

ANALYSIS OF THE PATOS DAM IN THE MUNICIPALITY OF SOBRAL IN THE STATE OF CEARÁ IN THE NORTHEAST SEMIARID

Juscelino Chaves Sales

Universidade Estadual Vale do Acaraú/UVA

juscelinochaves@hotmail.com

<https://orcid.org/0000-0003-0815-8585>

Recebido: 11/12/2022 Aceito: 12/01/2023

60

ABSTRAT

Drought has been plaguing the State of Ceará for many years and one of the ways found to mitigate the drought was the construction of dams. The present work makes a physical analysis of one of the oldest dams that were built in the State of Ceará, which is the Patos Dam, which was built to alleviate the problem of drought in the municipality of Sobral located in the semi-arid region of the State of Ceará. The present work was carried out through an on-site visit where visual inspections were made in the structures of the Patos Dam in the municipality of Sobral located in the northern zone of the State of Ceará in a semi-arid region. It was possible to conclude that the Patos dam, which was built damming the Aracatiáçu River, is among the few that has two spillways and requires maintenance by the DNOCS (National Department of Works Against Drought) because it presents some pathological manifestations such as erosion in the spillway and the transverse undulation of a plastic nature in the asphalt coating on the road that passes over the crest of the dam. It was also possible to conclude that there is a great need for the construction of an ETA (Water Treatment Station) for the treatment of raw water for human consumption on the bank of the Patos Dam, as the population of the District of Patos has been increasing.

Keywords – Patos Dam, Aracatiáçu River, dam, spillway.

ANÁLISE DO AÇUDE PATOS NO MUNICÍPIO DE SOBRAL NO ESTADO DO CEARÁ NO SEMIÁRIDO NORDESTINO

RESUMO

A seca vem assolando o Estado do Ceará por muitos anos e uma das maneiras que se encontrou para amenizar a seca foi a construção de açudes. O presente trabalho faz uma análise física de um dos mais antigos açudes que foram construídos no Estado do Ceará que é o Açude Patos que foi construído para amenizar o problema da seca no município do Sobral localizado na região semiárida do Estado do Ceará. O presente trabalho foi realizado através de visita *in loco* onde foram feitas inspeções visuais nas estruturas do Açude Patos no município de Sobral localizado na zona norte do Estado do Ceará em uma região semiárida. Foi possível concluir que o Açude Patos que foi construído barrando o Rio Aracatiáçu, está entre os poucos que possui dois sangradouros e necessita de manutenção por parte do DNOCS (Departamento Nacional de Obras Contra a Seca) pois apresenta algumas manifestações patológicas como a erosão no sangradouro e a ondulação transversal de caráter plástico no revestimento asfáltico na rodovia que passa sobre a crista da barragem. Também foi possível concluir que existe uma grande necessidade da construção de uma ETA (Estação de Tratamento de Água) para o tratamento da água bruta para consumo humano na margem do Açude Patos pois a população do Distrito de Patos vem aumentando.

Palavras-Chave – Açude Patos, Rio Aracatiáçu, barragem, sangradouro.

INTRODUCTION

The policy of damming in the semi-arid region of Brazil began in the 18th century, when during the empire, Emperor Dom Pedro II ordered the construction of the Cedro Dam in the municipality of Quixadá, which is in the central hinterland of the State of Ceará, so the Cedro Dam was the first to be built in the semi-arid region of northeastern Brazil.

Water is an essential good for life, limited and precious. Of the land surface occupied by water, only 3% of this total is fresh water. In addition, the distribution of water is uneven in different regions of the planet, which means that there is a shortage of this good in several countries or regions due to different climatic characteristics and use (RIBEIRO, 2020).

The Brazilian Northeast covers an area of more than one million km², highlighting among its characteristics the occurrence of droughts at least once every decade, with an average rainfall of around 700 mm per year (MALVEIRA, 2013).

The Salitre River is a tributary of the São Francisco River in the State of Bahia, where we have the dams that were built to retain water for the irrigation of various crops (PEREIRA, 2020).

Researchers concluded that among the benefits brought by the construction of the Taquara dam are the control of the floods of the Jaibaras River, as well as its perpetuity, tourism, and leisure, being also an important source of water supply for the northern region of Ceará (AGUIAR FILHO, 2013). Weirs were built throughout the northeastern semi-arid region as an alternative to fight drought.

The Patos dam, in the municipality of Sobral, in the northern region, overflowed in 2019, being the thirty-first dam to bleed in the State of Ceará (DIÁRIO DO NORDESTE, 2019).

