SOCIO-ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS OF THE USE OF WATER CONTAMINATED BY SEWAGE IN IGARAPÉ KM 04: LEGAL CHALLENGES AND POSSIBLE SOLUTIONS

OS IMPACTOS SOCIOAMBIENTAIS E DE SAÚDE PÚBLICA NO USO DA ÁGUA CONTAMINADA POR ESGOTO NO IGARAPÉ KM 04: DESAFIOS JURÍDICOS E SOLUÇÕES POSSÍVEIS

IMPACTOS SOCIOAMBIENTALES Y EN LA SALUD PÚBLICA DEL USO DE AGUA CONTAMINADA POR AGUAS RESIDUALES EN IGARAPÉ KM 04: DESAFÍOS LEGALES Y POSIBLES SOLUCIONES

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RESUMO

O presente artigo tem como objetivo investigar as responsabilidades do poder público e dos agentes envolvidos nos impactos ambientais e de saúde pública do esgoto não tratado no Igarapé KM 04. Os resultados revelam altos índices de poluentes, como fósforo total e demanda bioquímica de oxigênio, além da presença de coliformes fecais, o que indica severa degradação ambiental e riscos à saúde pública. Constatou-se a omissão estatal na implementação de políticas de saneamento e violação dos direitos fundamentais ao meio ambiente e à saúde frente as normas jurídicas de proteção ambiental brasileira, especialmente à luz da Constituição Federal de 1988, da Lei nº 11.445/2007 e da Resolução CONAMA nº 357/2005. A metodologia utilizada inclui uma pesquisa bibliográfica e inclui uma análise documental, observações fotográficas in loco e interpretação de laudos técnicos laboratoriais sobre a qualidade da água.

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Palavras-chave: Direito ambiental. Poluição Igarapé KM4. Saneamento básico. Responsabilidade jurídica.

ABSTRACT

This article aims to investigate the responsibilities of the public authorities and agents involved in the environmental and public health impacts of untreated sewage in the KM 04 stream. The results reveal high levels of pollutants, such as total phosphorus and biochemical oxygen demand, in addition to the presence of fecal coliforms, which indicates severe environmental degradation and risks to public health. It was found the omission of the state in the implementation of sanitation policies and violation of the fundamental rights to the environment and health in the face of the legal norms of Brazilian environmental protection, especially in the light of the Federal Constitution of 1988, Law No. 11,445/2007 and CONAMA Resolution No. 357/2005. The methodology used includes a bibliographic research and includes a documentary analysis, on-site photographic observations and interpretation of technical laboratory reports on water quality.

Keywords: Environmental law. Pollution Igarapé KM4. Sanitation. Legal liability.

RESUMEN

Este artículo tiene como objetivo investigar las responsabilidades del gobierno y de los agentes involucrados en los impactos ambientales y de salud pública de las aguas residuales sin tratar en el kilómetro 04 de Igarapé. Los resultados revelan altos niveles de contaminantes, como fósforo total y demanda bioquímica de oxígeno, además de la presencia de coliformes fecales, lo que indica una grave degradación ambiental y riesgos para la salud pública. Se constató la incapacidad del gobierno para implementar políticas de saneamiento y la violación de los derechos fundamentales al medio ambiente y a la salud, de conformidad con las normas legales brasileñas de protección ambiental, especialmente la Constitución Federal de 1988, la Ley n.º 11.445/2007 y la Resolución CONAMA n.º 357/2005. La metodología empleada incluye investigación bibliográfica, análisis documental, observaciones fotográficas in situ e interpretación de informes técnicos de laboratorio sobre la calidad del agua.

Palabras clave: Derecho ambiental. Contaminación del kilómetro 4 de Igarapé. Saneamiento básico. Responsabilidad legal.

INTRODUCTION

The discharge of untreated sewage into water bodies represents a serious environmental and public health challenge, with complex legal implications. Water contamination impacts the daily use of this resource, whether in the irrigation of vegetable gardens, which supply school meals and fairs, or in the use by domestic animals and livestock. Thus, the problem goes beyond environmental damage, extending to public health issues and exposure of residents to the risks of waterborne diseases.

This is a problem that emerges as a significant legal issue, such as in the definition of legal responsibilities for the maintenance and preservation of water resources. In the foreground, anchored in Brazil, as provided for in article 225 of the Federal Constitution (FC) of 1988 when it states that "Everyone has the right to an ecologically balanced environment, a good for the common use of the people and essential to a healthy quality of life, imposing on the Government and the community the duty to defend and preserve it for present and future generations."

It is important to emphasize the importance of an analysis of the socio-environmental and public health impacts, specifically related to the use of water contaminated by sewage in the KM 04 stream, located near the Tocantins River.

In this way, the study focuses on the legal consequences of the discharge of untreated sewage in this area, investigating the legal responsibilities of the agents involved and the implications for the health of the local population and the preservation of the ecosystem.

In addition, it seeks to examine the relationship between water contamination and the quality of life of residents, as well as the legal standards of environmental protection and public health applicable to the case.

As a problematization of the theme, it is taken into account that in view of article 225 of the 1988 Federal Constitution, it is observed that the Brazilian legislation ensures the right to a balanced environment and public health, imposing duties on the public power and other agents involved in basic sanitation actions.

The investigation of the legal and socio-environmental implications of this case seeks to understand the extent of these duties, identifying the management failures that contribute to the perpetuation of the damage and proposing possible solutions to mitigate the impacts of this contamination.

In the context of the KM 04 Stream, located near the Tocantins River, this situation is aggravated by directly affecting the living conditions of the local population and the ecosystems of the region.

In view of this, the following research question is constituted: "What are the legal and socio-environmental consequences of the discharge of untreated sewage in the KM 04 stream, and what are the legal responsibilities of the agents involved in the face of the risks imposed on public health and the environment?"

Thus, the seriousness of water contamination is highlighted, which not only compromises the quality of the water resource, but also exposes the local community to health risks, constituting a violation of environmental and public health legal standards.

