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What Governance Failures Reveal about Water Resources Management in a Municipality of Brazil

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Abstract: Humans have historically chosen to develop their cities close to rivers due to the need for water and food security. In Brazil, water security represents a growing challenge, despite advances in the National Water Resources Management System. While municipalities are responsible for integrating the various public policies that impact urban rivers, such as the environment, basic sanitation, and urban planning, only states and the federal government, along with watershed committees, have a formal role in the National Water Resources Management System. The goal of this paper is to assess the Brazilian water governance system from the perspective of municipalities. The OECD water governance framework is applied to a medium-sized Brazilian municipality (c. 200,000 inhabitants), Itabuna, Bahia state, through perception-based and objective data. Studies dealing with water governance do not address this reality, despite representing more than 90% Brazilian municipalities and approximately half of the country's population. Several water governance failures were identified, such as connections between administrative and political failures, which highlight the tragic consequences of hydrological issues in this region. Developing integrated water resources' management, as fixed in national and state laws, depends on the effective participation of the municipality. This study discusses the importance of water governance at the municipal scale.

Keywords: water governance; integrated water resources management; governance failure; municipal administration; scale; water security; urban rivers

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1. Introduction

Brazil holds the largest surface freshwater reserve in the world and has a modern legal and institutional framework to manage its water resources. The Brazilian National Water Resources Policy, created in 1997, is inspired by the French model and based on international principles that guide sustainable development and integrated water resources' management [1–3]. The country is a member of the Global Water Partnership (GWP), and its National Water and Basic Sanitation Agency (ANA), the authority responsible for implementing the National Water Resources Policy, helped to found the Regional GWP in Latin America, in 2005. The country hosted Rio + 20 in 1992 and the eighth World Water Forum in 2018. Brazil is a signatory of the AGENDA 2030 and the development of its SDG 6 "Water and Sanitation" has been monitored by international organizations such as the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) [4]. The OECD Water Governance Initiative has followed Brazilian advances in the development of its National Water Resources Management System for more than a decade [5–7].

However, as of 2017, ANA included a new theme in its annual report: "water crises." Related to scarcity, water crises have become more frequent in Brazilian municipalities

in the last decade, and their territorial coverage has increased significantly [8–10]. The best-known crisis occurred in 2014 in the São Paulo metropolis, affecting millions of people. Unfortunately, these crises have been occurring nationwide. Between 2017 and 2020, more than half of the country's municipalities, representing up to 50,000 inhabitants, suffered at least one episode of drought that affected the population's supply [10]. Despite the natural abundance of water, ensuring water security has become a major challenge for most Brazilian cities in the context of climate change. At the end of 2021, 140 municipalities of the state of Bahia in northeastern Brazil had their water supplies halted due to floods that also affected the pumps and facilities of water companies. Thus, both water shortage and its excess can have direct and deleterious consequences for populations, posing great risks to their water security.

Several factors are responsible for this trend, such as deforestation, changes in land use and occupation, agriculture, and mining; however, their direct relationship with the city, both from the perspective of both of causes and consequences, requires urgent changes in the decision-making processes affecting water resources in urban environments. The Water Alliance of Brazil [11] considers the water resources management model that currently predominates in Brazilian cities to be unsustainable, as it is highly sectorized and fragmented, and this opinion has been reinforced by several studies [12–15]. The path towards greater water security would involve the development of water governance and the promotion of an integrated management capable of properly communicating about water resources with environmental management, basic sanitation, and urban planning [16–20]. Good governance requires that hierarchical power structures are overcome while the concepts of accountability, transparency, legitimacy, public participation, justice, and efficiency are adopted [2]. Local authorities are fundamental to the development of water governance [21,22]. According to the OECD (2015), in Brazil, the low participation of municipalities in the National Water Resources Management System represents one of the main challenges to improving water management.

Therefore, the question is, what would the importance of water governance be for municipalities? How can the discussion of water governance at the municipal scale contribute to the improvement in water resources' management in Brazil? This study aims to contribute to the discussion on water governance in the context of Brazilian cities, as administered by small and medium-sized municipalities (up to 200,000 inhabitants). Studies dealing with water management do not address the reality of these municipalities [23–25], despite their representing more than 90% of Brazilian municipalities and approximately half of the country's population.

Studies on water governance show that governance failures are at the root of water-related problems [5,7,21,22,26,27]. We hypothesize that governance failures are at the origin of the problems faced by Brazilian municipalities in the management of water resources. The OECD has developed an analytical and prescriptive perspective on water governance, based on studies in public administration [28,29], which describes various types of governance failures, affecting different areas of management. The development of water governance would involve identifying and overcoming failures [30].

This approach was adopted to analyze failures in water governance in a specific municipality, Itabuna, located in the south of the state of Bahia, Northeastern Brazil, with a population of almost 214,000 inhabitants [31] and a 97% urbanization rate [32]. The city, despite being located on the banks of the Cachoeira River and having a humid tropical climate, has a water scarcity crisis. As a regional capital with influence over more than 50 small municipalities and a population of approximately 1 million inhabitants, it has a privileged political–administrative structure. Water and sewage services have already been managed by a state company, as in 70% of Brazilian municipalities, and are currently organized and provided by the municipality itself. However, the dense network of surface waters in the municipality, comprising 11 sub-basins of the Cachoeira River, is polluted and degraded. Its water supply depends on the collection of water from another river, almost 30 km away and located in the neighboring municipality. The city's sewage treatment rate

is close to zero and almost 50% of water distributed in the supply system is lost (total water loss). Analysis of the indicators of the surrounding municipalities reinforces that Itabuna is the rule, not the exception, in the region.

The analysis of water governance in the municipality of Itabuna, which used the indicators proposed by the OECD [7,19,22], mainly focused on the discussion of administrative failure, which refers to the mismatch between management scales, hydrological scales, and the scale of problems affecting water resources. The description of this failure made it possible to specifically discuss the role of the municipality in the management of water resources, considering regional and national factors. Its effects on other failures, such as political failure, which concerns the divergences in definitions of attributions and responsibilities, and the lack of information, complete the discussion. Following the GWP methodology [1,33], this study involved an analysis of the institutional environment (legal framework) of water resources' management, the institutional arrangement and management instruments, and allowed us to identify problems that the municipal administration faces in the implementation of integrated water resources management.

The role of the municipality of Itabuna in developing water governance on a regional scale, and the importance of water governance in the municipality, are discussed, considering the need for greater integration of public policies focusing on water resources at the local scale. Our results show that there is a weakness in the legal framework and in the development of the National Water Resources Management System regarding the role of municipalities, which is reflected in Itabuna and in municipalities in the region. Although it is the responsibility of municipalities to promote the multilevel integration of water resources policies with environmental management, basic sanitation, and urban planning, in practice, they are excluded from the system, and their participation is very restricted. The management instruments that the municipality must apply to ensure the sustainable management of water resources are discussed, considering the importance of a municipal water resources policy and the development of water governance at the municipal scale.

2. Why It Is Urgent, in Brazil, to Discuss Water Resources Management at the Local Scale

2.1. Brazil, a Country Far from the SDG 6 "Water and Sanitation"

Surface waters (rivers and lakes) account for only 0.4% of freshwater reserves on Earth, and of this water, only 1.6% occurs in rivers. The greatest importance of rivers is not in the volume of water, but in their ecological relevance as dynamic transport systems that renew quickly [34]. Brazil has more than 12% freshwater and the largest total actual renewable water resources (TARWR) on the planet, according to the Food and Agriculture Organization of the United Nations (FAO) [35]. However, 80% of this water is in the northern region of the country, where only 3% of the population lives.

Brazil, with a population of over 210 million inhabitants, comprises 26 states, a federal district, and 5570 municipalities. Brazilian municipalities are usually structured around a city with the same name. More than 85% of the population lives in cities. Most of the municipalities (3034) are located in the biome of the Atlantic Forest and the highest population densities occur in the hydrographic regions that occupy the coastal part of the country (Eastern Brazil). Less than 10% of rivers have good water quality in this region [36], mainly due to sewage pollution from cities [8,36,37].

Currently, urban supply represents the second largest consumptive use of water in the country (after irrigation), with 25% total withdrawals. About 57% of Brazilian cities, corresponding to 85% of the urban population, depend, exclusively or predominantly, on surface water sources [37]. The coverage of urban water supply services has stabilized in Brazil at around 93% over the last five years. The high coverage index indicates access to the water supply system network, but does not necessarily guarantee water supply, that is, water availability from the source. However, ANA estimates that 40.1% of all water made available is lost during its distribution, and it is not possible to distinguish real and apparent losses [37].

In Brazil, nearly 63% of the urban population is served with sewage collection, although it is estimated that more than half of the sewage volume produced in cities is dumped into the environment without treatment, mainly into rivers [38]. The proportion of municipalities with sanitary sewage service increased from 47.3% in 1989 to 60.3% in 2017. These rates are much lower than the growth in access to sewage collection by the network verified in the IBGE household surveys in the same period. This suggests that the increase in service is more vertical than horizontal—that is, it occurs more due to the expansion of areas served in municipalities that already had these service than to the provision of this service in other, new municipalities [10]. In 2020, 1937 municipalities still had no public sewage system and 826 municipalities did not provide information on their situation [38].

Studies show that, in the last decade, there has been a significant reduction in river flows in much of Brazil, especially between 2014 and 2017 and in 2020 [37]. An unprecedented survey by the Mapbiomas Institute revealed that Brazil is drying up: there has been a 15.7% reduction in the area covered by water in the country since the early 1990s, falling from 19.7 million hectares in 1991 to 16.6 million hectares in 2020 [39]. The ATLAS for Urban Water Supply [40] indicates that water security for 42% of the urban population is intermediate, while for 26% of the urban population it is low. The Brazilian Institute of Geography and Statistics (IBGE), which carries out demographic censuses and collects data on municipal and state administration, as of 2017, included questions about risk and disaster management in municipalities, largely due to the increase in the frequency of water crises. As a result of the drought events that hit the municipalities between 2017 and 2020, in 13.2% of them there was a higher concentration of pollutants in the water, requiring the expansion of water collection and treatment [10].

2.2. Integrated Water Resources Management in Brazil and the Role of Municipalities

The Brazilian Federal Constitution of 1988 stated that only the Union and the states of the Federation have administrative dominance over water assets, while the municipality does not have ownership over water and, therefore, does not have direct responsibility for the management of water resources [11,41]. On the other hand, protecting the environment and combating pollution, as well as promoting health and improving basic sanitation conditions, are common competences. In other words, when we deal with water, for example, from the perspective of human supply, the responsibility is shared between the union, states, and municipalities (Appendix A, Table A1).

