Scalar mismatches in metropolitan water governance
A comparative study of São Paulo and Mexico City
van den Brandeler, F.A.

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6. THE IMPLEMENTATION OF UWM IN SÃO PAULO

6.1 INTRODUCTION

This chapter examines how different drivers and institutions at multiple levels of the urban water governance regime shape water-related challenges in the Metropolitan Region of São Paulo (MRSP). It uncovers the causal chains behind these water challenges and the effectiveness of existing policy instruments. It reviews the relevant context of Brazilian urban water governance and its main drivers (see 6.2); analyses the driving forces according to their scalar level; explores which formal actors and institutions shape Urban Water Management (UWM) (see 6.3); analyses the instruments of UWM according to their stated mandates, their effect on actors’ behaviour and their impacts on inclusive and sustainable water governance (see 6.4). Finally, the chapter summarizes the main empirical findings and considers how more appropriate instruments could be (re)designed for São Paulo in relation to UWM (see 6.5).

6.2 CONTEXT AND DRIVERS OF SÃO PAULO’S URBAN WATER CHALLENGES

6.2.1 CONTEXT IN RELATION TO THE METROPOLITAN REGION

São Paulo was founded in 1554, but remained a small and relatively unimportant settlement until the 19th century, when the country attained independence and the Southeast developed the coffee industry (Bógus and Véras, 2000).48 Since the 1930’s, São Paulo has transitioned into a new period of industrialization and the city has experienced exponential urban growth (see 2.2.2). With few natural barriers, the city expanded horizontally, absorbing surrounding towns and transforming into one of the world’s largest metropolises. The MRSP is composed of 39 municipalities, occupying an area of 8,050 km² (Kellas, 2010).

6.2.2 MAIN DRIVERS OF SÃO PAULO’S URBAN WATER CHALLENGES

Table 6.1 provides an overview of the main direct and indirect drivers at multiple levels of urban water challenges in the MRSP.

Urbanization

Unplanned urbanization in the MRSP has contributed to soil-sealing49 and the occupation of hillsides, aggravating the risk of floods and mudslides (Jacobi et al., 2015; FABHAT, 2016; Bis, 2017) (Interviews-B14/B17/B19). These risks are compounded by inadequate sanitation and solid waste management, and poor citizen awareness, causing the accumulation of waste in streams and rivers that consequently clog drains and stormwater channels (Jacobi et al., 2015; Bis, 2017) (Interviews-B16/B17/B19).

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48 São Paulo’s population was 30,000 in 1872 when the first census was conducted (São Paulo, no date).
49 It is estimated that 37% of the land within the ATB is impermeable (Jacobi et al., 2015).
The lack of spatial planning has facilitated the multiplication of informal settlements, while real estate speculation and a lack of affordable housing policies have facilitated vacant plots and inner-city buildings, and the inadequate enforcement of land use regulations has allowed for the construction of luxury developments on the edge of the Pinheiros River (Monteiro et al., 2017) (Interview-B15/B19).

Rapid urban growth, mainly through rural to urban migration due to the modernization of agriculture and the expansion of industrialization, has meant that cities could not meet the growing need for housing, which stimulated the occupation of abandoned buildings in inner cities and the expansion of informal settlements within and around cities (Jacobi, 2004; Monteiro et al., 2017) (Interview-B15). Local governments and utilities could also not meet the growing need for Wat&San services (FABHAT, 2016). Informal settlements spread to the margins of the MRSP, and especially to the East and South, around springs and water supply reservoirs, as these were vacant being Protected Areas relatively near the urban core (see 5.4.4) (Alvim and Kato, 2011; Rolnik and et al., 2015). This has reinforced marginalization processes, as low-income residents were living increasingly far from the urban core, in precarious housing, and without access to land tenure and access to adequate infrastructure and services (Denizo, 2009; Monteiro et al., 2017). Rivers and streams became progressively more polluted, with downstream municipalities particularly affected.

From the 1970’s, housing programmes were designed by all levels of government in response to the growing low-income housing crisis. These were mainly designed to fulfill the primary need for shelter with less consideration for urban planning and basic infrastructure and services (e.g. drainage, sanitation, lighting, and other public services) or environmental impacts (Interview-B30). Housing projects were mainly developed in the MRSP’s periphery (Rolnik and et al., 2015). Housing programmes were also not linked to other policies promoting social inclusion, such as access to education and jobs, nor did they consider factors such as the target population’s limited ability to pay taxes and maintenance and utility costs, their proximity to jobs, or the loss of social fabric that can come from uprooting communities (Denizo, 2009). These programmes also soon stopped targeting the poorest section of the population, due to the high default rate on subsidized loans offered for the acquisition of a home (Monteiro et al., 2017). Federal government action has focused on promoting housing programmes rather than developing a housing policy that considers slum upgrading and linkages with land use management and with urban planning (Marguti, 2018) (Interview-B30).

Economic development

Municipalities lack the financial and human capacity to contribute adequately to investments in Wat&San services. This motivates many to delegate the responsibility of service provision to the state water company, SABESP, or (more rarely) to a private company. Municipalities, especially small ones, often rely significantly on financial support from the federal government.

