDERATIONS

The alternative and individual water supply system needs at least a standardization for distribution and access to water in an equal way to the residents. In the case of the place studied, according to the interviewees, the Cidade do Lobo neighborhood has all the necessary plumbing to supply treated water made available by the general network, however, in contact with CAERD, in search of information about which well performs the water supply in the neighborhood, no return was obtained from the company, to answer the question, thus generating the hypothesis of "insufficiency on the part of this well", which cannot meet the demand for water use, probably not having enough flow and/or pressure to reach the taps of many residents.

Thus, the general network plays an important role in people's lives, but has the supply of treated water limited to some residences, forcing the rest of the residents, who do not use well water for direct consumption, to seek alternative solutions to obtain access to better quality water, including the purchase of water through a kite car or mineral water available in shops, in addition to conducting water collections through gallons in places that have piped water service. By the field survey, it was possible to identify the predominance of two types of wells: the semi-artesian and the Amazonian type, the latter as the main form of water supply in the neighborhood.

Much of the neighborhood community ends up feeling violated and seeks to solve the situation in its way: the problem of water supply. Because it is a considerably old neighborhood, residents make use of wells that, in most cases, were not built according to current regulations, causing health risks.

The population understands that they need to consume good quality water, from the moment they make use of the spout in the pipe of CAERD. Improvements and expansions are needed in the distribution network of treated water to the neighborhood, which can be the subject of further research. The poor construction of wells, the low flow in the dry season, the inadequate conditioning and transport of water, are facts that show that the population of the neighborhood is excluded from the policies offered by the government, concerning the supply of water treated by protected source.

Finally, it is suggested to those responsible for the supply and sanitary inspection to carry out examinations in the wells, to verify the quality of the water and that the residents can be guided in the best possible way, how to proceed in situations that interfere with the well-being of the people, giving due importance to the diseases caused through the origin or transmission of water.

REFERENCES

BORZACOV, Yêdda Pinheiro. Os bairros na História de Porto Velho. Porto Velho: Porto Madeira Gráfica & Comunicação Visual, 2016.

BRASIL. Ministério da Saúde. Manual de Saneamento. 4. ed. Brasília: Fundação Nacional de Saúde, 2015.

BRASIL. Ministério da Saúde. Manual prático de análise da água. 4. ed. Brasília: Fundação Nacional de Saúde, 2013.

BRASIL. Ministério da Saúde. Portaria de Consolidação nº 5, de 28 de setembro de 2017. Consolida as normas sobre as ações e os serviços de saúde do Sistema Único de Saúde. Brasília: MS, 2017. Disponível em: http://portalsinan.saude.gov.br/images/documentos/Legislacoes/Portaria_Consolidacao_5_28_SETEMBRO_2017.pdf. Acesso em: 18 out. 2018.

BRASIL. Ministério da Saúde. Portaria GM/MS nº 888, de 4 de maio de 2021. Altera o Anexo XX da Portaria de Consolidação GM/MS nº 5, de 28 de setembro de 2017, para dispor sobre os procedimentos de controle e de vigilância da qualidade da água para consumo humano e seu padrão de potabilidade. Brasília: MS, 2021. Disponível em: https://www.in.gov.br/en/web/dou/-/portaria-gm/ms-n-888-de-4-de-maio-de-2021-318461562. Acesso em: 29 maio 2023.

BRASIL. Ministério da Saúde. Portaria nº 2.914, de 12 de dezembro de 2011. Dispõe sobre os procedimentos de controle e de vigilância da qualidade da água para consumo humano e seu padrão de potabilidade. Diário Oficial da União, n. 12, 2011. Disponível em: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2011/prt2914_12_12_2011.html. Acesso em: 24 abr. 2023.

BRASIL. Ministério do Meio Ambiente. Ciclo da Água. Brasília: Ministério do Meio Ambiente, 2018. Disponível em: http://www.mma.gov.br/agua/recursos-hidricos/aguas-subterraneas/ciclohidrologico.html. Acesso em: 8 abr. 2023.

CORRÊA, Roberto Lobato. O espaço urbano. São Paulo: Ática, 1989.

GIL, Antonio Carlos. Métodos e técnicas de pesquisa social. 6. ed. São Paulo: Atlas, 2008.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). Banco de dados agregados. [S.d]. Online. Disponível em: https://sidra.ibge.gov.br/Acervo?nivel=102&unidade=1100205049#/S/Q. Acesso em: 08 set. 2018.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). Censo Demográfico 2010: resultados gerais da amostra. Rio de Janeiro: IBGE, 2012. Disponível em: https://censo2010.ibge.gov.br/resultados.html. Acesso em: 04 mar. 2023.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). Malhas territoriais - Malhas municipais 1:250.000. Rio de Janeiro: Diretoria de Geociências (IBGE), 2007. Disponível em: https://www.ibge.gov.br/geociencias/downloads-geociencias.html. Acesso em: 18 maio 2018.

LAKATOS, Eva Maria; MARCONI, Marina de Andrade. Metodologia do trabalho científico: procedimentos básicos, pesquisa bibliográfica, projeto e relatório, publicações e trabalhos científicos. 4. ed. São Paulo: Atlas, 1992.

MENEZES, Aline Caroline Oliveira. O abastecimento de água no bairro Cidade do Lobo em Porto Velho-RO. 2018. Monografia (Bacharelado em Geografia) - Universidade Federal de Rondônia, Porto Velho/RO, 2018.

OLIVEIRA, Walter Engracia de. Importância do abastecimento de água. A água na transmissão de doenças. *In:* AZEVEDO NETTO, José Martiniano de; RICHTER Carlos A. Técnica de abastecimento e tratamento de água. São Paulo: CETESB/ASCETESB, 1987.

PORTO VELHO. Secretaria de Planejamento Orçamento e Gestão (SEMPOG). Bairros de Porto Velho. Porto Velho: SEMPOG, 2018. Disponível em: https://sempog.portovelho.ro.gov.br/artigo/19400/bairros-de-porto-velho. Acesso em: 5 set. 2018.

RONDÔNIA. Secretaria de Estado do Desenvolvimento Ambiental (SEDAM). Atlas Geoambiental de Rondônia. Porto Velho: Núcleo de Sensoriamento Remoto e Climatologia, 2002.