Among the exclusive municipal tasks, the organization and management of public services of local interest stand out, including basic sanitation, urban planning, and other matters of local interest. Thus, in this work, in addition to the management of water resources, three areas of public policy that directly and indirectly affect urban rivers and apply to all municipalities are considered: (1) the environment, (2) basic sanitation, and (3) urban planning. These public policies are based on (a) specific legislation, (b) a multilevel institutional arrangement, (c) management tools, and (d) an information base, which can be organized into several systems or one unified system (Table 1). Other policies depend on the characteristics of each municipality, requiring that specific legislation is considered, such as industry, mining, dam management, etc. The concept of local interest is considered a key factor in understanding the role of the municipality in the preservation of water resources [11]. The National Water Resources Policy (PNRH) (Law 9433/1997), which established the National Water Resources Management System (SINGREH), has as decentralization, participation, and integration as its principles, to ensure multiple and sustainable uses of water. In Article 31, the law defines the role of municipalities in promoting multilevel integration, specifying that: "the executive powers of the [. . .] municipalities will promote the integration of local policies of basic sanitation; use, occupation and conservation of the soil; and the environment; with federal and state water resources policies".

Table 1. Main policies related to the management of urban rivers in Brazil.

National Policies	Water Resources (WR) (1997) National Agency (2000) New Framework of BS (2020)	Environment (E) (1981) Licensing (Complementary Law 140/2011) Forest Code (2012)	Basic Sanitation (BS) (2007) Solid Waste (2010) New Framework of BS (2020)	Urban Development City Statute (2001) Land Regularization (2017)
Topics of Interest to WR	- Multiple uses of WR; 1. Management instruments specific to WR.	- Combating pollution; 1. Vegetation conservation; 2. Zoning and permanent protected areas.	- Water and sewage services; 1. Urban drainage; 2. Solid waste.	- Precarious settlements; 1. Tenure regularization.

Decentralization occurs at the level of the states and the hydrographic basins. The committee constitutes the maximum body of a hydrographic basin, responsible for promoting the integrated management of water resources in its coverage territory [42,43]. Municipalities' participation in committees, guaranteed by law, is defined in the regulations regarding the number of municipalities that can participate and whether participation occurs directly, by the representation of another municipality or an association/consortium of municipalities. The basin agency has an executive function and depends on the existence of the water resources plan and the implementation of charges for the use of water resources to guarantee the financial means for its operation. In addition to the management, planning, and collection instruments, there are: (a) the license, which corresponds to an authorization that establishes the right to use water resources with certain conditions, such as deadlines, water quality, characteristics of effluents, etc.; (b) the classification of water bodies into a class of preponderant use that corresponds to a level of quality to be achieved or maintained over a period of time in a specific stretch of a river. The classification is a reference for authorization and charging, as well as for environmental management instruments (licensing and monitoring), and is, therefore, a link between the National Water Resources System and the National Environmental System [44].

More information can be found on the institutional arrangement of the different local policies that affect water resources in Appendix A (Environmental Policy, Basic Sanitation and Urban Development Policies in Brazil and the State of Bahia), and the laws consulted are listed in the Supplementary Materials.

2.3. Reforms That Tend to Centralize or Fragment Decision-Making Processes in Water Resources Management in Brazil

Brazil is going through profound changes affecting its current water and sanitation legal frameworks. The Water Governance Observatory in Brazil (a multisectoral network that brings together 61 institutions of public power, private sector, and civil society organizations, and 22 researchers) and the São Paulo Forum of Hydrographic Basin Committees have been criticizing the process of elaborating the new "Water Framework" proposed by the Ministry of Regional Development. The organizations warn that the proposal drastically impacts the National Water Resources Policy and mischaracterizes its principles. It considers that the elaboration process was not transparent and did not have the participation of the bodies that make up the National Water Resources Management System (SINGREH), nor did it have a formal presentation of its highest body, the National Water Resources Council. The Climate Observatory, in turn, described, in a January 2021 report, the "misgovernance" in the environmental area and the breakdown of collegiate bodies, which are equipped by the Federal Government (Report "*Passando a Boiada*"). In 2020, the New Legal Framework for Basic Sanitation was approved, which adopts the regionalized provision of services and structures the sector as a business to encourage the entry of the private sector.

The National Confederation of Municipalities alleges that the changes make it difficult for public management to participate in the area, particularly the municipalities [45].

The National Water Agency (ANA), created in 2000, was an autarchy linked to the Ministry of the Environment, responsible for implementing the National Water Resources Policy. In 2019, it was transformed into the National Agency of Water and Basic Sanitation, linked to the Ministry of Regional Development, and became a regulatory and supervisory agency of the Federal Government in the basic sanitation sector.

In terms of basic sanitation, the New Legal Framework (Law 14026 of 2020) states that the organization and provision of services, particularly water and sewage, should preferably take place in a regionalized manner. With the new law, in addition to metropolitan regions, microregions, and urban agglomerations, it is possible to create a "regional basic sanitation unit" or "reference block"—the former instituted by the States and the latter by the Union, through ordinary laws. Critics warn that, in practice, the new law means that municipalities, when forced to adhere to regionalized structures created by the State or the Union, lose ownership of services. In practice, the transfer of federal resources will be linked to the principle of regionalization, although the new law states that adherence to regionalized provision structures is optional when sanitation qualifies as a public service of local interest (art. 8-A)—that is, when the underlying operational infrastructure and facilities serve only one municipality [45,46]. The new model harms the national water resources system [47], centralizes the planning of the basic sanitation sector, and imposes exclusively economic solutions to complex problems of a socio-environmental nature, while delegitimizing the municipality as the regulator of the urban land use and the main body responsible for public services of local interest. Defenders of the new law argue that the initiative will make the sector more attractive to private actors, enabling the provision of services in smaller municipalities, where individualized action would prove deficient or unprofitable [48].

Regarding environmental legislation, a new law, already approved by the Chamber of Deputies, provides for the flexibility of the Brazilian Forest Code and transfers the power to define the dimensions of permanent protection areas around urban rivers to municipalities. The same trend is observed for urban planning with regard to land tenure regularization. The Program "Casa Verde e Amarela," launched by the Federal Government in August 2020, supported by Law No. 13.465/2019, which deals with land title regularization, reformulates the Social Housing Program "Minha Casa Minha Vida" of the previous government. The main changes are: (a) the end of a public budget for financing house-building for families with the lowest family income (former Band 1)—that is, the population with the highest housing deficit; (b) instead of building houses for this income bracket, the new program only proposes land regularization and housing improvements. The old program was frequently used by city halls to enable the resettlement of communities from areas with no conditions of habitability, such as hillside areas, old dumps, Permanent Protection Areas, river banks, etc., [49].

2.4. The Municipality of Itabuna, Southeastern of Bahia

The state of Bahia, located in the northeast of Brazil, is the fifth-largest state in the country. Its territorial extension is comparable to that of France, with a population of 15 million inhabitants distributed in 417 municipalities. There are big differences between municipalities in Bahia; however, on average, the coverage with water supply is up to 98% of the urban population and water losses represent close to 40%. The rate of urban population with sewage service is only 55%, and treated sewage in relation to consumed water is only 48% [38].

Bahia has had its own State Water Resources Policy since 1995. Between 1998 and 2005, the Water and Hydrographic Basins Planning and Management Regions (RPGA) were created, and the respective committees. At present, in Bahia, less than half of the state committees have a contracted water resources plan, the primary management instrument, and none have a plan in progress or their own basin agency, which is a prerequisite to handling their own financial resources aimed at watershed management; most have

functioned in a precarious way, with the main difficulties being related to the centralization of decisions by the governmental Institute for the Environment and Water Resources (INEMA) and the lack of financial resources, resulting in low levels of autonomy [50,51].

A large part of the territory of Bahia is covered by the hydrographic region of the East Atlantic of Brazil. This region is part of the biome of the Atlantic Forest and has the second-lowest average annual precipitation (940 mm) among the 12 regions of Brazil, resulting in an average flow rate of 1556 m^3/s and water availability of only 271 m^3/s [8]. The city of Itabuna has its seat located in this region and is part of the Eastern Hydrographic Basin of Bahia (Figure 1.). Located 35 km from the coast, where it has the seat city of its municipality of origin, Ilhéus, the municipality of Itabuna, has a hot and humid climate, considered tropical rainy, without a dry season, according to the Koppen classification. The average annual temperature is 23.6 °C and the relative humidity is above 80% on average. The rainy season occurs from November to April, with an average annual rainfall of approximately 1300 mm [52,53]. The territorial area of the municipality is 401.028 km^2, with a demographic density higher than 470 inhabitants/km^2, well above the average of approximately 25 inhabitants/km in Bahia [31].

Itabuna is considered a medium-sized city and is the main regional capital of the Southern Coastal Territory of the state of Bahia, exerting influence over more than 50 small municipalities [54]. This situation is reflected in the main social and demographic indicators, with the Municipal Human Development Index (MHDI) of Itabuna of 0.712, compared to Salvador (capital of Bahia State) of 0.759 and that of the State of Bahia of 0.660 [31]. The cities of Itabuna and Ilhéus, both located on the banks of the Cachoeira River and connected by the BR-415 motorway, form an urban agglomeration with the potential to become a metropolitan region [54].

The history of Itabuna is related to the cocoa crop cycle, marked by the accelerated and disorderly growth of the city. In the period from 1940 to 2020, the population jumped from 50,000 to 214,000 inhabitants, reaching an urbanization rate of 97% [31,32,55]. The urban sprawl has mainly expanded through the creation of precarious settlements around the city center or in Permanent Protected Areas (PPA), which cover the banks of rivers. In 1999, almost 40% of the population of Itabuna lived in precarious settlements. In the 2010s, the housing deficit decreased, with the implementation of social housing complexes of the Federal Program "Minha Casa Minha Vida," in peripheral areas of the city [52,55]. Itabuna has a Master Plan (Law 2111/2008) that institutes social interest housing zoning and policy.

Water crisis is also part of the city's history: 11 sub-basins make up the urban area and all flow into the Cachoeira River, in the stretch that crosses the city center. Therefore, the municipality is marked by floods, and the low-income population, who live in flooded areas, is the most affected by disasters [56]. Studies have identified 32 high and very high risk sectors related to landslides and floods [57]. On the other hand, supplying the population with drinking water is affected by crises of scarcity and by intermittence, resulting from failures in the distribution network [38,58]. A water capture initiative from the Almada River, in the municipality of Ilhéus, implemented in the 1970s, had to be expanded several times to meet the growing demand. In 2006, similar action was implemented from the Cachoeira River, upstream of the city of Itabuna [58].