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50 The State is responsible for the housing needs of those that cannot access the formal housing market (Denizo, 2007). It operates through the State Housing Department and the Housing and Urban Development Company of São Paulo State (CDHU). The CDHU attends families that earn between one and 10 minimum wages (CDHU, no date).
The economic crisis that hit Brazil in 2012 further reduced budgets at all levels of government for sanitation and risk prevention.

**Heat island effect**

Furthermore, large-scale urbanization has triggered the heat island effect. This, combined with water shortages, is believed to have caused a severe dengue epidemic during the 2013-2015 water crisis (Clorosur, 2015) (Interview-B33). The heat island effect also leads to a decrease in atmospheric pressure causing heavier precipitation (Goldenstein, 2017).

**Table 6.1 Multi-level drivers of water-related challenges in the city**

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
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<tbody>
<tr>
<td></td>
<td>Local</td>
<td>Regional / global</td>
</tr>
<tr>
<td>Land use change</td>
<td>Urbanization (especially unplanned, informal)</td>
<td>Urbanization</td>
</tr>
<tr>
<td>Demographic</td>
<td>Population growth in urban periphery</td>
<td>Growing water demand for public supply</td>
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<tr>
<td></td>
<td>Growing water demand for public supply</td>
<td>Rapid population growth during 20th century</td>
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<tr>
<td></td>
<td>Economic centre of Brazil</td>
<td>Economic crisis in Brazil (2012-ongoing)</td>
</tr>
<tr>
<td>Economic</td>
<td>Insufficient investments in sanitation and solid waste management</td>
<td>Economic centre of Brazil</td>
</tr>
<tr>
<td>development</td>
<td>Lack of environmental awareness</td>
<td>Economic crisis in Brazil (2012-ongoing)</td>
</tr>
<tr>
<td>Environmental</td>
<td>Heat island effect</td>
<td>Climate variability and change</td>
</tr>
<tr>
<td>awareness</td>
<td>Drought of 2013-2015</td>
<td>Climates and change</td>
</tr>
</tbody>
</table>

*Source: Author*

6.3 **INSTITUTIONAL FRAMEWORK**

Actors and institutions of UWM at multiple levels shape metropolitan water-related challenges and responses to these in the MRSP (see Figure 6.1).

6.3.1 **GLOBAL LEVEL**

Global level actors have played a crucial role in UWM through the financing of infrastructure for Wat&San in the MRSP. The World Bank has granted loans to SABESP, for programmes
aimed at reducing leaks and connecting areas using irregular connections to the public network (SABESP, 2018).

6.3.2 **NATIONAL LEVEL**

During the 1970’s, Brazil went through a period of important investments in Wat&San infrastructure, with the implementation of the PLANASA in 1971 (National Sanitation Plan). This centralized, top-down process, led by the military regime, focused on expanding water supply infrastructure through the creation of powerful state water companies (Saiani and Toneto Júnior, 2010; Jacobi *et al.*, 2015). The Federal government established policy guidelines for state companies, and municipalities were given a merely passive role in the sector (Sousa and Costa, 2016). Investments dropped sharply in the late 1970’s, and the plan was abandoned in 1992, after the democratic transition. As the centralized state remains associated with the military dictatorship to this day, there is widespread support for decentralization as a mechanism for empowering disadvantaged groups (Abers and Keck, 2004). Although the Constitution gave municipalities the responsibility for Wat&San provision, a policy vacuum remained at national level until 2007 (Saiani and Toneto Júnior, 2010) (Interview-B36).

In 2007, the Federal Law No. 11.445 for basic sanitation established a legal framework for Wat&San services (Brazil, 2007). The definition of these services was expanded to include drinking water for public supply, the collection, treatment and discharge of wastewater, urban drainage, stormwater management and solid waste management. This legal framework led to the National Basic Sanitation Plan (PLANSAB), which aims for the universalization and improvement of Wat&San services nation-wide (see Table 6.2). It is based on the principles of universality, equity, integration (i.e. Wat&San services should be provided together), sectoral integration, economic efficiency and sustainability, and alignment with public health and environmental concerns. Although this is a distinctive shift away from the sectoral approach to Wat&San services, investments may be too low to reach the goal of universalization by 2033 (Almeida, 2017). The Law also explicitly stipulates that it does not address water resources management (Brazil, 2007, Art. 4). This reinforces a separation in Wat&San and WRM policies, as federal and state water resources laws focus on users and the municipality is not given a role (dos Santos *et al.*, 2019) (Interviews-B12/B15/B16/B32/B36).

The National Secretariat for Sanitation is responsible for implementing the PLANSAB in municipalities of more than 50,000 inhabitants (SNS, 2019). The Ministry of Health has this responsibility for municipalities below 50,000 inhabitants (Ibid). The Environmental Ministry is involved in urban water policy, such as flood control, areas of springs, and river parks.