Considering the above issue, the hypothesis that arises is that the discharge of untreated sewage into the KM 04 stream, in addition to causing serious environmental damage, exposes the community and animals to health risks, constituting a violation of environmental and public health legal standards, and it is possible to hold both the government and those directly responsible for sanitation accountable.

In view of this, the objective is to evaluate the impacts of untreated sewage in the KM 04 stream, relating them to environmental and public health legal standards, and propose solutions to mitigate them. Thus, the specific objectives: to identify the environmental and public health impacts caused by sewage in the KM 04 stream; understand the influence of sewage on water quality and biodiversity of the KM 04 Creek and the Tocantins River; examine the legal responsibilities of the public agencies and agents involved, proposing solution measures.

In this way, the research is justified by the intersection between the fundamental rights to health and a balanced environment, since the quality of life of the population and the preservation of ecosystems are constituents of inalienable rights that are directly affected by the discharge of untreated sewage into the KM 04 stream, in the face of the inertia of the government itself.

Thus, there is a need to protect the rights to health and a healthy environment and to promote public policies that ensure adequate sanitation in rural and peri-urban areas. These legal and doctrinal foundations reinforce the importance of a critical analysis of the legal responsibilities of the agents involved, aiming to contribute to the development of solutions that prioritize the well-being of the community and environmental preservation.

In this sense, Costa (2022) argues that water contamination by untreated sewage affects both fauna and flora and human health, exposing the population to infectious diseases. It is noteworthy that there is the vulnerability of communities that depend on these resources for consumption, food and economic activities, justifying the relevance of interventions that protect the health of local residents.

To achieve the work, the methodological procedures consisted of context, in which the research was carried out in the area of the Igarapé KM 04, tributary of the Tocantins River. The Igarapé receives untreated sewage from various sources, including the prison system. The data collection period will focus on the months of greatest agricultural activity and the rainy season, when the impacts of contamination are more visible.

The present research adopts a qualitative approach, of exploratory and descriptive nature, in order to understand the environmental, social and legal impacts resulting from water contamination by sewage in the surroundings of the KM 04 stream, as well as its implications in the use of water for irrigation of urban gardens.

Data collection was conducted through two main methodological procedures: direct on-site observation and review of specialized literature.

With regard to on-site observation, technical visits were made to the KM 04 stream and to the area affected by domestic sewage, with the objective of identifying the conditions of the water body, verifying the existence of effluent discharge in natura and ascertaining the use of water for agricultural purposes, especially the irrigation of vegetable gardens.

During the visits, a systematized observation script was adopted, which included variables such as odor, water color, presence of solid waste, signs of anthropogenic use, and evidence of local agricultural practices.

In addition, water samples were collected from the stream, which were submitted to physicochemical and microbiological analysis in an accredited laboratory, with the objective of identifying parameters indicating pollution, such as the presence of fecal coliforms, organic matter and heavy metals.

The second stage consisted of conducting a bibliographic and documentary review, with a survey of scientific publications, legislation and technical studies that address the themes of basic sanitation, environmental rights, public health and legal liability for environmental damage related to sewage contamination.

The data obtained from the observations and interviews conducted with residents of the region were treated through content analysis, in order to identify, group and interpret the recurrent thematic nuclei in the reports and records.

The categorization of qualitative data was organized into three central thematic axes: "impacts on public health", "environmental damage" and "legal responsibilities", allowing a systematic analysis of the evidence collected in the field in the light of theoretical and legal references.

The literature review played a fundamental role in the theoretical foundation of the research, subsidizing the critical discussion of the empirical data, contributing to the legal

framework of the observed situation and to the identification of alternatives and possible solutions to the problem addressed.

The text is organized in a sequential and thematic way, starting with the Introduction, where the problem of untreated sewage in peri-urban streams is presented, focusing on KM 04 of BR 422. In Chapter 1, the environmental impacts resulting from the inadequate discharge of sewage are analyzed, emphasizing the degradation of water and local biodiversity. Next, Chapter 2 addresses the risks to public health, especially related to the consumption of contaminated food by the population residing in the affected area. Chapter 3 discusses the legal responsibility of the public and private agents involved and the need to implement effective public policies to promote basic sanitation. Finally, the Final Considerations are presented, which summarize the main findings and propose referrals, followed by the Bibliographic References, which support the study.

THE ENVIRONMENTAL IMPACTS CAUSED BY UNTREATED SEWAGE IN PERI-URBAN STREAMS – KM 04 OF BR 422

The discharge of untreated sewage into the Igarapé KM 04 of BR 422 represents a serious environmental threat, directly impacting water quality and compromising local biodiversity. The presence of pollutants resulting from this improper disposal intensifies the degradation of the aquatic ecosystem, making the water unfit for human and animal consumption.

In addition, the accumulation of residues and toxic substances favors the proliferation of pathogenic agents, increasing the risks of waterborne diseases and affecting public health. Thus, the contamination of water resources by untreated sewage reinforces the urgency of effective measures to mitigate its impacts and preserve the environmental integrity of the KM 04 stream.

It is noteworthy that Soares; Souza and Souza (2020), discuss that the discharge of domestic sewage and industrial effluents into water bodies, even after conventional treatment, still increases the concentration of pollutants, compromising aquatic ecosystems and generating environmental impacts and health risks.

Based on the conceptions of Soares; Souza and Souza (2020), the contamination of water by untreated sewage harms the quality of the water resource, increasing the levels of pollutants and making the water unsuitable for human and animal use.

According to Soares; Souza and Souza, (2020) water contamination by micropollutants, originating mainly from industrialized products, represents a significant risk to public health. From this notion it is possible that conventional water treatment techniques

are suitable for the removal of these contaminants, which can have cumulative and harmful effects on living organisms and the environment.