The consumption of water for supply represents 80% consumptive of the use in the municipality of Itabuna and almost 98% of the urban population receives treated water; however, losses (apparent and real) in the supply system represent around 48% of the water produced [58].

The launch, in 2018, of the Colônia River Dam, built on the main tributary of the Cachoeira River, with a storage capacity of 62 million m^3, should contribute to water security, guaranteeing the supply of water and reducing flood risks through the regulation of river flow [58].

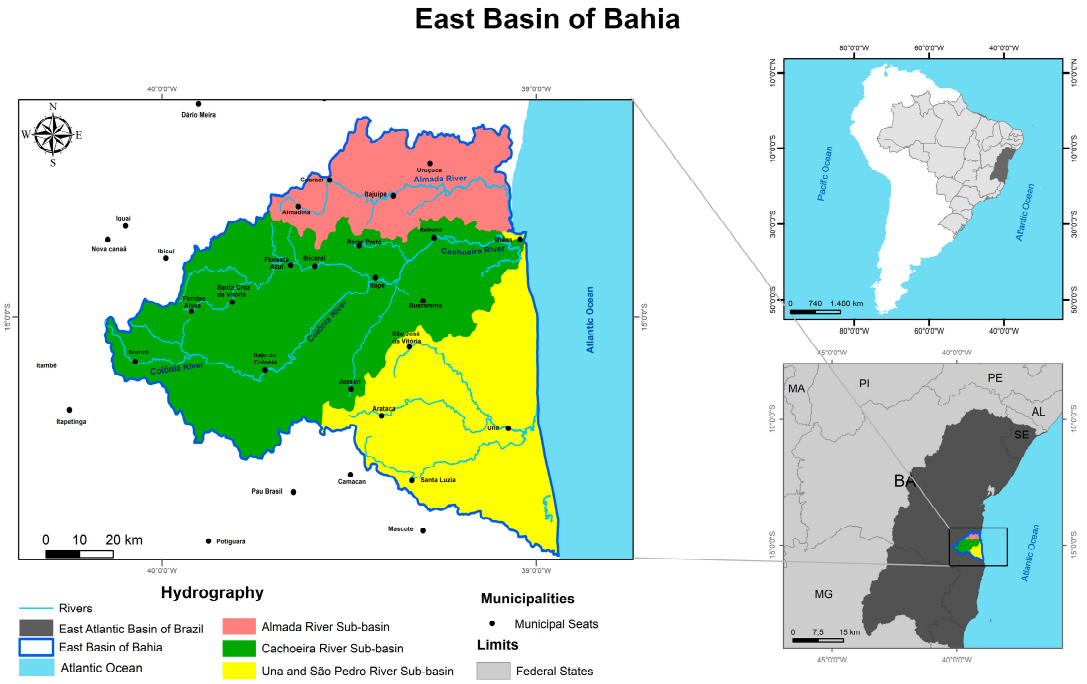

Figure 1. Location of the hydrographic basins of the Cachoeira River and Almada River, which guarantee the water supply to the city of Itabuna. The sum of the colored areas is the area covered by RPGA VII (East Basin of Bahia).

In the state of Bahia, 88% of municipalities are currently served by the Water and Sanitation Company of the state of Bahia (EMBASA) and regulated by the Basic Sanitation Regulatory Agency of the state of Bahia (AGERSA). However, of the municipalities served by EMBASA, only 30% receive water and sewage services; 70% of these municipalities are served only with water supply services, while the local governments are responsible for sewage collection and treatment [59]. Since the 1970s, water and sewage services in the city of Itabuna have been under the responsibility of the Water and Sanitation Company of the state of Bahia (EMBASA), until they were municipalized in 1989. The Municipal Water and Sanitation Company S/A (EMASA) of Itabuna is a publicly held, mixed-capital company, linked to the local Urban Development Secretariat (SEDUR) and incorporated by municipal law [58]. At the end of the historic drought that generated the collapse of the city's supply system in 2016, the Municipal Basic Sanitation Plan of Itabuna (2016) was approved. In 2017, the State Secretariat for the Environment (SEMA) delivered the Executive Plan for the Revitalization of the Cachoeira River Basin, which contains a governance plan and a portfolio of recovery projects for the basin [53,60]. This plan was criticized for having been prioritized over the East Basin Water Resources Plan and for not addressing basic sanitation.

The latest Demographic Census reported that 81.2% of the municipality population has "adequate sanitation" [31]. The National Information System on Basic Sanitation (SNIS), which has recorded information on water and sewage from Itabuna since 1995, shows that almost 81% of the population is served by a sewage network [38]. These data do not portray the reality of the city, as the sewage treatment rate is close to zero [58,61]. More information about Itabuna can be found in Appendix B.

In 2019, the State Government, through Complementary Law 48/2019, organized the state territory into 19 Basic Sanitation Microregions, which combine all municipalities of the state of Bahia. Each microregion has a collegiate body that brings together the mayors of the municipalities that comprise it, being chaired by the State Governor and, in their absence, by the Secretary of Water Infrastructure and Sanitation (SIHS).

The Microregion of Basic Sanitation that includes Itabuna and Ilhéus includes another 39 municipalities. The microregion is part of the East Atlantic Basin of Brazil and is

covered by the state basin of Bahia. The Microregion Basic Sanitation Plan shows that all municipalities have fewer than 40,000 inhabitants [62], except for one with nearly 90,000 inhabitants and Ilhéus with nearly 180,000 inhabitants. The coverage rate for water supply is 73.9%, and for sewage services it is 67.5% of the urban population of the microregion, although less than 30% of the sewage volume is treated. Almost all municipalities (93%) have cities near rivers and there are 101 water abstraction points in the microregion, with 85 points (84.16%) being surface water, with an average flow of 4348.87 L/s. The average loss in water distribution is estimated at 35% and the real loss is up to 25.5% for the 41 municipalities. Among the 71 mapped water supply systems, 17 use alternative sources; 34 of the municipalities are served by the Water and Sanitation Company of the state of Bahia (EMBASA) for water supply, but in 11 cities, the EMBASA also offers sewage services; 76% of municipalities do not have any sewage system, while 39% of municipalities do not have any public policy for basic sanitation and 93% have an insufficient policy in this area. Most cities have precarious settlements on the banks of rivers that require land tenure regularization so that they can be served by basic sanitation services; 62% of municipalities have a City Master Plan or a similar law. Regarding environmental management, 54% of the municipalities meet at least one of the requirements of a local policy (legal framework, city council, or fund for environment).

3. Theoretical–Methodological Framework

Climate change makes the adoption of new water management models more urgent [9,13,21]. The "good management" of water resources, according to the Global Water Partnership (GWP), is Integrated Water Resources Management (IWRM), defined as "a process that promotes water management, articulated with the development of other resources, in order to achieve social and economic well-being in an equitable way, without compromising the sustainability of vital ecosystems" [1]. Water governance has emerged as a crucial factor for adequate and sustained progress towards achieving Sustainable Development Goal (SDG) 6, "Water and Sanitation," and the management arrangement is a core function of water governance that refers to the combination of organizational, managerial, and institutional arrangements at national and subnational levels [20]. The concept of water security, more recent and developed in the context of climate change, adds, besides the human, ecosystem, and economic dimensions, a fourth dimension: resilience [9]. Management and governance are distinct processes: the first refers to the activities of organizing, monitoring, and controlling a system, while the second deals with decision-making processes aimed at transforming the system towards a greater resilience [21]. It is necessary to build in an adaptation capacity to achieve water security; this requires political and institutional flexibility, communication, and multistakeholder participation at all scales (municipal, river basin, state, and federal) [24,25]. Increasing the resilience of a given system depends on both the institutional organization and water availability and the management of supply and demand; these factors need to be considered in an integrated, systematic way [9,63].

The integration of different policies that affect water resources must occur at different levels and scales [64], vertically and horizontally: involving various administrative levels, e.g., municipalities, states, and the federation (in this case, Brazil), as well as different sectors at a given level, such as government sectors, public and private organizations, civil society, etc., related to different areas of management [65]. Multilevel integration is a key concept in water management [19,33], based on the Integrated Water Resources Management (IWRM) model, a world reference from the 1990s onwards [1,66]. The development of IWRM depends on a favorable legal framework, an adequate institutional arrangement, and the implementation of management instruments aimed at water resources. In addition, a solid base of social and environmental data is required to support decision making. This means that, in a given context of public administration, the integration of the management of water resources, the environment, basic sanitation, and urban planning needs to take place within the scope of legislation and institutions and in the application of the respective management instruments.

Integrated water resources management, a concept as old [67] as it is difficult to implement [68–70], remains current for contexts in which water management is fragmented, sectored, and centralized, without the effective participation of society, and with a lack of transparency regarding decision-making processes. Water governance represents a necessary approach for its development. Adaptation will have the current hierarchical and fragmented social–ecological system as the baseline from which new approaches will be developed [71].

The river basin is considered the ideal scale to promote the integrated and multilevel management of water resources. However, considering that a watershed is a socioecological construction [26,72,73], it does not necessarily represent the most effective scale for water management [64,74,75]. There are often asymmetries between the scales of the watershed, the "problem shed" and the "policy shed," among other inconsistencies [76–78]. Pahl-Wostl (2017) emphasizes the importance of the local scale of a polycentric organization and the integration of processes of self-organization (bottom-up) and coordination (top-down), for the greater resilience of socioecological systems. However, there are few studies about water governance at the local scale [27].

The concept of governance is used in several areas of study, leading to various interpretations and uses [79]. Three approaches to governance are clearly distinguished: (a) synonymous with expanded government with the participation of stakeholders; (b) a normative–prescriptive framework, applied to corporations or public administration projects and aiming at financial efficiency and transparency; (c) an analytical tool.

The OECD Water Governance Initiative is at once analytical, normative, and prescriptive. Based on public governance studies, it defines "gaps" or "failures" in the relationships between administrative agencies that impact specific areas of management, as shown in Table 2.

Table 2. Water governance failures according to the OECD.

Administrative	Political	Objectives	Financing	Information	Capacity	Accountability
Mismatch between administrative and functional (hydrological) levels and scales.	Sectoral, hierarchical approaches. Uncertainties, gaps, and conflicts of responsibilities.	Inconsistencies and contradictions in objectives. Lack of political commitment.	Lack and discontinuity of financial resources.	Failures in the number, quality of information, leading to wrong decisions.	Lack of trained professionals, tools, and infrastructure.	Fragile institutions, lack of integrity of agents. Lack of transparency. Absence of social participation and control.

Source: Adapted from [19,80].