The main benefits of dams are water supply for humans, river flood control, irrigation for agriculture, electricity generation, fish farming, flow regulation, tailings containment (mining), landscaping and urbanism, leisure, and animal watering (SALES, 2019).

The Patos Dam is in the hydraulic basin of the Aracatiaçu River in the municipality of Sobral in the State of Ceará and is less than 1 km from the edge of the federal highway BR-222, in the north of the State of Ceará.

The objective of this work was to make a physical analysis of the Patos Dam, which was completed by DNOCS (National Department of Works against Drought) in 1921 to alleviate the effects of drought in the semi-arid region of the north of the State of Ceará, being one of the first dams built in the region.

METHODOLOGY

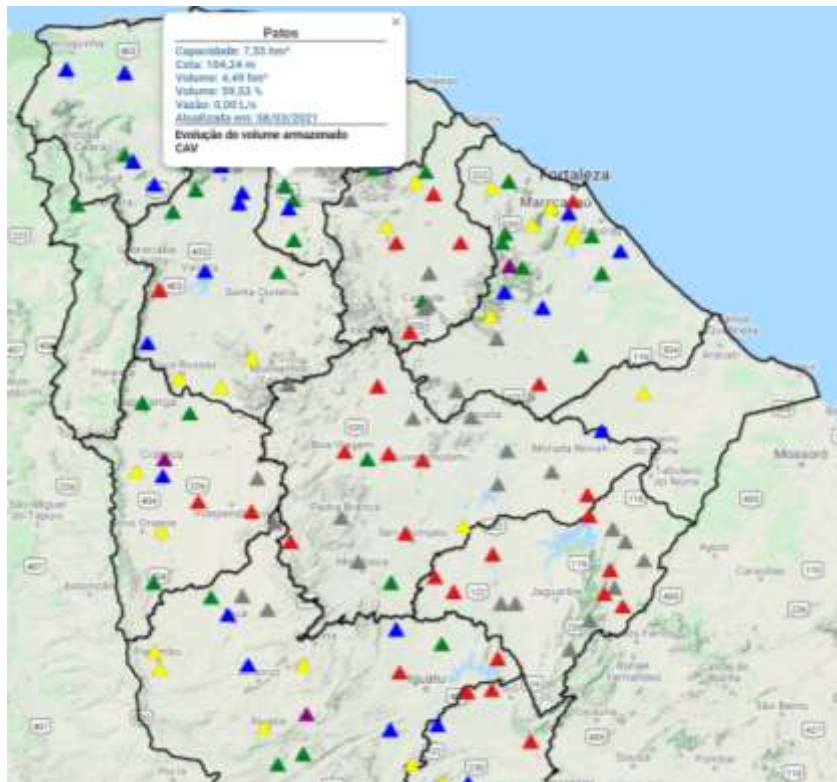
To carry out this work, an on-site visit was made to the Patos Dam, where photographic records were made, as well as the analysis of the influence of the Patos Dam from the BR-222, which is about 700m from the BR-222 bank. An interview was conducted with a resident of the district about where the water for the inhabitants to drink comes from. Bibliographical research was also carried out on websites, articles, newspapers, etc.

PATOS DAM ANALYSIS

The Patos Dam is in the district of Patos in the municipality of Sobral in the northern region of the State of Ceará and was built and completed by DNOCS (National Department of Works Against Drought) in the year 1921 and completed 100 years of existence in the year 2021.

Figure 1 shows the location of the Açude Patos in the semi-arid region in the north of the State of Ceará with its total capacity of being able to store 7.55hm³ of water. On March 8, 2021, the quota was 104.24m, with a volume of 4.49hm³ where this volume corresponded to only 59.53% of its total volume (maximum capacity of the reservoir) and the flow was zero l/s, that is, no water passed through the bleeder (COGERH, 2021).

Figure 1 - Location of the Patos Dam in the north of the State of Ceará.



Source: (COGERH, 2021).

As it was possible to see in Figure 2, the reservoir of the Açude Patos has a length much greater than its width. This great length of the reservoir is encompassing the entire bed of the Aracatiaçu River close to the dam and its tributaries that are close to the reservoir.

It is also worth noting that the Patos dam runs parallel to the state road CE-176 throughout its entire course.

Figure 2 – Patos Dam Reservoir.



Source: GOOGLE MAPS, 2020.

It was possible to see the reservoir of Açude Patos from above the dam, with a satisfactory stored water capacity after a winter with a good amount of rain in the northern region of the State of Ceará in 2019 (Figure 3).