In this context, Barros; Amin (2008) state that "it is necessary to adopt forms of management that make it possible to ensure the quantitative and qualitative conservation of water and the rationality of uses and their fair sharing".

It is notorious that the coherent management of water resources allows conservation and this is given by rational practices, because:

> Water is a fundamental resource for the subsistence of all forms of life on the planet. This indispensable resource has been under great pressure in various parts of the world, which is expected to increase due to population growth and increased agricultural and industrial production. There are great challenges for the management of water resources, which involves solving problems such as scarcity, degradation of its quality and the proper allocation of its use (Furriela, 2001, p. 51).

Thus, the discharge of untreated sewage into the KM 04 stream reveals itself as a significant threat to water quality and local biodiversity, directly impacting the health of ecosystems and populations that depend on these resources. This improper waste disposal leads to increased levels of pollutants in water, which, when reaching aquatic ecosystems, compromises both animal life and the safety of water for human consumption.

In this context, Soares; Souza and Souza (2020, p. 102-103) highlight that:

> The discharge of domestic sewage and industrial effluents into water bodies, even after conventional treatment, increases the concentrations of these pollutants in aquatic ecosystems and can cause environmental and health damage, which highlights the seriousness of the environmental and health impacts of this practice.

In addition, water contamination by micropollutants, which come largely from industrialized products, intensifies the risks to public health. These micropollutants are resistant to traditional water treatment methods and can accumulate in living organisms, generating adverse effects for both aquatic fauna and humans. (Soares; Souza and Souza, 2020).

This alert reinforces the need to reassess water treatment processes, aiming at greater efficiency in the elimination of emerging pollutants. Thus, the sustainable management of water resources is essential to ensure environmental preservation and the balanced use of water.

Barras and Amin (2008) underline the importance of adopting conservation measures that ensure the rational and fair use of water resources: "it is necessary to adopt forms of management that make it possible to ensure the quantitative and qualitative conservation of waters, and the rationality of uses and their fair sharing". This management

model requires an approach that contemplates both the protection of the quality and the equitable distribution of water resources, which are essential for sustainable development.

Population growth and increased agricultural and industrial activity intensify the pressure on water resources, making it even more challenging to properly manage water.

As Furriela (2001) points out, the challenges make it imperative to invest in effective public policies and advanced technologies to ensure water conservation and minimize the environmental and social impacts of its degradation.

The contamination of the KM 04 Creek by the continuous discharge of untreated sewage compromises the quality of the water and triggers a severe ecological imbalance. The excessive presence of organic matter and toxic substances contributes to the reduction of dissolved oxygen, directly affecting the aquatic species that depend on this environment to survive.

As a consequence, the death of fish and other organisms occurs, triggering a significant loss of biodiversity, which impacts not only aquatic ecosystems, but also terrestrial species that use the stream as a source of food and water.

It is noteworthy that the effects of pollution that extend beyond the watercourse persist, directly affecting the soil and vegetation on the banks. The infiltration of contaminants into the soil reduces its fertility and compromises the vegetation's ability to regenerate, impacting local plantations that depend on irrigation with this water.

The environmental degradation resulting from this process threatens not only the surrounding fauna and flora, but also compromises the food security of the communities that use these natural resources for subsistence.

Given this scenario, it becomes evident the need for urgent actions to mitigate environmental damage and restore the ecological balance of the KM 04 Stream, such as the implementation of sewage treatment systems, added to sustainable environmental preservation practices, is essential to avoid continuous contamination and ensure the protection of biodiversity and the quality of life of the populations that depend on this water resource.

RISKS TO PUBLIC HEALTH AND THE CONSUMPTION OF CONTAMINATED FOOD BY THE LOCAL POPULATION

This section aims to analyze the extent of the impacts generated by the discharge of untreated sewage into the KM 04 stream, especially with regard to water quality and the integrity of aquatic fauna in the Tocantins River.

The growing concern about public health risks stems from the possibility of contamination of the food chain, especially through the consumption of contaminated fish and crustaceans, which compromises the food security of riverside and urban populations that depend on these resources.

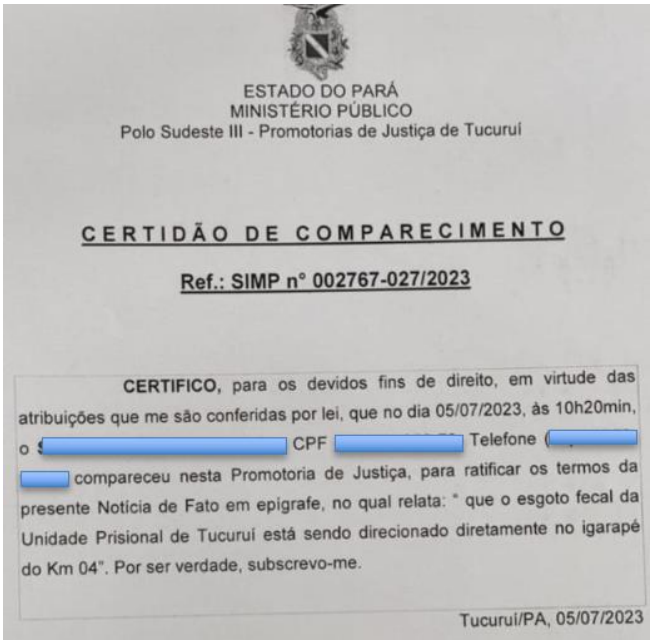
It is assumed that the continuous discharge of domestic and institutional sewage without adequate treatment into the KM 04 stream represents a serious environmental threat. When it reaches this water body, the effluents carry with them organic loads, fecal coliforms, chemical residues and other pollutants that not only degrade the water quality of the stream, but, due to its direct connection with the Tocantins River, significantly expand the radius of environmental impact.