The development of water governance presupposes the identification and overcoming of governance failures. This process can be guided by the implementation of the Water Governance Principles, involving stakeholders, with the key steps in the development of water governance being identification of the most appropriate scale and the clear definition of attributions and responsibilities in view of the problems to be solved [30].

Considering that water is a common good, essential to all forms of life, and an input for production processes, it is up to the State to guarantee multiple uses simultaneously, and promote the conservation of water resources. Therefore, in water governance, public power is the centerpiece for its development. Building "governance" is a practical undertaking that takes place through participatory assessment and planning tools [19]. "Practitioners" are the people who participate in the implementation of water resources' management, through governance, and can be managers and professionals from different areas [20].

4. Research Techniques and Material

This investigation aimed to analyze water governance in the municipality of Itabuna and discuss possible relationships between governance failures and problems that mark the management of water resources in the city and its surroundings. This exploratory study sought to understand the situation of water resources' management in a specific

municipality, to establish relationships between governance failures and management problems, and to translate results into socioenvironmental indicators.

In contrast to the increased attention to metropolitan cities in policy and research, small cities have rarely been the object of study in the developing world. To narrow the knowledge gap about socioecological processes in this type of human settlement, more explorative research is necessary [81]. Therefore, the investigation went through several stages and, for each stage, different research techniques were used (Table 3). We sought to balance subjective and objective data, as suggested by the OECD [7].

Since this study was based on the concept of IWRM, the management of water resources in the municipality was analyzed, considering four areas of administration: water resources, environment, basic sanitation, and urban development. This is justified by the fact that they represent areas that directly affect urban rivers, impacting the quantity and quality of their water, and are relevant to all municipalities. As for basic sanitation, the study considered the water supply and the sewage systems. The dimensions urban drainage and solid waste management, which are also considered components of the basic sanitation system in Brazilian law, were not considered in the water governance failure analyses. Only the seat city of Itabuna was considered and not the districts, since these cover less than 1% of the population of Itabuna. The focus on the city, adopted in the research, was intended to allow for a holistic approach, considering the various public policies that affect urban rivers. The analysis of these policies in a specific, medium-sized city would make it possible to discuss, in depth, their multilevel integration and the failures in water governance that make this process difficult.

During the period in which this research was carried out, between 2017 and 2020, it was observed that there was no project aimed at the development of water governance within the municipality of Itabuna, despite the Executive Plan's recommendation for the Revitalization of the Cachoeira River Basin [53]. However, it was assumed that any society has, implicitly or explicitly, a governance that organizes decision-making processes related to the use of water resources [79]. Therefore, to know the reality of water resources management and its results in the studied context, it was necessary to go beyond the formal aspects contained in the legal framework and verify how decision-making processes are carried out in practice. Different ethnographic techniques were used, such as immersion, analysis of secondary data, and fieldwork [80]

The starting point was the knowledge of water problems that characterize the municipality, described in Section 2.4. The knowledge of the reality of Itabuna took place during an immersion phase, preparatory to the research, and resulted in the formulation of the hypothesis that governance failures are the origin of management problems in the municipality of Itabuna. A secondary data analysis complemented this iterative investigation process [80].

(a) The understanding built on the problems of Itabuna resulted from a shared vision, over four years, with the group "Together for Cachoeira River" (Juntos pelo Rio Cachoeira), a collective led by the two public universities in the region, the Federal University of Southern Bahia and the State University of Santa Cruz, which has been working towards the recovery of this river in the city of Itabuna and region. More than 20 organizations participate in this collective, including public and private educational institutions, representatives of the City Hall, Municipal Water and Sanitation Company S/A (EMASA), the State Public Ministry, State Bank (Caixa Econômica Federal), associations, companies, and the community in general.

(b) The "subjective and shared perception" of reality was confronted with official data and information, through document analysis and research on official websites, mainly from the Itabuna City Hall, Transparency Portal, and the Federal Government of Brazil and their ministries and autarchies. Doubts were resolved through consultations with public officials.

Table 3. Phases of applied research in Itabuna.

Phases	Research Techniques	Outputs
1. Immersion to understand the socio-environmental reality and public policies that affect water resources	Ethnographic approach. Direct and participant observation, document analysis, interviews and consultations with managers, website consultations, etc.	Description of the current model of water resources management in the municipality of Itabuna and main water problems.
2. Assessment of water governance failures	Indicators adapted from OECD (2016). Analysis of the legal framework (institutional environment); institutional arrangement and management instruments.	Description of water governance failures in the municipality of Itabuna.
3. Search for a possible relationship of failures with the water resources management model	Discussion of research results.	Description of the possible relationship between failures and the management model in the municipality of Itabuna.

In the next phase, governance failures in the municipality of Itabuna were analyzed, starting with the administrative failure, which was investigated in detail based on the indicators listed in Table 4; the results are presented herein. Since this failure refers to management scales, the present study shed light on problems related to the municipal scale, specifically, allowing us to discuss water governance at the municipal level. Indicators used were adapted from references [7,82,83].

It was necessary to analyze the federal, state, and municipal legal framework for water resources, the environment, basic sanitation, and urban planning, in order to assess which management scales are provided for by law for the management of water resources and whether there is the necessary "favorable environment" for municipal-scale management. The impact of the legal framework on the institutional arrangement and on the application of management instruments in the municipality of Itabuna was analyzed. The use of ethnographic techniques in the analysis of failures is related to the scarcity of existing information on the effective functioning of the institutional arrangement and the application of management instruments in municipalities. It was considered that the functioning of a public agency, collegiate, or sanitation company could be evaluated by observing the application of management instruments under its responsibility or knowing the results of their decision-making processes [80,84].

As for the source of the data, federal and state legislation and part of the municipal legislation were found on public websites, as well as information on the institutional arrangement (managing bodies, basic sanitation companies). The rest of the information on municipal legislation was obtained through consultations with managers. The Federal Government's Transparency Portal provided information on the structure of public bodies and their functioning. In obtaining information about decision-making processes and the application of management instruments, the following were observed: differences between data from different sources, divergence of data from observed reality, and a lack of accurate information. Therefore, direct and participant observation was used, in addition to consultations with managers and public workers. Moreover, the websites of the Brazilian Institute of Geography and Statistics and the National System of Information on Basic Sanitation (SNIS) were consulted; the data were compared with the Statistical Yearbook of Itabuna, journal articles, and the literature on the history of the city and the region.

The scales of action of existing public bodies were compared with the scale of water problems, to verify whether there was a mismatch between these scales.

This survey gathered enough information to allow for the analysis of other failures; however, in the present study, they will only be addressed as possible consequences of administrative failure. Finally, the administrative failure observed in Itabuna is discussed, considering municipalities in the Microregion of Basic Sanitation, in order to verify whether the results allow for some generalization and define the research limits.

Table 4. Analysis of governance failures in the municipality of Itabuna.

Types of Water Governance Failures	Indicators	Research Instruments	Data Sources (Supplementary Materials)
Administrative Failure	- Territorial scales of water issues; 1. Territorial scales of decision-making instances that influence water resources; 2. Integration/fragmentation among municipalities; 3. Relations between instances of different administrative levels; 4. Content of decisions that affect water issues.	- Bibliographic survey; 1. Document analysis; 2. Participant observation.	- State and municipal legislation; 1. Official websites of state and municipal governments; 2. Minutes of the East River Basin Committee (CBHL); 3. Meetings of CBHL and Itabuna Municipal Council for the Environment.

5. Results

In this section, the results from the administrative water governance failure analysis are presented. The scale of the problems in Itabuna is revealed, as well as the management scales that affect water resources.

5.1. Water Resources Management Model in the Municipality of Itabuna

In the city of Itabuna, the conventional model of water resources' management, which is considered unsustainable, predominates [11,12,85]. This is characterized by the emphasis on water supply management, rather than demand management or a systemic approach. One of the characteristics of this model is the search for water from increasingly distant sources to meet a growing demand, while, in the supply system, almost half of the water that is abstracted, treated, and distributed is lost and wasted. The water consumed, in turn, is transformed into sewage, which is returned to the environment without proper treatment. The water quality of the water sources closest to the city has been getting worse, making its treatment with conventional methods of supply unfeasible.

In the case of Itabuna, water is abstracted from the Almada River, in the territory of the neighboring municipality, Ilhéus. Sewage is disposed into the stretch of the Cachoeira River that runs through the city of Itabuna (approximately 12 km), following the territory of Ilhéus, for a stretch of approximately 40 km, until its seat city, where the river flows into the Atlantic Ocean (Figure 2.).

5.2. Administrative Water Governance Failure in the Municipality of Itabuna, State of Bahia

The first finding of the governance analysis is that Brazil's legal framework is unfavorable for municipal-scale management and the disenabling environment is reflected in the State of Bahia. The analysis of the administrative water governance failure in Itabuna evidences the consequences of the unfavorable legal and institutional conditions (Table 5).

In Brazil, there is no legal provision for the existence of a municipal water resources policy. Therefore, the municipality of Itabuna does not have specific legislation, nor does it have an institutional arrangement to act in the management of water resources. In other words, there is no water resources management at the municipal scale. As for the scales of water resources' management provided for by law (the country, the state, and the hydrographic basin), the following was observed:

(a) Like all Brazilian municipalities, Itabuna does not directly participate in the National Water Resources Management System (SINGREH) [8];

(b) The municipality of Itabuna formally participates in the East Basin Committee, representing the other municipalities, and is also represented in the committee by a representative of the Association of Municipalities of the Cacao Region (AMURC). However, in practice, the inactivity of this management instance was verified, since the committee did not exercise its consultative and deliberative functions during the research period;

(c) At the state level, the public Institute for the Environment and Water Resources (INEMA) operates in the 417 municipalities of Bahia, with one of its regional offices located in the city of Itabuna;

(d) The Basic Sanitation Microregion that covers 41 municipalities, inclusive of Itabuna and Ilhéus, was created by the state government without negotiation with the municipalities, having operational and infrastructure aspects related to basic sanitation as its sole criterion.

