

Wastewater in Paraná: Implementation of a Wastewater Treatment Plant

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Summary— Paraná is the capital city of Entre Ríos province, being one of the cities with the highest water consumption. This used and discarded water is referred to as black and gray water. These waters do not undergo treatment, causing multiple environmental and health problems. The problem to be addressed in this paper is, therefore, the lack of wastewater treatment in Paraná. The purpose of this project is to analyze the implementation of a wastewater treatment plant that can reduce water wastage and address the aforementioned issue. The goal is to raise awareness about the problems that can arise due to the lack of wastewater treatment.

Keywords: Wastewater treatment plant, wastewater, wastewater treatment.

Resumen— Paraná es la capital de la provincia de Entre Ríos, siendo una de las ciudades con mayor consumo de agua. Estas aguas usadas y desechadas se conocen como aguas negras y grises. Estas aguas no son tratadas, lo que causa múltiples problemas ambientales y de salud. El problema a analizar en este trabajo es, entonces, la falta de tratamiento de aguas residuales en Paraná. El propósito de este proyecto es analizar la implementación de una planta de tratamiento de aguas residuales que pueda reducir el desperdicio de agua y resolver el problema mencionado anteriormente. El objetivo es crear conciencia sobre los problemas que pueden surgir debido a la falta de tratamiento de aguas residuales.

Palabras clave: planta de tratamiento de aguas residuales, aguas residuales, tratamiento de aguas residuales.

I. INTRODUCTION

Paraná is the capital city of the province of Entre Ríos province, in Argentina. It is one of the cities with the highest water consumption. The average daily consumption per inhabitant has reached 800 liters on some days, while the recommendation is that should be 250 liters per person. In January 2023, water use reached 700 liters [1].

This number includes water that is consumed as well as water that is discarded as gray and black water. Gray water refers to wastewater generated by domestic activities. Both are contaminated water.

The purpose of this study is to address the problem of lack of treatment of gray and black water. As well as this, there is an analysis of the possibility of implementing a wastewater management treatment plant.

To achieve this purpose, this paper is organized as follows. First, the excessive water consumption in Paraná is going to be described. Secondly, the problem is going to be presented accompanied by images depicting the lack of wastewater treatment. Thirdly, the causes are going to be identified. As well as this, the way the consequences affect health and the environment is going to be discussed. Finally,

a solution is going to be presented, analyzing all aspects related to its implementation.

II. PROBLEM DEFINITION AND ANALYSIS

A. Description of the Context

Paraná is a city in the province of Entre Ríos, which borders the Paraná River. It has a population of approximately 391,962 people and it is the most populated city in the province.

In the city there are two water treatment plants. The Ramírez plant and the Echeverría plant, which are located in different parts of the city.

The Echeverría plant, as it is the biggest, produces 85% of the water in the city. It is located between Esteban Echeverría and Rondeau Streets. Fig. 1 shows a satellite photo of the Echeverría water treatment plant in Paraná.



Fig. 1. Satellite photo of the Echeverría plant [2]

In this area, there are few houses and many trees surrounding the area. It should be noted that it is located near the Paraná River.

In large cities, wastewater management treatment plants can be found, and they are usually located near the water treatment plants. As it can be observed, this does not happen in Paraná, since this city only has water treatment plants.

B. Problem Statement

The problem that will be addressed in this study is the lack of treatment of wastewater. Wastewater refers to all gray and black water. This wastewater found in streams and the river generates a great environmental and social impact.

C. Description of Scenes that Help Picture the Problematic Situation

The following images show different situations where local streams and the Paraná River are affected.

The Antoñico stream is the most important stream in the city. It originates in Santa Lucia neighborhood, and flows into the Paraná River. As it can be observed in Fig. 2, the wastewater runs through this stream.



Fig. 2. Photo of the Antoñico stream

Fig. 3 shows a glass of water from the Paraná River. It can be observed that the water is turbid and contains particles that appear to be sediment at the bottom.



Fig. 3. Photo of water [3].

D. Identification and analysis of causes or factors that give rise to the problem:

In Paraná, there are many causes or factors that contribute to the problem of wastewater. Among them, three key factors can be highlighted. Firstly, illegal sewerage systems are common in many areas of Paraná. These installations involve directing sewage drains directly toward the stream.

Secondly, the usage of chemical components is prevalent in our daily lives. These chemicals are found in cleaning products such as detergents and shampoos. Also, washing materials that have been used for painting, varnishing, etc., are discarded in the sewage network.

Lastly, the overflow of sewer systems is quite common in Paraná. During heavy rains and floods, sewer

systems can overflow due to water pressure, leading to the release of wastewater into the environment. In the streets of Paraná, it is frequent to see sunken or broken manhole covers.