The connection between the two watercourses implies that the effects of sewage discharge go beyond the limits of the stream, compromising the aquatic biodiversity of the Tocantins River. Species of fish and other aquatic organisms that inhabit or transit between these environments can be contaminated, accumulating harmful substances in their bodies, in addition, such as ortalice and vegetables in general, which once consumed by the population, become potential vehicles of infectious, parasitic and even chronic diseases, such as those caused by heavy metals and persistent chemical compounds.

It should be noted that it is through the Tocantins River that the population gets its family food, and thus, it is important to consider the cultural and economic role of fishing for local communities. The degradation of water quality directly affects the livelihood of many families who live from artisanal fishing and compromises the quality of life of populations that do not have other safe sources of food.

Figure 1 presents a Certificate of Attendance issued by the Tucuruí Prosecutor's Office, linked to the Public Prosecutor's Office of the State of Pará, dated July 5, 2023. The document officially confirms that fecal sewage from the Tucuruí Prison Unit is being dumped directly into the KM 04 stream, as follows:

Figure 1 - Fecal sewage and Tucuruí prison unit in the Igarapé of KM 04



ESTADO DO PARÁ
MINISTÉRIO PÚBLICO
Polo Sudeste III - Promotorias de Justiça de Tucuruí

CERTIDÃO DE COMPARECIMENTO

Ref.: SIMP nº 002767-027/2023

CERTIFICO, para os devidos fins de direito, em virtude das atribuições que me são conferidas por lei, que no dia 05/07/2023, às 10h20min, o [redacted] CPF [redacted] Telefone [redacted] compareceu nesta Promotoria de Justiça, para ratificar os termos da presente Notícia de Fato em epígrafe, no qual relata: " que o esgoto fecal da Unidade Prisional de Tucuruí está sendo direcionado diretamente no igarapé do Km 04". Por ser verdade, subscrevo-me.

Tucuruí/PA, 05/07/2023

Source: Public Prosecutor's Office of Pará-PA

This certification represents institutional proof of the existence and continuity of the problem, serving as a starting point for the investigation of the extent of the environmental and social damage involved.

The relevance of the figure lies in its function as documentary evidence, which strengthens the argument about the imminent risks to public health and the environment. From this official data, the urgent need for environmental control measures, water quality monitoring and evaluation of the effects on local fauna is reinforced.

The following image 1 presents a photographic record taken on the morning of December 13, 2024, at 05:42 am, with cloudy weather and a temperature of 21°C, at latitude 3.737568° S and longitude 49.690769° E, with an altitude of 3.73 meters. The location indicates the natural area of Igarapé KM 04, a stretch taken over by riparian forest and adjacent to the watercourse, as follows:

Image 1 - site of the colleague of uncontaminated water of the Igarapé KM 04

Source: Author's personal archive (2025)

Despite the low light conditions, it is observed that the native vegetation is still relatively preserved. The presence of green leaves and shrub density indicate an environment that, until the time of recording, maintained characteristics compatible with a healthy ecosystem — reinforcing the information that the water, at this point, was still considered of good quality.

Thus, even if certain stretches of the creek have the appearance of clean water or conserved vegetation, the continuous transport of contaminants through the water flow represents a systemic risk.

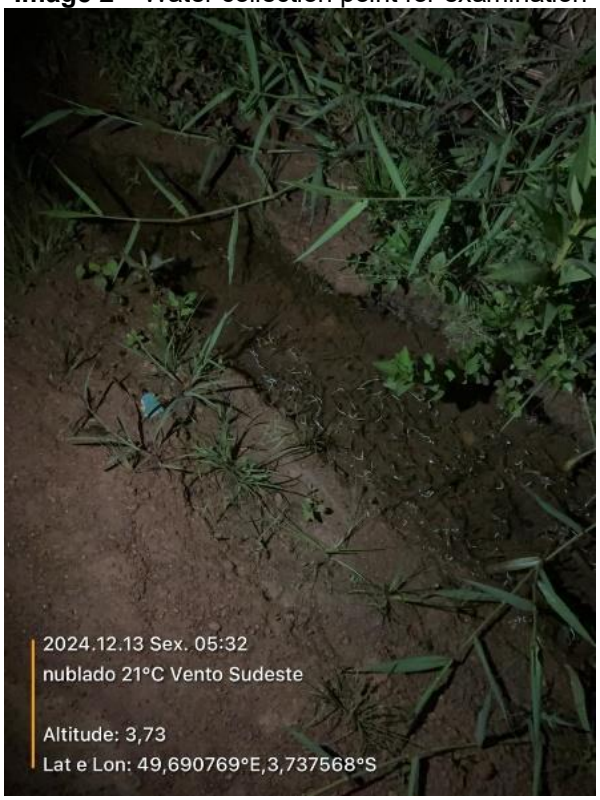
With the runoff of surface water towards the Tocantins River, pollutants from irregular dumping — such as the one recorded in Figure 1 — are inevitably transported, affecting more ecologically stable areas and expanding the area of impact.

This phenomenon of water dispersion is especially worrisome because initial contamination, even in specific stretches, has the potential to accumulate and propagate, significantly altering the quality of the water at more distant points.

In addition, local biodiversity, which includes fish, crustaceans and other aquatic organisms, tends to be gradually compromised, even in places where water quality still seems to be preserved.

When we look at image 2, there is evidence of a worrying contradiction, that apparently healthy areas may already be in the process of invisible degradation, serving as corridors for the dispersion of pollutants, as follows:

Image 2 – Water collection point for examination



Source: Author's personal archive (2025)

The contamination of fauna and, consequently, the risk to human health via the food chain, become more complex problems and less perceptible to simple visual observation.

Image 2, captured on December 13, 2024, at 05:32 am, under a temperature of 21°C and southeast wind, shows an area of Transcametá, near Km 04, a place already recognized by the presence of open sewage.

The aforementioned image reveals a small patch of wet, waterlogged soil, with visible signs of stagnant and darkened water, surrounded by undergrowth. The geographic coordinates (latitude 3.737568°S, longitude 49.690769°E and altitude of 3.73m) indicate that the record was made near the site of irregular discharge of effluents from the Tucuruí Prison Unit, as shown in Figure 1 (MP-PA doc.).