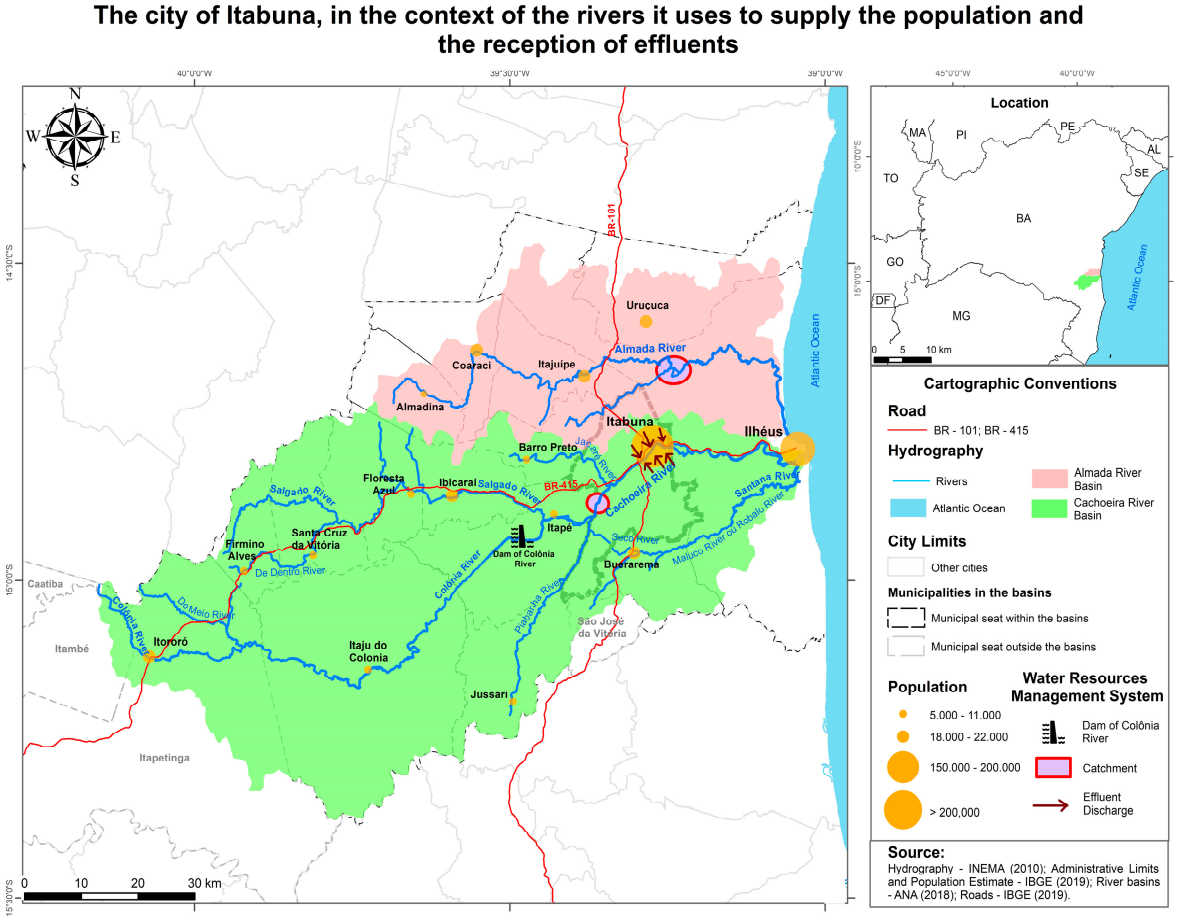

Figure 2. Itabuna and abstraction points in the Cachoeira and Almada rivers and the discharge of effluents into the Cachoeira River.

In addition to these scales, Identity Territories and intermunicipal consortia were identified, which cover Itabuna and Ilhéus, the East Basin, or the sub-basins, although these territorial organizations do not coincide with the scales of the basins, nor do they have projects in the area of water resources.

As for the scales of operation of the basic sanitation companies, which provide services in Itabuna (EMASA—municipal) and Ilhéus (EMBASA—state), it was found that their operation occurs in an isolated manner, without communication between the companies.

The comparison of the management scales and territorial coverage of water problems reveals that there are no institutions acting on the scale of problems related to water resources management. Administrative decisions in Itabuna do not cover the scale of the problems in their entirety, nor the decisions of the municipality of Ilhéus, and there is no intermunicipal body that acts in this territory. Problems are contained only at the scale of the state administration. As for the scale of the river basin, the creation of a formal committee does not guarantee its functionality. The reorganization of management at the basin level and scale (rescaling) depends on the processes of participation and negotiation, also involving municipalities [78,86]. The existence of the East Basin Committee, which

has the formal prerogative of promoting the integrated management of water resources, ends up discouraging the municipality from seeking solutions in the area. In Itabuna, there seems to be a classic mismatch between the scales of administration and the scale of the problems (problem shed) [72,73,87].

As for the management instruments, the State of Bahia, through its public agencies and the hiring of specialized consultancies, prepared the: (a) State Plan of Water Resources (2005) [88], which is under review; (b) Plan for the Revitalization of the Cachoeira River Basin (2017) [53], which was not implemented; (c) recent Regional Plan of the Basic Sanitation of Litoral Sul and Baixo Sul (2021) [62], which has not yet been implemented. The Committee of the East Basin has no water resources plan, the most important management instrument.

In Bahia, an audit by the State Court of Auditors (TCE), carried out in 2021, evaluated the State Water Resources Policy (Law Bahia 11.612/2009) from 2016 to 2020, pointing out its low effectiveness in the application of all management instruments. The audit showed that the State Water Resources Plan lacks essential information, well-defined goals, and deadlines for their execution. The report emphasizes that Bahia has not yet created its committees in all the State's Water Management and Planning Regions, and less than one-third of these have a water resources plan; in addition, the formal existence of these bodies does not ensure effective participation by the central bodies. As for water-use authorizations, the report shows that there is partial implementation of the processes, and they are not accompanied by monitoring and inspection, with a reduced number of inspectors hindering the State's environmental policy. Other issues include the difficulty of accessing the environmental information system, which results in low transparency of the actions of state agencies (SEMA-INEMA); a lack of financial resources in the area, since the collection is not implemented; most of the resources, collected via royalties, being applied in other areas; and not all promised resources being transferred by the federal government.

Table 5. Summary of the results of the analysis of the administrative water governance failure in Itabuna, state of Bahia.

Indicators	Results of the Administrative Water Governance Failure
Scale or territorial coverage of water issues?	1. Water supply: Stretches of the Almada and Cachoeira rivers, in the municipalities of Ilhéus, respectively, Itabuna; and the hydrographic sub-basins of the Almada and Cachoeira rivers. 2. Water pollution: Stretches of the Cachoeira River in the urban region of Itabuna; downstream of the city; upstream of the city and in the city of Ilhéus.
Municipalities involved?	1. Water supply: Itabuna and Ilhéus. 2. Water pollution: Itabuna and Ilhéus.
Problems contained in the municipality itself?	1. Water supply: No. The problem involves the municipalities of Itabuna and Ilhéus and the hydrographic sub-basins of the Almada and Cachoeira rivers. 2. Water pollution: Partial, the greatest pollution occurs in the territory of the municipality of Itabuna and, to a lesser extent, in the territory of Ilhéus.
Existing administrative instances that cover the municipalities?	(a) State of Bahia (covering 417 municipalities) and its governing agencies. (b) Basic Sanitation Microregion (41 municipalities): Governance under construction. (c) East Basin with inactive committee. There is no instance on the scale of the sub-basins of the Cachoeira and Almada rivers.
Existence of municipal decision-making agencies?	There are no such instances for water resources; there are others at the municipal level and decisions shared with the state in the area of environmental management.

Table 5. *Cont.*

Indicators	Results of the Administrative Water Governance Failure
Comparison of coverage of water problems vs. decision-making processes?	Water problems are dealt with by decisions of state agencies and should be affected by decisions of the Basic Sanitation Microregion (Governance under construction—Collegiate).
Communication between municipalities that share the problems?	There is no communication or partnership between the municipalities in this area.
Municipality's participation in existing decision-making instances/processes?	Do not participate. They will participate in the Microregion Collegiate (under construction).
Integration mechanisms between existing decision-making instances/processes?	Shared Environmental Management Program (GAC), does not cover the management of water resources, it only admits the inspection of pollution and concessions by municipal authorities.
Diversity/communication between sanitation companies that cover water issues?	EMASA (Itabuna) vs. EMBASA (Ilhéus). There is no communication or partnership between these companies.
Are water issues seen, defined, and dealt with by any public agency or specific plan?	None of the existing plans specifically address the water issues discussed.

5.3. Political Water Governance Failure in the Municipality of Itabuna: No One Is Responsible for the Rivers in and around the City

As observed in other countries [89], there are significant contradictions in the analyzed governance structures. There is an intrinsic relationship between failures, both administrative and political. The mismatch between different scales and levels of administration gives rise to conflicts or a lack of definitions of the competences and responsibilities of public agencies, service providers, and actors. This mismatch is due, in part, to the formal differentiation of control over water between States/Union and municipalities [11,27]. In addition, historically, environmental management and basic sanitation were considered the responsibility of states and not municipalities [90,91].

In the municipality of Itabuna, gaps, uncertainties, and conflicts were observed between (a) federal and municipal agencies and municipal basic sanitation companies in the process of implementing the social habitation program; (b) state and municipal agencies in the application of instruments for the management of water resources and the environment; (c) municipal agencies (secretariats); (d) municipal agencies and companies contracted to provide basic sanitation services.

The political failure, involving federal and municipal instances and companies (construction company and municipal basic sanitation company), resulted in the implementation of sewage treatment stations in remote areas, affecting the City Master Plan and without planning by the Municipal Water and Sanitation Company S/A (EMASA). The operation of these stations by EMASA is precarious. As for the state agencies, the following were observed: a contrast between the intended (formal) communication of the environmental and water resources policies of the state system and the large number of agencies that act (in practice) in an isolated and disjointed manner in the implementation of state policies; nonapplication or partial or inadequate application of water resources' management instruments; the centralization of decisions, such as, for example, infrastructure works (Colônia Dam), decided by the State Government and Mayor(s); the coordination of the East Basin Committee (which does not work) by the Institute for the Environment and Water Resources (INEMA); the State Secretariat for the Environment's (SEMA) decision to draw up the Cachoeira sub-basin plan to the detriment of the East Basin Water Resources Plan; the council of the Basic Sanitation Microregion being chaired by the Governor or a secretary of the State.

At the municipal level, the nonexistence of a municipal water resources policy, which results from administrative failure, results in the nonexistence of legislation, administrative

agencies, and specific management instruments in the area. Water resources are only indirectly covered by municipal legislation. It is not possible to identify which agency is responsible for promoting the integrated management of water resources in Itabuna. As for the local institutional arrangement, environmental management is precarious in Itabuna, since it is linked to another secretariat. In the analyzed period, only the Environmental Licensing and Inspection Department worked, and it had a single specialized professional. During the research period, the municipal councils did not act in areas that affect water resources. The formally constituted Municipal Public Services Regulatory Agency is not functioning effectively. The Municipal Basic Sanitation Policy, approved in 2020, is not properly integrated with the Municipal Basic Sanitation Plan (2016), or with the City Master Plan (2011), and has not yet been implemented. The recent Plan of the Basic Sanitation Microregion does not present new information about Itabuna, since it is based on the Municipal Basic Sanitation Plan (2016).