E. Identification and Description of the Consequences

Many consequences can be identified that come from wastewater in Paraná. These include water pollution in rivers and streams, health risks and damage to the ecosystem and wildlife.

Wastewater discharges into rivers and streams cause water to be contaminated with chemicals, human waste, microorganisms, among others. Then, sources of safe and clean drinking water for use are reduced. This ends up causing a shortage of potable water.

Regarding health risks, contaminated water can cause numerous diseases. Among them, diarrhea, cholera and other gastrointestinal infections can be mentioned. These arise from consuming or coming into contact with contaminated water.

In relation to ecosystem damage, water pollution can affect animal life, including fish, birds, and other forms of life. The habitats and survival of many species are also threatened. This leads to not only marine life being affected but also terrestrial life.

III. THE WAY FORWARD

A. Problem approach

There is a potential solution that can be proposed to the problem of the lack of treatment of black and gray water in Paraná. The solution is a wastewater treatment plant, as it is presented in Fig.4. This plant could be conveniently located on the same site as the current Echeverría drinking water plant.



Fig. 4. An example of wastewater treatment plant [4].

A wastewater treatment plant is a facility designed to receive, process, and treat wastewater generated by human, industrial, and commercial activities, with the purpose of removing contaminants, microorganisms, and solid materials. It aims to enable us to reuse water or safely release it into the environment, significantly reducing water pollution and consumption.

The wastewater treatment process involves several stages and techniques to eliminate harmful contaminants and microorganisms. Below are the main stages and processes that are usually found in a wastewater treatment plant [5].

In the wastewater treatment process, the first step involves the collection of wastewater. Subsequently, pretreatment is conducted, which includes the removal of large solids such as sticks, rocks, and similar objects that could damage equipment. Next, in the primary treatment phase, organic suspended solids are removed through sedimentation and flotation processes. This is achieved using clarifiers and sedimentation tanks.

During the secondary treatment stage, remaining suspended and dissolved solids are eliminated using aerobic microorganisms. The most commonly employed method for secondary treatment is the activated sludge process, where wastewater is aerated, and microorganisms feed on the contaminants. Tertiary treatment, also known as advanced treatment, is used to remove specific impurities from treated water. This is accomplished through physical and chemical processes such as membrane filtration or chlorine disinfection.

Finally, disinfection is carried out to eliminate any microorganisms that may have remained in the treated water. After disinfection, the sludge formed during the treatment process is removed. The treated and disinfected water can be discharged into receiving water bodies, such as rivers or lakes, if it meets environmental quality standards, or it can be reused for non-potable purposes, such as agricultural irrigation, garden watering, or industrial uses.

Around the world, wastewater treatment plants have been implemented. Argentina has some provinces that have incorporated this solution. Without going any further, in the province neighboring Entre Rios, Santa Fe has several wastewater treatment plants. Some of them are located in the cities such as Cañada de Gómez, Rafaela, Casilda, among others [6].



Fig. 5. Cañada de Gómez Wastewater treatment plant [7].

B. Strengths and Weaknesses of the Proposal

This proposal aims to address a significant portion of the pollution problem in Paraná. However, like any project, it has its advantages and disadvantages. Several positive aspects can be highlighted, including environmental protection by reducing water pollution, a decrease in waterborne diseases through the elimination of pathogenic microorganisms, the opportunity for water reuse in agricultural irrigation, industrial applications, and non-potable purposes, as well as the reduction of odors in streams and rivers.

While this proposal has more strengths than weaknesses, it is important to note that it involves costly construction and requires constant maintenance. Additionally, it necessitates the employment of qualified

personnel. A significant downside is the energy requirement to operate pumps, aerators, disinfection systems, and other equipment, which can contribute to greenhouse gas emissions if the energy is sourced from non-renewable resources.

IV. CONCLUSION

In conclusion, the lack of water treatment poses a significant problem not only environmentally but also socially. The little importance given to such a valuable and limited resource like water undoubtedly reflects the lack of education in our society. The purpose of this project has been to inform and raise awareness among readers about this issue, offering a solution that has worked in major cities.

Throughout the proposal, the problem has been elaborated, visualized through photographs, and its causes and consequences have been analyzed. To conclude, the idea of implementing a wastewater treatment plant would not only help reduce water loss but also provide the Paraná inhabitants with a better quality of life. The negative and positive aspects of the evaluated solution have also been examined. Now, it is just a matter of time to continue progressing and make the right decision regarding water conservation.

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The present project is a skills integration activity in Inglés I at Universidad Tecnológica Nacional, Facultad Regional Paraná, carried out by EFL engineering students. The yearlong project requires students to delve into a problem in the city where they live and to address it by means of a simple project in English. Should the reader have any questions regarding this work, please contact Graciela Yugdar Tófaló, Senior Lecturer, at yugdar@frp.utm.edu.ar.