Although the environment still has vegetation present, visual indications point to a condition of compromised water — turbid, smelly and with the possible presence of decomposing organic matter.

This scenario is characteristic of areas impacted by the discharge of untreated sewage, which favors the proliferation of pathogenic microorganisms and the decrease of dissolved oxygen in the water, directly affecting the local aquatic fauna.

This type of silent pollution, with effluent runoff through the soil or secondary channels, represents a real threat to the environmental quality of the KM 04 Creek and,

consequently, to the Tocantins River, given the natural connection between the water bodies.

As a result, the degradation observed in Transcametá compromises the balance of the ecosystem and exposes the riverside population to health risks, especially those who use the water for fishing, hygiene or even consumption.

The evidence gathered along this section, especially in the region of Transcametá – Km 04, demonstrates that the discharge of untreated sewage seriously compromises the water quality of the KM 04 stream.

The analysis of the images and institutional records reveals that pollution is advancing continuously and directly affects not only the local ecosystem, but also the Tocantins River, where this contaminated water inevitably drains.

This contamination process has serious implications for food security and public health, especially for riverside communities that depend on the river for economic activities and for water and food consumption. The presence of sewage in the natural environment threatens aquatic species, reduces biodiversity and compromises the sustainability of the way of life of these populations.

Thus, it is concluded that the contamination located in the KM 04 Creek has regional consequences and that the preservation of smaller water bodies is essential to protect the entire Tocantins River basin.

The situation demands urgent actions for basic sanitation, environmental inspection and public policies that promote the sustainable and safe use of water resources. In view of these aspects, it is possible to think about the sense of legal responsibilities and public policies to solve or minimize this problem.

LEGAL RESPONSIBILITY AND PUBLIC POLICIES FOR BASIC SANITATION

According to Silva (2009), article 225 of the Brazilian Constitution of 1988 enshrines the right to an ecologically balanced environment as a right of all, imposing on the public power and the community the duty to defend and preserve it. Thus, the discharge of untreated sewage into the KM 04 stream represents a violation of this right, compromising both the local ecosystem and the quality of life of the region's residents.

With regard to legal liability, Milaré (1998) discusses the principles of the polluter pays and prevention, which support the need to hold polluting agents responsible for environmental damage.

These principles justify that the entities responsible for basic sanitation must repair the damage caused to the environment and public health. In addition, Milaré (1998)

understands the importance of prevention as a measure to prevent environmental damage from becoming irreversible, emphasizing the need for proactive policies in relation to sanitation.

Law No. 11,445/2007 establishes national guidelines for basic sanitation and reinforces the need for public policies that guarantee access to a healthy environment. (Brazil, 2007). This legislation defines basic sanitation as an essential public service for health and the environment, and the absence of adequate sewage treatment in Igarapé KM 04 represents an omission that contradicts these principles, entailing serious risks to public health.

Based on Law No. 11,445/2007, the case of Igarapé KM 04 shows not only the environmental degradation caused by the absence of adequate infrastructure, but also a violation of the fundamental rights of the local population, especially the right to health, drinking water and an ecologically balanced environment, as guaranteed by the Federal Constitution of 1988.

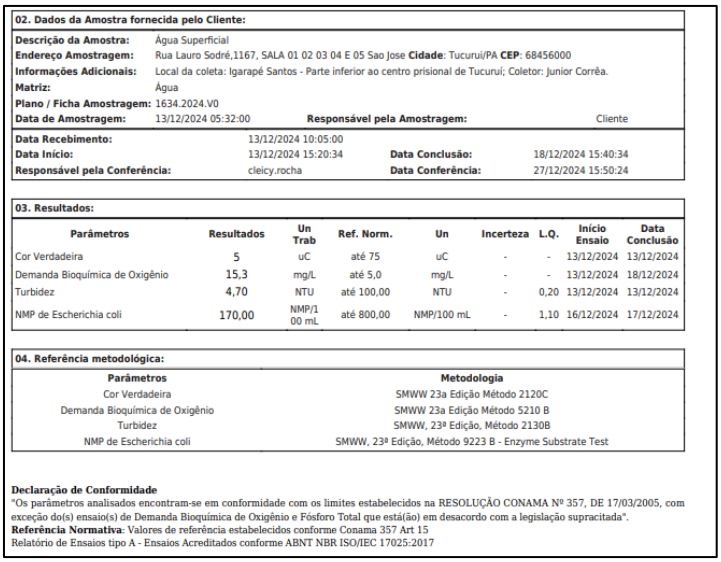
From this perspective, it is highlighted that the responsibility for basic sanitation is shared among the federative entities and, in certain circumstances, extends to the private concessionaires that operate sewage collection and treatment services.

According to the regulatory framework for sanitation, these agents have a legal duty to act efficiently and continuously, promoting universal access to sanitation and preventing socio-environmental damage.

Thus, the central argument that guides this study maintains that the omission in the management and inspection of sanitation configures not only an administrative failure, but also a legal infraction, subject to civil, administrative and even criminal liability. The contamination of the KM 04 Stream, which extends to the Tocantins River, thus becomes an emblematic example of the urgency of strengthening the legal mechanisms of environmental control and the importance of an integrated action between the various responsible sectors.