The municipality does not participate in any of the state agencies. There is no commission involving the municipality, state, and federal government that is capable of communicating about environmental management activities. The municipal secretariats and respective agencies and outsourced companies have sectorial and disjointed action, even though they are fully under the responsibility and coordination of the city hall.

5.4. Administrative Failure and Political Failure Give Rise to Other Water Governance Failures

The mismatch between management scales and uncertainties regarding the attributions and responsibilities of public agencies, companies, and actors triggers failures in other areas of administration (Figure 3).

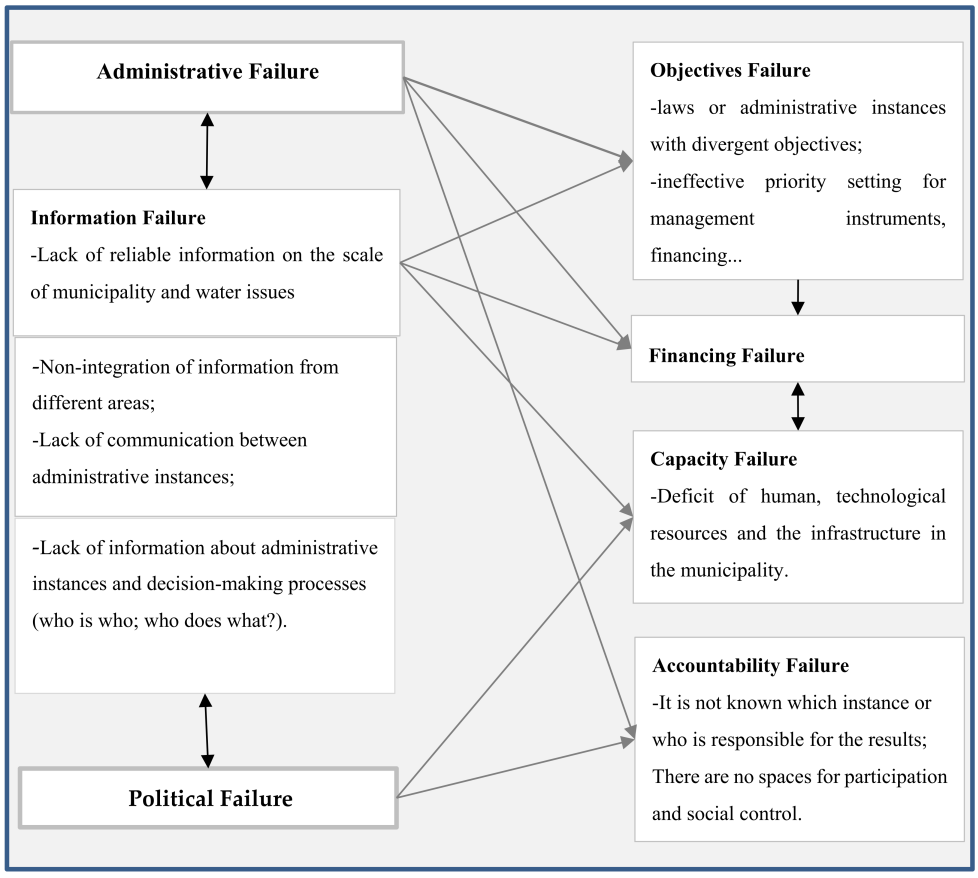

Figure 3. Administrative and political failures and their relationship to other failures.

5.4.1. Information Failure

The main consequences of administrative and political failures in the information area are:

(a) A lack of reliable data at the municipal scale: data provided by the basic sanitation company represent the most relevant information base. However, these data have a known weakness, as they are provided by sanitation companies [92]. In Itabuna, there were many contradictions, demonstrating a high degree of uncertainty, for example, regarding the coverage of the sewage network, sewage treatment rates (volume treated/volume collected), average water consumption per capita, and water loss rates in the supply system; there is no information about the characteristics of the effluents discharged by sewage treatment stations. The hydrological stations that capture data on the flow and quality of water from the rivers in the region (Cachoeira, Almada, and others) are monitored by the state (INEMA) and federal (ANA) agencies and are not located in strategic places for the municipalities.
(b) Poor communication between administrative instances, both from an intersectoral perspective at the local level, and from the perspective of vertical integration between administrative levels.
(c) Unavailability of information on the roles, responsibility, and decision-making processes, making it impossible to define roles in the management of water resources' activities.
(d) A lack of information on the application of management instruments (licensing, registration of users, grants, etc.) for municipal managers and civil society.
(e) Insufficient standardization of data.

5.4.2. Objectives Failure

The mismatch of scales and the lack of definition of roles are reflected in the divergence of objectives present in municipal legislation and in managing agencies, resulting in precarious management instruments, such as a lack of planning, the incorrect setting of priorities, and the creation of disjointed, incomplete, or not executed plans. The local managers do not have the management of water resources per se, their conservation, or the improvement of their situation as common objectives, as each municipal policy has its own objectives and, in these, socioeconomic aspects are predominant. Water problems that affect the city of Itabuna are not prioritized by the state managers of Bahia.

5.4.3. Financing Failure

The divergence of objectives and the lack of information make decision making and project management unfeasible, resulting in the absence or discontinuation of funding.

5.4.4. Capacity Failure

A lack of management agencies working at the scale of the problems generates deficiencies in technical–scientific knowledge and infrastructure, due to the lack of financial resources. In Itabuna, during the analyzed period, there were no water resources specialists in the local sector responsible for environmental management. The environmental licensing and inspection processes were carried out in a precarious way. In the Institute for the Environment and Water Resources (INEMA), there are not enough state professionals to work on pollution inspection.

5.4.5. Accountability Failure

There is a lack of transparency when making decisions, due to political, objective, and information failures. There is a lack of political commitment on the part of managers to provide information on decision-making processes, a fundamental presupposition for the mechanisms of transparency, participation, and social control.

5.5. The Governance Failures in the New Scale of the Basic Sanitation Microregion

The degradation of the rivers that cross the cities of the microregion is similar to that of the Cachoeira and Almada rivers, and official data do not reflect the situation on the ground. Most problems are related to deficits in basic sanitation and their consequences are of local interest; municipalities do not have the necessary management structures to overcome these problems. The new scale brings together municipalities that do not have previous projects in common and are partially covered by four different hydrographic basins, although the microregion does not fit the hydrologic boundaries. Forty-one percent of municipalities formally participate in the Committee of the East Basin of Bahia; however, the microregion does not cover the springs of the most important rivers (the Cachoeira and Almada) that supply the largest cities of the microregion.

The collegiate body that coordinates the microregion is composed of representatives of the state government (the governor is also its president; in his absence, the secretary of water infrastructure fills this role) and a representative from each municipality.

According to the state law of Bahia, LC 48/2019, it is up to the collegiate body to establish guidelines on the planning, organization, and execution of public functions of common interest in the area of basic sanitation, to be observed by the direct and indirect administration of the state and municipalities; deliberate on matters of regional interest and specify public services of common interest; approve microregional, intermunicipal, or local plans; and define the regulatory entity responsible for the activities of regulation and inspection of public services of common interest, in the area of basic sanitation, as well as establish these services' forms of provision, among others.

In the decision-making processes, the state government has 50% of the vote and the municipalities 50%, with the tie-breaking vote being the president's.

6. Discussion

The analysis of the legal framework reveals that the Brazilian municipality has no direct participation in the National Water Resources Management System or in the State Water Resources Management System. According to the Water Law, municipalities are only indirectly part of SINGREH, through: (a) the hydrographic basin committee, (b) the association of municipalities, or (c) the water resources council (federal or state). There is no legal provision for the creation of a municipal water resources policy and, consequently, the municipality has no management bodies, collegiate bodies, or management instruments related to the area, such as a specific plan or system of information with indicators representing the performance of the municipal administration in the management of water resources.

Contrary to other areas of public administration, there are no official indicators (for example, from the Brazilian Institute of Geography and Statistics (IBGE)) of the management of water resources within the municipality of Itabuna. To identify the investments made by the municipality in this area, for example, it is necessary to access items related to basic sanitation, the environment, or urban infrastructure.

In the areas of environmental management, basic sanitation, and urban planning, there is a legal provision for the creation of a municipal policy. The municipality has its own legislation that provides for the existence of management bodies to work in the area, and management instruments, such as the Municipal Basic Sanitation Plan, the City Master Plan, and/or an information system.

When trying to connect the municipality water resources management with other areas of municipal management or with water resources management at other levels (federal and state), it was observed that there is a legal, institutional, and management tool gap in the municipality. Therefore, it was concluded that there is no "favorable environment" to develop integrated water resources' management in the analyzed municipality.

The unfavorable legal environment for IWRM is reflected in a fragmented institutional arrangement and poor implementation of management instruments. Although Brazil has made significant progress in the development of its Water Resources Management System,

as attested by annual and thematic reports [8,9,93,94], its results have not placed the small and middle-sized cities that were analyzed on a path toward water security.

Agencies of the State of Bahia are the only decision-making bodies that cover the water problems in Itabuna and the region. The city's history shows that the most relevant factor for the State Government is guaranteeing the supply of the largest city in the South Bahia region, Itabuna, which is an understandable political–administrative priority. Providing for the management of water supply and reducing the risk of floods through infrastructure works represents a government strategy to ensure water security for a population [9]. The municipality is absent from decision-making processes due to the lack of a management instance to deal with water problems, the unavailability of information and lack of technical capacity to participate in decision-making processes, and a lack of transparency. At the same time, there are no systematic and continuous actions to recover the Cachoeira and Almada river basins. It seems that there is no common goal, or communication, between the State, committees, and municipalities, to facilitate the implementation of regional plans.

Demand management programs that aim to ensure greater water security depend on systemic actions and continuous processes involving water resources, basic sanitation, and the environment, and their results are perceived in the medium- and long-term. However, in the analyzed context, the priorities of municipal managers, sanitation companies, and the regulatory agency are the financial viability of basic sanitation services and their universalization, through the expansion of the existing system, that is, "doing more of the same". Ensuring water security is related to SDG 6 of the UN's 2030 Agenda, while developing water and sanitation in cities, depends on the efficient implementation of environmental and urban policies. The integration of the management instruments of these different policies by the municipality occurs, for example, in the monitoring of state authorization for water collection and effluent discharge in rivers, whereas it is up to the sanitation service providers to request them; in the inspection of water pollution sources; in the inspection of the occupation of permanent protection areas on riverbanks; and in the land tenure regularization to enable access to basic sanitation services in precarious settlements.