Figure 3 – Reservoir of the dam with a good amount of water.



Source: Own, 2019.

Figure 4 shows the dam of the dam where on its crest there is an asphalted roadway that gives access to the state road CE-176 that connects the locality of Patos (district) to the district of Santo Antônio do Aracatiçu that bears the name of the river, which is dammed by the Patos dam, which is the Aracatiçu River. It was also possible to detect the water intake and the fence made of concrete pillars with barbed wire, on the left bank of the

crest of the dam with lampposts. The fence serves to demonstrate that the right side of the weir dam has become private property.

Figure 4 – Patos dam where there is a carriageway on its crest.



Source: Own, 2019.

The Patos dam has two spillways, where in one of the spillways there is a passage over one of the spillways made of concrete that connects the District of Patos to the dam where there is a carriage way, and it is possible to see the end of the surface in concrete (bleeder) and the beginning of the rolling surface with asphalt that will pass over the crest of the dam. During the winter with the incidence of rain, depending on this incidence, the water submerges the passage made of concrete and it is impossible for traffic to pass through the site. Figure 5 shows one of the spillways and the carriageway made of concrete over the spillway with more than 100m in length and at the end of the spillway on both sides, the continuation of the road made of flexible pavement (asphalted road) begins. It was also possible to see that buildings in the district of Patos in the municipality of Sobral were built close to the shore of the Patos dam that leads to the same in the district, such as the sports gym in the locality of Patos and emphasizing that the reservoir of the dam is close to Serra Manuel Dias. The peculiarity of having two spillways occurred due to the dimensioning of the hydraulic basin of the Aracatiaçu River in the dry (semi-arid) region of the north of the State of Ceará in Brazil.

Figure 5 – Bleeding and the raceway over the bleed.



Source: Own, 2019.

The Patos dam has two spillways, where in one of the spillways there is a passage over one of the spillways made of concrete that connects the District of Patos to the dam where there is a carriage way and it is possible to see the end of the surface in concrete (bleeder) and the beginning of the rolling surface with asphalt that will pass over the crest of the dam. The dry riverbed of the Aracatiaçu River downstream of the dam can be seen in Figure 6, where it is also possible to see the barbed wire fences that delimit the riverbed of the Aracatiaçu River. Today, where the Aracatiaçu River passed before the construction of the Patos Dam, there is very little vegetation. The fences made with wooden stakes (trees present in the caatinga) and barbed wire, which were placed on the banks of the Arataiaçu River, are totally irregular because after the dam was built in 1921, the landowners on the banks of the Arataiaçu River took the entire area of its riparian forest in a totally irregular way.

Figure 6 – Dry bed of the Aracatiaçu River downstream of the dam.



Source: Own, 2019.

On the left side of the riverbed of the Aracatiaçu River, where we see the dry part, we have some crops planted where we can see in Figure 7 a greener area to the left of the fence that was built of wood (thrush, jurema) which is a vegetation typical of the dam biome. caatinga present in the semi-arid region of the State of Ceará, which delimits the bed of the Aracatiaçu River where it was possible to see a man watering the plantation with water coming from the Patos Dam itself. Part of the green area belongs to the riparian forest of the Aracatiaçu River.

Figure 7 – Planting some crops downstream of the dam.



Source: Own, 2019.

Most dams built in the semi-arid region of northeastern Brazil are built (made) from earth dams, where only the Castanhão dam located in the municipality of Jaguaribara, which dams the Jaguaribe River, has a dam built of earth and CCR concrete (CCR). roller compacted). Figure 8 shows the dam at Açude Patos, which was made of earth covered with stone and the water intake was made of reinforced concrete, where it is possible to see the bridge (walkway) with a guardrail, between the dam and the water intake, to be able to access and be able to activate the water intake valve.

Figure 8 – Stone-lined earth dam and reinforced concrete water intake.



Source: Own, 2019.

The other spillway is on the side of the left abutment of the dam and was built of stone and concrete, which also works as a wet passage where it was possible to notice the existence of four concrete pipes that were placed for the passage of water when the dam is bleeding. The structure of the spillway (spillway) has erosion points (pathological manifestation) that occurred due to the passage of water through the spillway over the years (100 years) of the structure's existence (Figure 9).

Figure 9 – Bleeding on the side of the left abutment of the dam.



Source: Own, 2019.