To confirm the situation of the Igarapé, some tests of the water removed from the site were carried out, as shown in image 3 below:

Image 3 - Test Report No. 21425.2024.A-V.0



02. Dados da Amostra fornecida pelo Cliente:

Descrição da Amostra: Água Superficial
Endereço Amostragem: Rua Lauro Sodré,1167, SALA 01 02 03 04 E 05 Sao Jose **Cidade**: Tucurui/PA **CEP**: 68456000
Informações Adicionais: Local da coleta: Igarapé Santos - Parte inferior ao centro prisional de Tucuruí; Coletor: Junior Corrêa.
Matriz: Água
Plano / Ficha Amostragem: 1634.2024.V0
Data de Amostragem: 13/12/2024 05:32:00 **Responsável pela Amostragem:** Cliente

Data Recebimento: 13/12/2024 10:05:00
Data Início: 13/12/2024 15:20:34 **Data Conclusão:** 18/12/2024 15:40:34
Responsável pela Conferência: cleicy.rocha **Data Conferência:** 27/12/2024 15:50:24

03. Resultados:

Parâmetros	Resultados	Un Trab	Ref. Norm.	Un	Incerteza	L.Q.	Início Ensaio	Data Conclusão
Cor Verdadeira	5	uC	até 75	uC	-	-	13/12/2024	13/12/2024
Demanda Bioquímica de Oxigênio	15,3	mg/L	até 5,0	mg/L	-	-	13/12/2024	18/12/2024
Turbidez	4,70	NTU	até 100,00	NTU	-	0,20	13/12/2024	13/12/2024
NMP de Escherichia coli	170,00	NMP/100 mL	até 800,00	NMP/100 mL	-	1,10	16/12/2024	17/12/2024

04. Referência metodológica:

Parâmetros	Metodologia
Cor Verdadeira	SMWW 23a Edição Método 2120C
Demanda Bioquímica de Oxigênio	SMWW 23a Edição Método 5210 B
Turbidez	SMWW, 23ª Edição, Método 2130B
NMP de Escherichia coli	SMWW, 23ª Edição, Método 9223 B - Enzyme Substrate Test

Declaração de Conformidade
"Os parâmetros analisados encontram-se em conformidade com os limites estabelecidos na RESOLUÇÃO CONAMA Nº 357, DE 17/03/2005, com exceção do(s) ensaio(s) de Demanda Bioquímica de Oxigênio e Fósforo Total que está(ão) em desacordo com a legislação supracitada".
Referência Normativa: Valores de referência estabelecidos conforme Conama 357 Art 15
Relatório de Ensaios tipo A - Ensaios Acreditados conforme ABNT NBR ISO/IEC 17025:2017

Source: Vet Plus Serviços Veterinários e Assessoria LTDA

The technical and legal analysis of the results is supported by the Federal Constitution of 1988, in its article 225, which establishes "everyone has the right to an ecologically balanced environment, and it is the duty of the public power and the community to defend and preserve it for present and future generations". (Brazil, 1988).

In addition, Law No. 11,445/2007, which establishes the national guidelines for basic sanitation, determines that access to drinking water and sanitation is a fundamental right, and that the inadequate supply or absence of these services represents a violation of public health and the environment. (Brazil, 2007).

The technical report analyzed reveals alarming results regarding the quality of the water collected in the Igarapé, which are incompatible with the parameters established by CONAMA Resolution No. 357/2005 for class 2 water bodies (fresh water intended for human supply after simplified treatment, for the protection of aquatic life, and for primary contact recreation). (Brazil, 2005).

The following data stand out:

a) Biochemical Oxygen Demand (BOD): 15.3 mg/L

Reference value: up to 5.0 mg/L

It should be analyzed that the value three times higher than the maximum allowed limit. High BOD indicates a large amount of decomposing organic matter, which significantly reduces dissolved oxygen in the water, affecting aquatic life and favoring the proliferation of pathogenic bacteria (Rodrigues, 2020).

b) Most Likely Number (MPN) of Escherichia coli: 170.00 MPN/100 mL

Reference value: up to 800.00 NMP/100 mL

It is analyzed that, although below the maximum allowed value, the presence of this bacterium indicates fecal contamination, representing health risks, especially if there is consumption or direct contact with this water (CONAMA, 2005).

c) Turbidity: 4.70 NTU

Reference value: up to 40 NTU

It is analyzed that within the legal limits. However, turbidity does not cancel out the effects of the high organic and fecal loads present.

d) True Color: 5 uC (color units)

Reference value: up to 75 uC

It is analyzed that, within the limit, but insufficient to characterize the potability of water, since other indicators are critical.

In view of this, the perception of legal implications, through the data show violation of water quality standards and, therefore, of current environmental legislation. Legal responsibility for this situation can be attributed based on the polluter-pays principle, enshrined in article 14, paragraph 1, of Law No. 6,938/1981 (National Environmental Policy), which determines that the polluter must bear the costs of repairing the environmental damage. (Brazil, 1981).

In addition, the omission of the public power to supervise, mitigate and remedy the discharge of untreated sewage constitutes a breach of its constitutional duty to ensure adequate conditions of environmental health (Brasil, 1988).

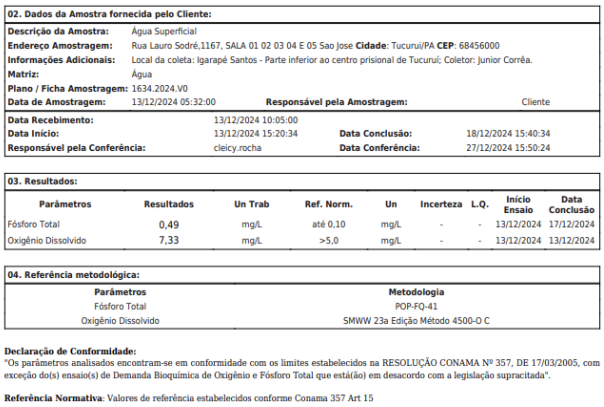
Such conduct may generate strict civil liability, with the possibility of public civil actions, and even criminal and administrative liability, under the terms of Law No. 9,605/1998, the enshrined Environmental Crimes Law. (Brazil, 1998).

Thus, the technical report analyzed proves the existence of significant water contamination in the KM 04 stream, being a direct result of the discharge of untreated sewage, as already certified by the Public Prosecutor's Office. Such a situation requires immediate action by the government, based on what is determined by the Federal Constitution, the Basic Sanitation Law and environmental legislation.