However, it was observed that municipal management has the sole objective of guaranteeing the potability of water for human supply. There is no systematic and efficient monitoring of the water quality of rivers, as the Institute for the Environment and Water Resources (INEMA) only works in the urban region, when prompted by the State Prosecution. Water pollution is likely to continue due to the lack of a responsible agency at the municipal scale. The fact that urban rivers are within the municipal territory reinforces the argument that pollution is a matter of local interest and, therefore, its inspection is as well. Nevertheless, in Itabuna, there is a lack of trained professionals and infrastructure, which are requirements for monitoring and inspection. Governance failures result in ineffective management of water resources—no one is responsible, so no one makes decisions in this area. Water pollution that occurs in the municipality or in its local sub-basins may be irrelevant at the state scale; however, it becomes a regional problem of significance for the municipalities of Itabuna and Ilhéus.

One of the most serious consequences of governance failures is that official data do not portray the reality of small and medium-sized municipalities, especially with regard to the situation of urban rivers. The newly created Basic Sanitation Microregion of Baixo Sul and Litoral Sul da Bahia, comprising 41 municipalities, represents one more scale for managing water, sanitation, environmental, and urban issues. However, the boundaries of the new region do not match the boundaries of the hydrological or municipal issues of the region. Itabuna is the largest city in the region and could exercise leadership in coordinating policies. However, the municipality has no interest in participating in the region and has already formally asked for its exclusion. The organization of municipalities in the microregion was carried out by the state government without prior negotiation with municipal authorities. The priority of the Federal Government and the State Government is to attract private investment to improve infrastructure and the provision of services in the

basic sanitation sector. Despite the undeniable importance of its initiatives, the approach is technical, authoritarian, and centralizing. The new scale makes the management of water resources even more complex and fragmented in the municipalities of the microregion and tends to make it difficult for municipalities to participate in decision-making processes. It was observed, in a national basin in Brazil, that the maintenance of a federal system that perpetuates the federal government's central role may continue "to wreck any attempt to promote decentralization and subnational and interstate collaboration." As the federal government defined the state's commitments without any prior negotiation, three of the recipient states did not assume their responsibilities in implementing the planned actions [95]. The same trend occurs between the state government and municipalities.

The mismatch of scales affects management, as a core governance function that is reflected in organizational, managerial, and institutional arrangements at national and subnational levels: "In service provision, it entails the definition of the service delivery model—who owns, who invests, who develops and who operates the infrastructure, who supervises and provides technical support, and the relationship among all these actors, and with the users. In water resources, management arrangements entail the processes for allocation and distribution of water resources" [20]. These are the aspects of management that most interest municipalities, as they define the results at the local scale.

It is argued that water governance is an essential approach to improve water resources management in the analyzed municipality. The current legal and administrative changes tend to weaken the communication of policies at the local scale, making the discussion of water governance for Brazilian municipalities even more urgent.

The regulatory framework for water resources management, from the perspective of multilevel integration, is too complex, which makes it difficult to understand, as well as comply with the rules, for public agencies and their companies, regulatory sectors, and citizens in general. As for the levels of water resources' management, what draws attention in Brazilian policies is the minimal importance given to municipal management.

There is a need for a systemic approach to water resources' management, and the lack of a municipal water resources' policy represents a gap. Considering that multilevel integration means vertical and horizontal integration, the effective participation of the municipality in state and national water resources' management systems is essential. However, as observed in other countries [27], the lack of local management makes any cooperation difficult. The same is true at the watershed level. For the committee to operate properly, the active participation of municipalities in the basin would be necessary; however, water resources are not a priority for local administration. The implementation of new municipal policies usually depends on federal or state incentives [90,91,96]. At the same time, the mere fact that there is a formal municipal policy does not guarantee its effectiveness, as evidenced by a unique experience in a Brazilian municipality [97]. Therefore, specific programs (national or state) are required to structure the water resources policy within the scope of small and medium-sized municipalities.

Itabuna has the potential to exercise a leadership role in the development of water governance at the regional level, and it is important to structure a municipal policy in the area, to facilitate communication with other municipalities, basin committees, and State agencies. Considering the analyzed water problems, the initiative to introduce intermunicipal governance could also come from the neighboring municipality, Ilhéus, since it is the most interested in the control of water pollution. As discussed in [21], bottom-up organization processes and polycentricity are required to solve local and regional water problems.

The transition from the current management model, which prioritizes the supply of water (to the detriment of demand management), to a new culture depends on advances in public policies and governance in different areas: care for water sources in rural and urban areas, reduction of water waste and losses, water treatment and reuse, efficient application of economic instruments and granting the use of water resources, and the expansion of participation and social control. Integrated water management is necessary and must

be applied at different scales: at home, in the neighborhood, in the city, and in regions or hydrographic basins. A legal water framework needs to be elaborated at the level of municipal performance and harmonized with the legal sanitation framework

Recent basic sanitation regionalization policies may end up moving the municipality further away from decision-making instances or may be an opportunity to promote integrated management, considering basic sanitation in the context of environmental and water resources context. While the infrastructure needed to improve basic sanitation services depends on substantial investment, the development of water governance could be initiated by the municipality, using its own resources, at any time. The initiative to develop water governance could also come from other organizations and local social actors. However, the municipal government will always be the leader in any decision-making processes, since it has the competence and responsibility to promote the multilevel integration of public policies at the local level.

The present research shows that the small and medium-sized municipalities that were analyzed have many weaknesses in various areas of competence, such as environmental management and urban planning. However, it is not possible to restore urban rivers without the initiative of local authorities and the participation of the community that is directly concerned.

Water governance, much more than a trendy term, is an essential approach for the municipality of Itabuna when it comes to the management of rivers in the city and in the region it supplies. When considering water governance, decision-making processes become the center of attention (instead of buildings and technological solutions), with the priority being the building of relationships between stakeholders based on trust and transparency, and supported by a solid base of information; the definition of priority problems; the definition of the appropriate scale to address these problems; the definition of attributions and responsibilities; and the elaboration of an action plan and monitoring of results. This path, based on the principles of water governance, may seem obvious and not very innovative. However, the systematic development of water governance principles, starting with the municipality, aims to build permanent and consistent processes that alter conventional scales of water resources management and bridge the existing gaps in laws, institutional arrangements, and management instruments.

Furthermore, there is a positive relationship between integrated water governance mechanisms, such as participation, representation, knowledge, and information use, and adaptive capacity [98]. While centralization and lack of coordination are associated with a low adaptive capacity, polycentric governance regimes that combine the decentralization of power with effective coordination are characterized by their high adaptive capacity [99]. The present work intends to be a counterpoint to recent changes, which tend to reinforce the fragmentation of policies at the municipal level, remembering the importance of the fundamental principles of water resources' management for sustainable development, such as integration, decentralization, and participation, and invites us to rethink the role of municipal administration in this context.

Improving water governance requires an operational framework that covers the delivery water and sanitation services, water resources' management, environmental protection, and urban planning. Practical guidance is needed for decision makers on how action-oriented water governance processes can be meaningfully designed. Ultimately, governance is eminently practical and requires a dialogue between multiple disciplines, including experts from different areas, social scientists, and legal scholars [20].

This research shows that governance is an important theme for small and middle-sized cities in Brazil. Its broader significance is related to the fact that governance research often overlooks these cities. Nonetheless, studies with other municipalities and the promotion of concrete experiences are necessary, and will allow for an evaluation and comparison of the results of municipal water governance projects, in terms of improving the management of water resources in cities.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su14042144/s1, Federal Laws, State Laws of Bahia, Municipal Laws of Itabuna.

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Appendix A.

The Brazilian Federal Constitution of 1988 defined the competences of the federated entities and established responsibilities based on the principles of cooperation and subsidiarity [100]. It also conferred unprecedented status on municipalities, recognizing them as federated entities with their own legal personality and broad political–administrative autonomy.

Table A1. Rules of control and competences of municipalities in relation to surface freshwater, in accordance with the Federal Constitution of Brazil (1988).

Rules of the Federal Constitution of 1988	
Control over surface freshwater: Union has control over rivers that cross or border two or more states States have control over rivers within their own territories	
Competences and Responsibilities to Manage Areas Related to Water Resources Management	
Shared between the Union, states, and municipalities	**Exclusive to municipalities**
Environment Health Improvements in basic sanitation conditions Inspection of water use licenses	Public services of local interest Territorial planning, urban land use and occupation Matters of "local interest"

Source: Adapted from [11,41,45].

The National Environmental Policy (PNMA), established in 1981, created the National Environment System (SISNAMA), which integrates the state and municipal environmental systems—that is, decentralization in this area occurs down to the municipal level. Complementary Law (CL) 140/2011 detailed the competences of the three federated entities, recognizing the municipality autonomy in the environmental area. The administrative attributions of environmental licensing for activities with "local impact" were transferred from the state to the municipalities. Despite these advances, the administrative structure of small and medium-sized municipalities for the environment is still quite precarious and generally remains linked to another secretariat [60,101].

The State Environmental Policy (laws 10431/2006 and 12212/2011) of Bahia is linked to the water resources policy in several ways, with the managing and executing agencies being the State Secretariat for the Environment (SEMA) and the Institute for the Environment and Water Resources (INEMA) responsible for both areas; they are part of the State System for Environmental and Water Resources Information (SEIA). However, there is a separate state council for each area.

Table A2. Public policies focusing on water resources, respective institutional arrangements, and their integration at the levels of the federation and the state of Bahia.

National Policies	Water Resources (WR) (1997) National Agency (2000) New Framework of BS (2020)	Environment (E) (1981) Licensing (Complementary Law 140/2011) Forest Code (2012)	Basic Sanitation (BS) (2007) Solid Waste (2010) New Framework of BS (2020)	Urban Development City Statute (2001) Land Regularization (2017)
Topics of Interest to RH	Multiple Uses of WR Management Instruments specific to WR	Combating Pollution Vegetation Conservation Zoning and Permanent Protected Areas	Water and Sewage Urban drainage Solid waste	Precarious Settlements
Federal Institutional Arrangement	National Council WR National Information System on WR (SNIRH)	National Council E Several information systems (not unified)	National City Council (2004–2017) National Information System on BS (SNIS)	Several systems
	Ministry of Regional Development (MDR)	Ministry of the Environment (MMA)	Ministry of Regional Development (MDR)	
	National Water and Basic Sanitation Agency (ANA)	IBAMA, ICMBio	**National Water and Basic Sanitation Agency (ANA)**	Other related agencies
		Regulation of WR and BS		
State Institutional Arrangement (Bahia)	State Council for Water Resources (CONERH)	State Council for the Environment (CEPRAM)	State Council of Cities (CONCIDADES)	
	State Information System on Environment and Water		Several information systems	
			Basic Sanitation Regulatory Agency of the state of Bahia (AGERSA)	
	State Secretariat for the Environment (SEMA)		Urban Development Secretariat (SEDUR)—Housing, Drainage, Solid Waste	
	Institute of Environment and Water Resources (INEMA)		Secretariat of Water Infrastructure and Sanitation (SIHS)—Water and Sewage	
			Water and Sanitation Company of the State of Bahia (EMBASA)—Water and Sewage	

Public agencies that integrate WR management with other management areas (in yellow).