In the Patos dam in the municipality of Sobral, it was possible that the road with flexible pavement passes over the crest of the dam and that the flexible pavement presents pathological manifestations, such as transverse undulation (pathological manifestation) of a plastic nature in the asphalt coating. This ripple is related to the passage of vehicles over the crest when accelerating or braking vehicles. The undulation (sag) of the pavement displacing the curb of the crest of the dam found on the upstream side of the

dam can cause accidents for people traveling over the crest of the dam of the Patos dam (Figure 10).

Figure 10 – Rippled flexible pavement, moving the dam crest curb on the dam's upstream side.



Source: Own, 2019.

Water from the Patos dam in the municipality of Sobral is basically used for human consumption such as bathing and washing clothes, but it was found that some residents drink the water from the dam. Due to the raising of cattle (cattle) and sheep around the dam, the animals drink water, that is, there is animal watering.

Due to the rains in 2020, it bled again, but there was a large amount of vegetation obstructing the passage of one of the spillways that was removed by the residents of the surroundings of the Patos Dam.

According to a resident of the region, that is, from the District of Patos, even with the existence of the Açude Patos which is also called the Açude Cachoeira, the water for people to drink comes from tank cars that supply the cisterns of the District of Patos.

CONCLUSION

The Patos dam is among the few that has two spillways and in one of the spillways we have a wet passage with concrete rings.

The Patos Dam in Sobral is basically used for human consumption such as bathing and washing clothes, but some residents drink the water from the Patos Dam. The vast majority of residents drink water from tank trucks that supply the cisterns.

It was possible to perceive that it is necessary to build an ETA (Water Treatment Station) for the treatment of raw water for human consumption on the shore of the Patos Dam so that residents can drink the water that is stored in the reservoir, which is of great importance for fixing man in the northeastern semi-arid region.

Due to good rainfall in 2020, the Patos Dam started to bleed again, even when it started to bleed, the residents themselves had to clear the passage of the bleeder, as there was a large amount of vegetation.

The Patos dam needs maintenance by the DNOCS (National Department of Works Against Drought) which is the Federal Government agency responsible for the engineering work as it presents some pathological manifestations such as erosion, the spillway, and the transverse undulation of a plastic nature in the asphalt coating on the surface of the crest of the Patos dam.

The water from the Patos Dam reservoir is basically used for irrigation for agriculture and for animals to drink (animal watering), as well as fish farming in the reservoir.

REFERENCES

AGUIAR FILHO, E. R. P.; SALES, J. C. (2013). Os benefícios da barragem Taquara para a região norte do estado do Ceará. **Anais...** do XXIX Seminário Nacional de Grandes Barragens. Porto de Galinhas.

COGERH - Companhia de Gestão dos Recursos Hídricos do Estado de Ceará. (2021). **Portal Hidrológico do Ceará**. Disponível em: <<http://www.hidro.ce.gov.br/>>. Acesso em: 09 mar. 2021.

DIÁRIO DO NORDESTE, (2019). **Açude transborda em Sobral; Ceará tem 31 reservatórios sangrando nesta quinta-feira**. Disponível em: <<https://diariodonordeste.verdesmares.com.br/regiao/acude-transborda-em-sobral-ceara-tem-31-reservatorios-sangrando-nesta-quinta-feira-4-1.2083354>>. Acesso em: 15 ago. 2020.

GOOGLE MAPS, (2020). Disponível em: <<https://www.google.com/maps/place/Tamboril+-+CE,+Brasil/@4.9401721,40.279334,3556m/data=!3m1!1e3!4m5!3m4!1s0x795de08d8362fad:0x32c552307519c70c!8m2!3d-4.8330598!4d-40.3212889?hl=pt-PT>>. Acesso em: 24 mar. 2020.

MALVEIRA, V. T. C.; ARAÚJO, J. C. (2013). Arranjos de açudagem no nordeste semiárido. **Anais...** do XXIX Seminário Nacional de Grandes Barragens. Porto de Galinhas.

PEREIRA, F. (2020). **Rio passa por seca no sertão da Bahia com a perfuração de poços clandestinos e barragens irregulares**. Globo Rural. 06 set. 2020.

RIBEIRO, C. S.; OLIVEIRA, G. G. (2019). A questão hídrica no semiárido baiano: conflitos pelo uso da água e as tecnologias sociais de aproveitamento de água de chuva. **Revista del CESLA**, n. 23.

SALES, J. C.; SILVA, E. L. C.; OLIVEIRA FILHO, J. G.; OLIVEIRA, R. T.; JUVENAL, R. (2019). Benefícios do açude Aires de Sousa na região norte do Estado do Ceará. **Anais...** do XXIII SBRH - Simpósio Brasileiro de Recursos Hídricos, Foz do Iguaçu.