The accountability of the public and private agents involved, combined with the repair of damages and the adoption of corrective measures, is an indispensable condition to ensure the integrity of the environment and the health of the population of Tucuruí-PA.

In addition, Test Report No. 21425.2024.B-V.0 stands out, as shown in image 4 below:

Image 4 - Test Report No. 21425.2024.B-V.0



02. Dados da Amostra fornecida pelo Cliente:

Descrição da Amostra:	Água Superficial		
Endereço Amostragem:	Rua Lauro Sodré,1167, SALA 01 02 03 04 E 05 Sao Jose **Cidade**: Tucurui/PA **CEP**: 68456000		
Informações Adicionais:	Local da coleta: Igarapé Santos - Parte inferior ao centro prisional de Tucuruí; Coletor: Junior Corrêa.		
Matriz:	Água		
Plano / Ficha Amostragem:	1634.2024.V0		
Data de Amostragem:	13/12/2024 05:32:00	**Responsável pela Amostragem:**	Cliente
Data Recebimento:	13/12/2024 10:05:00		
Data Início:	13/12/2024 15:20:34	**Data Conclusão:**	18/12/2024 15:40:34
Responsável pela Conferência:	cleicy.rocha	**Data Conferência:**	27/12/2024 15:50:24

03. Resultados:

Parâmetros	Resultados	Un Trab	Ref. Norm.	Un	Incerteza	L.Q.	Início Ensaio	Data Conclusão
Fósforo Total	0,49	mg/L	até 0,10	mg/L	-	-	13/12/2024	17/12/2024
Oxigênio Dissolvido	7,33	mg/L	>5,0	mg/L	-	-	13/12/2024	13/12/2024

04. Referência metodológica:

Parâmetros	Metodologia
Fósforo Total	POP-FQ-41
Oxigênio Dissolvido	SMWW 23a Edição Método 4500-O C

Declaração de Conformidade:
"Os parâmetros analisados encontram-se em conformidade com os limites estabelecidos na RESOLUÇÃO CONAMA Nº 357, DE 17/03/2005, com exceção do(s) ensaio(s) de Demanda Bioquímica de Oxigênio e Fósforo Total que está(ão) em desacordo com a legislação supracitada".

Referência Normativa: Valores de referência estabelecidos conforme Conama 357 Art 15

Source: Vet Plus Serviços Veterinários e Assessoria LTDA

The analysis of Test Report No. 21425.2024.B-V.0, issued by Vet Plus Serviços Veterinários e Assessoria LTDA, reveals new worrying data on the quality of the water collected in the Santos Stream, in an area close to the Tucuruí-PA prison center.

Total phosphorus was recorded at 0.49 mg/L, exceeding the maximum allowed limit of 0.10 mg/L, according to CONAMA Resolution No. 357/2005. This value indicates eutrophication — a process of enrichment of the water body by nutrients that favors the excessive proliferation of algae and microorganisms, compromising the ecological balance and potentially causing fish mortality and risks to human health (Brasil, 2005).

Although the dissolved oxygen level was 7.33 mg/L, which is higher than the minimum required of 5.0 mg/L, this indicator may be masking the effects of nutrient contamination, which tend to generate cumulative negative impacts over time.

From a legal point of view, the discharge of sewage or effluents with an excessive load of nutrients without adequate treatment constitutes an environmental infraction, subject to liability based on Law No. 9,605/1998 (Environmental Crimes Law), in addition to possible objective civil liability of the public power for omission, based on article 225 of the 1988 Federal Constitution.

In addition, the polluter-pays principle applies, which obliges the agent causing the degradation to bear the full reparation of the environmental damage. In this context, the results reinforce the urgency of the action of inspection agencies and the Public Prosecutor's Office to demand effective remediation plans and immediate corrective actions, under penalty of administrative, civil and criminal liability.

To illustrate the water situation in the Santos Creek in Tucuruí, image 5 is shown below:

Image 5 - Test Report No. 21425.2024.C-V.0

03. Resultados:

Parâmetros	Resultados	Un Trab	Ref. Norm.	Un	Incerteza	L.Q.	Início Ensaio	Data Conclusão
Cor Verdadeira	23	uC	até 75	uC	-	-	13/12/2024	13/12/2024
Demanda Bioquímica de Oxigênio	7,6	mg/L	até 5,0	mg/L	-	-	13/12/2024	18/12/2024
Turbidez	10,00	NTU	até 100,00	NTU	-	0,20	13/12/2024	13/12/2024
NMP de Escherichia coli	1.600,00	NMP/100 mL	até 800,00	NMP/100 mL	-	1,10	16/12/2024	17/12/2024

04. Referência metodológica:

Parâmetros	Metodologia
Cor Verdadeira	SMWW 23a Edição Método 2120C
Demanda Bioquímica de Oxigênio	SMWW 23a Edição Método 5210 B
Turbidez	SMWW, 23ª Edição, Método 2130B
NMP de Escherichia coli	SMWW, 23ª Edição, Método 9223 B - Enzyme Substrate Test

Declaração de Conformidade
"Os parâmetros analisados encontram-se em conformidade com os limites estabelecidos na RESOLUÇÃO CONAMA Nº 357, DE 17/03/2005, com exceção do(s) ensaio(s) de Demanda Bioquímica de Oxigênio e NMP de Escherichia coli que está(ão) em desacordo com a legislação supracitada".
Referência Normativa: Valores de referência estabelecidos conforme Conama 357 Art 15
Relatório de Ensaios tipo A - Ensaios Acreditados conforme ABNT NBR ISO/IEC 17025:2017

Source: Vet Plus Serviços Veterinários e Assessoria LTDA

The analysis of Test Report No. 21425.2024.C-V.0, issued by Vet Plus Serviços Veterinários e Assessoria LTDA, reveals alarming results on the quality of the water in the Santos Stream, in Tucuruí-PA. The total phosphorus concentration was recorded at 0.49 mg/L, significantly exceeding the limit of 0.10 mg/L established by CONAMA Resolution No. 357/2005 for class 2 water bodies. This excess phosphorus can lead to eutrophication, promoting excessive algae growth and resulting in a decrease in dissolved oxygen, which negatively affects aquatic fauna and compromises water quality.