Regarding basic sanitation, the National Basic Sanitation Policy (PNSB), Federal Law 11445 of 2007, regulated by Decree 7217/2010, considers the components of basic sanitation: the supply of drinking water; the collection, treatment, and proper disposal of effluents; rainwater drainage; cleaning; and integrated solid waste management. However, the PNSB makes it clear that water resources are not part of basic sanitation services (Art. 4). The National Basic Sanitation Plan for the period 2014–2033 has been implemented, monitored, and evaluated since 2014. In 2018, the first cycle of implementation of the National Water Resources Plan (PLANSAB 2014–2017), the National Sanitation Secretariat of the Ministry of Regional Development (SNS/MDR) coordinated the review of the Plan.

Currently, 70% of water and sewage services are provided by state companies; 20% are under the responsibility of municipalities, which provide services directly or through public or private companies, individually organized or in associations or cooperatives; and only 10% are provided by private companies [102]. However, the local government is responsible for making policy on basic sanitation, involving the development of the Basic Sanitation Municipal or Regional Plan (with other municipalities); the definition of the form of provision of services (this can be delegated); and the definition of the entities responsible for regulating and inspecting (this can also be delegated). Municipal responsibility or ownership is based on the constitutional rules on public services of local interest, such as economic activities, governed by free competition, consumer protection, and the environment, among others. According to the PNSB, the municipality can delegate basic sanitation activities to private companies or state-owned companies. The regulation and inspection activities must be carried out by an autonomous entity (municipal, consortium, or state), defined by the municipality. Basic sanitation companies must request, from the responsible state agency, the right to use water resources, for water abstraction and the final disposal of treated sewage [103]. It is up to the municipality to define the entity that is

responsible for the regulation and inspection of the provision of basic sanitation services, but it is possible to delegate this function [93,104].

As for urban development policies, the approval of the City Statute (2001) created a series of urban, legal, and tax instruments to promote adequate territorial ordering, through land regularization and implementation of social housing in suitable locations, and the fight against real estate speculation. The municipality's power to carry out urban policy requires the preparation of a Master Plan, which includes norms for the use and occupation of urban land, and a Zoning and Construction Code that ensures the protection of water resources and considers the impact of urbanization on the demand for water, the generation of effluents or wastewater, and their destination in the environment [11].

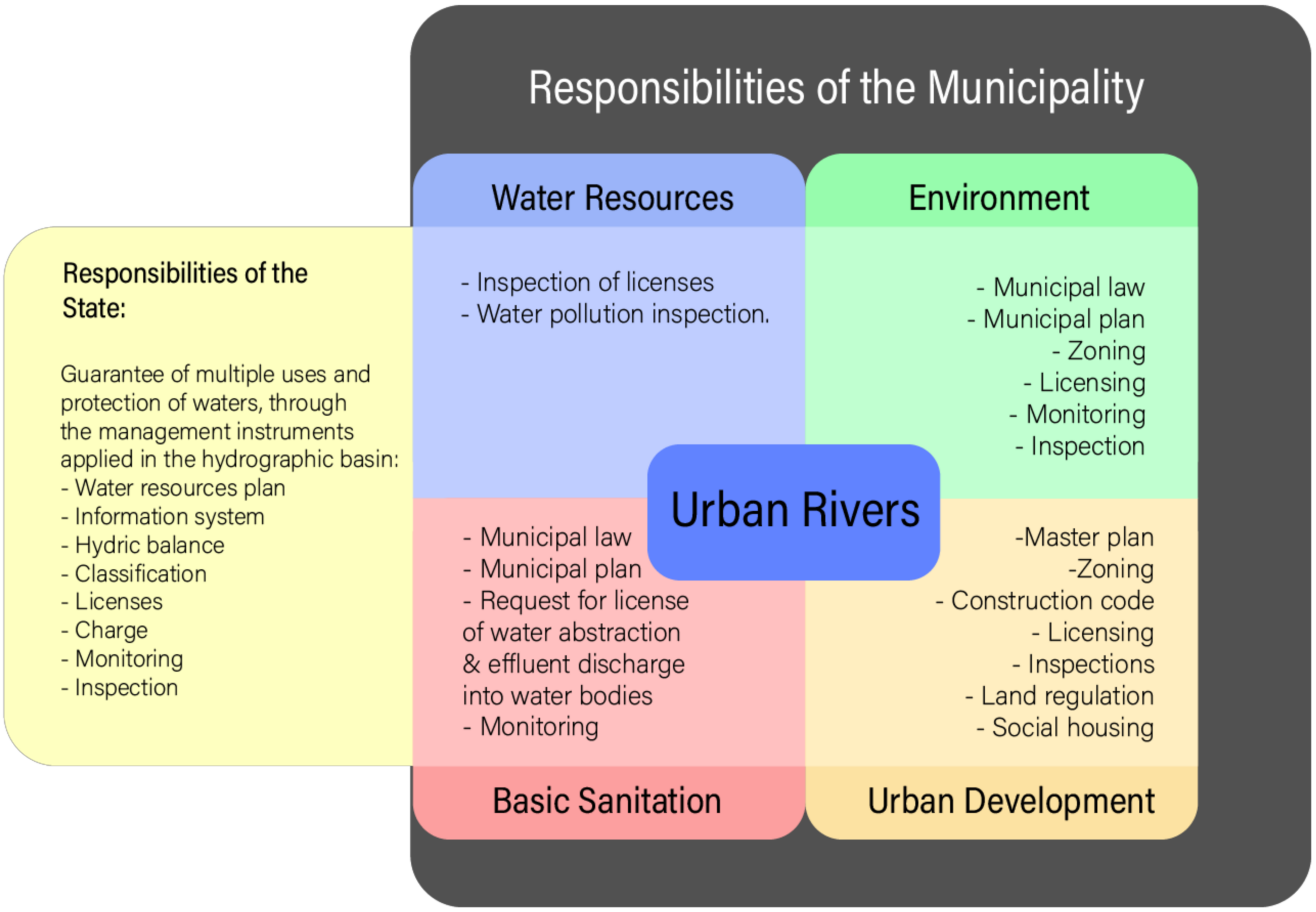

Figure A1. Municipal and state policies on the management of water resources and the respective management instruments. Source: Prepared by the authors based on relevant legislation.

Appendix B. Itabuna's Water: too Much, too Little, or too Polluted

The city of Itabuna has its seat at 14°47′ South and 39°16′ West [52]. According to the Municipal Basic Sanitation Plan (2016), the current demand for water to supply the city of Itabuna is 659.77 L/s. The existing water abstraction system has the capacity to supply 552 L/s from Almada River and 300 L/s from the Cachoeira River, totaling 852 L/s of capacity. The dam must guarantee a regularized flow of 1259 L/s, which could meet the total demand of Itabuna's Water Supply System until 2035 [58]. Regarding the flood risk, Itabuna experienced flooding in 2018, 2020, and 2021.

As for water availability, the hydrographic sub-basin of the Cachoeira River has high water vulnerability due to the natural flow variability, which depends on the rainfall regime. This situation was reinforced by the continuing environmental degradation of the region. The Watercourse Variability Index (VI = Q90/Qmed), according to the Jenks classification,

is 3.1% for the Cachoeira basin, which indicates a very high risk of drought, and 5.7% for the Almada basin, which indicates a high risk of drought [60,105]. With an area of approximately 5400 km^2, Cachoeira basin covers the headquarters of 12 municipalities and a population of approximately 500,000 inhabitants [53]. The Almada basin covers an area of 1575 km^2 and only four municipal seats, with a population of almost 65,000 inhabitants. The Almada basin has a higher risk of salinization of coastal aquifers due to the influence of tides [106]. Both rivers are part of the Water Planning and Management Regions (Região de Planejamento e Gestão da Água (RPGA)) VII, "East Basin," of the state of Bahia (Figure 1). As for water availability, among the 332 hydrographic basins mapped in Brazil, the "East Basin" of Bahia is in the second lowest range, with a specific flow of only 2–4 L/s/km^2 [105]. In the Almada and Cachoeira river sub-basins, urban supply accounts for almost 60% of water withdrawal, according to data from the National Information System on Water Resources (SNIRH), and 40% of the population of the Cachoeira basin is concentrated in the city of Itabuna.

Table A3. History of extreme events and water supply in Itabuna.

Periods/ Events	1910–1969	1970–1999	2000s	2010s	2020–2021
Urban Population (approx.)	<50,000	100,000	170,000	200,000	210,000
Extreme Events	Floods in 1914, 1920, 1947, and 1967 Drought in the 1950s	Drought in the 1970s	Flood in 2007	Floods in 2013, 2017, and 2018 Drought in 2015/16	Flood in 2020 Drought in 2021 Flood in 2021
Supply (Capture, storage)	Water supply from the Cachoeira River (deactivate)	-1970s: 1. Abstraction in the Almada River -1980s: 2. Abstraction in the Almada River	2007—Expansion of the water supplying system in the Almada River	2006—New capture on the Cachoeira River 2016—Collapse of the Water Supply System	2018—Colônia/Cachoeira River Dam

The sewage produced in the city of Itabuna is directly discharged to the environment or, when collected, discharged into small urban rivers (tributaries) and the main channel of the Cachoeira River [58]. A lawsuit filed by the Public Prosecutor of Bahia against the municipal concessionaire (Municipal Water and Sanitation Company S/A (EMASA)) revealed that the sewage treatment stations of the condominiums of the social habitation program (Programa Minha Casa Minha Vida) pollute the Cachoeira River tributaries with the release of untreated effluents. A historical series of a state-monitoring program (Programa Monitora (INEMA)) shows the degradation of water quality in the stretch where the river crosses the city of Itabuna, according to an analysis carried out during the preparation of the Executive Plan for the Revitalization of the Cachoeira River Basin [60]. As for environmental policy, the municipality of Itabuna has its own Municipal Environmental Policy (Law 2195/2011), linked to a secretariat with other roles, and there is an Environment Council without its own funding.

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