From a legal point of view, the presence of high levels of phosphorus indicates the discharge of effluents without adequate treatment, constituting an environmental infraction according to Law No. 9,605/1998 (Environmental Crimes Law).

In addition, the omission of the public power to inspect and control such practices may result in strict civil liability, as provided for in article 225 of the 1988 Federal Constitution. The polluter-pays principle also applies, imposing on those responsible the obligation to repair the damage caused to the environment.

In view of these results, it is imperative that the competent authorities adopt immediate measures to mitigate environmental impacts, hold offenders accountable, and implement effective basic sanitation policies, ensuring the protection of water resources and the public health of the local population. In view of this, it is important to place the caveat of the polluter-pays principle.

Thus, it is important to highlight that the polluter-pays principle, although already mentioned, deserves more in-depth attention in view of its centrality in environmental accountability. According to Paulo Affonso Leme Machado (2014), this principle imposes on the polluting agent the obligation to internalize the costs resulting from environmental degradation, bearing full responsibility for the measures of prevention, containment and

repair of the damage caused. The author states that "whoever causes the environmental damage must bear the economic burden resulting from the restoration of the damaged environment", which is an ethical-legal imperative that is in line with article 225 of the Federal Constitution and with article 14, paragraph 1, of Law No. 6,938/1981 (National Environmental Policy).

The effective application of this principle assumes a preventive and reparative character, functioning not only as an instrument of compensation for the damage caused, but also as a deterrent mechanism, aimed at discouraging practices that are harmful to the environment. In the case of the discharge of untreated sewage into the urban streams of Tucuruí, the polluter-pays principle reinforces the need for objective accountability of public entities or concessionaires that fail to comply with their legal obligations, as well as the requirement for concrete sanitation and environmental restoration measures. Thus, the absence of adequate infrastructure for sewage treatment cannot be dissociated from the legal responsibility of those who hold the ownership or concession of sanitation services, as inertia in this field results in a severe violation of the collective right to an ecologically balanced environment.

FINAL CONSIDERATIONS

The situation of untreated sewage discharge in the KM 04 stream, in Tucuruí-PA, transcends the environmental and sanitary sphere, directly affecting the legal foundations that govern the Democratic Rule of Law, especially the constitutional precepts of environmental protection and guarantee of public health. The technical and legal analysis of the documents presented, combined with visual and laboratory evidence, demonstrates the existence of an environmental crisis caused by state omission and the absence of effective public policies for basic sanitation, which frontally violates the legal provisions in force.

The Federal Constitution of 1988, in article 225, establishes that everyone has the right to an ecologically balanced environment, essential to a healthy quality of life, and that it is the duty of the public power and the community to defend and preserve it. Such a constitutional command is not limited to a programmatic guideline, but configures a fundamental right, enforceable judicially, the violation of which may give rise to civil, administrative and criminal sanctions. The absence of sewage treatment in the KM 04 stream, as found in technical reports and confirmed by an official document of the Public Prosecutor's Office, evidences the non-compliance with this constitutional commandment, imposing the responsibility of the public authorities for the omission and of the agents who contribute directly or indirectly to environmental degradation.

In this context, Law No. 11,445/2007, which establishes the national guidelines for basic sanitation, reinforces the essential character of this service, linking it to public health, human dignity and sustainable development. The lack of adequate sewage collection and treatment compromises these principles and exposes the inequality of access to basic rights. The case of Igarapé KM 04 reveals not only failures in the execution of public policies, but also the absence of inspection, control and prevention, as established by the precautionary principle, widely recognized in Environmental Law.

Also, according to article 14, paragraph 1, of Law No. 6,938/1981 (National Environmental Policy), the polluter-pays principle applies to the case in question. This principle establishes that the one who causes environmental degradation has the duty to bear the costs of repair, regardless of the existence of fault. Based on this understanding, both the omitted public entity and possible private entities involved in the generation and irregular disposal of sewage must be held responsible for the contamination of the KM 04 Creek and for the damage caused to the environment and the health of the local population.

The laboratory data extracted from the test reports demonstrate critical levels of pollutants, such as high biochemical oxygen demand (BOD), excess total phosphorus and presence of Escherichia coli, at concentrations that exceed the limits established by CONAMA Resolution No. 357/2005 for class 2 water bodies. These results point not only to the inefficiency of sanitation systems, but also to the non-compliance with environmental legislation and the state's obligation to guarantee minimum conditions of health and environmental quality.

The constant discharge of sewage into the Igarapé compromises aquatic fauna, reduces biodiversity, aggravates eutrophication processes and threatens the food security of riverside communities that depend on the river for subsistence. In addition, the presence of pathogenic microorganisms and persistent contaminants constitutes a direct violation of the right to health, provided for in article 196 of the Federal Constitution, which imposes on the State the duty to ensure universal and equal access to actions and services for its promotion, protection and recovery.

In view of all these findings, it is imperative to adopt a more energetic stance on the part of environmental inspection agencies, the Public Prosecutor's Office and municipal and state public managers. It is necessary to initiate public civil actions to hold the agents involved accountable, as well as the preparation of an effective sanitation plan, with a schedule, budget and short, medium and long-term goals, under penalty of continuing the violation of fundamental rights.

Therefore, the legal implications of the contamination of the KM 04 Creek must be faced based on the rigor of environmental legislation, the consolidated jurisprudence of the higher courts and the principles that guide Brazilian Environmental Law. Only through effective accountability, full reparation of environmental damage and the implementation of structuring public policies will it be possible to restore the ecological balance of the region, guarantee the health of the population and ensure the environmental justice that the Brazilian Constitution requires and human dignity demands.

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