Although housing policy is not directly linked to urban water governance, it indirectly plays a significant role, as access to water-related services and protection from water-related risks is significantly influenced by where and how people live. The 1988 Federal Constitution

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51 The Law defines national parameters such as minimum standards for drinking water and the promotion of incentives for conscientious water consumption (Paganine, 2015).
represented a turning point for housing policy, as it defined access to housing as a right and devolved greater responsibilities for social housing to states and municipalities (Souza et al., 2009; Santos and Duarte, 2010). However, this was not combined with adequate financial mechanisms, which especially hampered municipalities’ capacity to adequately respond to the housing demand (Santos and Duarte, 2010).

**Table 6.2 Main aspects of the PLANSAB**

<table>
<thead>
<tr>
<th>PLANSAB</th>
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<tbody>
<tr>
<td><strong>Approach to Wat&amp;San services</strong></td>
</tr>
<tr>
<td>A citizen’s right, fundamental to the improvement of their quality of life</td>
</tr>
<tr>
<td><strong>Goals</strong></td>
</tr>
<tr>
<td>Universalization, combined with fair prices and tariffs for:</td>
</tr>
<tr>
<td>-access to drinking water</td>
</tr>
<tr>
<td>-wastewater management (collection, treatment and disposal)</td>
</tr>
<tr>
<td>-urban solid waste management (collection, treatment and disposal)</td>
</tr>
<tr>
<td>-adequate urban stormwater management (and thereby flood control)</td>
</tr>
<tr>
<td><strong>Key actors</strong></td>
</tr>
<tr>
<td>Ministry of the Cities, through the National Secretariat for Environmental Sanitation (SNSA)</td>
</tr>
</tbody>
</table>

*Source: Adapted from (Federal Law nº 11.445, 2007)*

In 2015, the ‘Metropolitan Statute’, a Federal Law, established an institutional framework for metropolitan governance and created norms and guidelines for “public functions of common interest” (Casa Civil, 2015). The enactment of this Law derived from a 2013 Supreme Court decision that stated that services of ‘common interest’ in metropolitan regions should be managed jointly by the state and local governments (Costa and Góes, 2013). As Wat&San services fall under this category, it has important implications for UWM in the MRSP. In fact, the debate behind this decision was prompted by ambiguity surrounding the mandates of Wat&San services in metropolitan regions (see 6.3.4). The Metropolitan Statute requires all metropolitan regions in Brazil to develop Integrated Urban Development Plans (IUDPs) that harmonize municipal master plans.

**6.3.3 STATE LEVEL**

There is no state-level legal framework for Wat&San, and state actors follow the PLANSAB’s guidelines. Municipal governments are responsible for Wat&San planning and must guide the service provider’s actions (see 6.3.5) (Brazil, 2007). Before the PLANSAB’s adoption, state water companies often developed Wat&San plans, *de facto* shaping the sector’s policies (e.g. defining priorities, tariffs) (Interviews-B4/B29/B30/B32/B34/B36). Key actors at state level are SABESP, ARSESP, the DAEE, EMAE and the Public Prosecutor’s office.

The main actor for drinking water and sewerage services in São Paulo State is SABESP, the State Wat&San company, which operates in around half of the state’s municipalities. The largest in South America, it serves approximately 27.7 million consumers, including in
informal settlements (Tortajada and Biswas, 2018).\textsuperscript{52} It is a Government-sponsored, publicly-traded company (51% owned by the State and 49% owned by stockholders) and is listed on the stock exchanges of São Paulo and New York (Brandeler, 2013). SABESP is autonomous but linked to the SSRH (State Department of Sanitation and Water Resources) (see 5.3.4), and was founded during the military dictatorship, when the federal government pushed for the establishment of powerful state companies. The company has been consistently profitable (Tortajada, 2008). The MRSP corresponds to approximately 60% of the SABESP’s net revenue (Interview-B36). At the time of research, SABESP operated in 34 of 39 municipalities of the MRSP, although discussions were under way for its takeover of the operations in some remaining municipalities.

ARSESP (São Paulo State Regulatory Agency of Sanitation and Energy) is an independent regulatory agency, bound to the SSRH and created by the 2007 Federal Law on Wat&San. ARSESP regulates stated-owned sanitation services (i.e. SABESP’s services), and some municipal and private companies’ services. It promotes the expansion of these services at an affordable price, while meeting commercial (e.g. billing, tariffs) and operational (e.g. water quality) targets (Interviews-B11/B13). It also monitors whether utilities are meeting the targets established in municipal Wat&San plans, such as reducing leakages. It can punish the company or establish a Conduct Adjustment Commitment through which it converts a fine into an investment in the service. As the regulating agency was created long after SABESP and many private providers, it has had to negotiate its position and there are still some ambiguities regarding the limits of its role (Interviews-B5/B11). Overall, its powers are dwarfed by those of SABESP.

The DAEE is involved in UWM as it is responsible for macro-drainage and flood control around major rivers (i.e. those that cross municipal boundaries) (see 6.4.2). This means it must prevent flooding of the Tietê and Pinheiros Rivers within the MRSP. The EMAE also has mandates related to urban flood management within the MRSP, as it is responsible for controlling the volume of water in the canalized Pinheiros River to mitigate flood risks after heavy rains (EMAE, no date).\textsuperscript{53}

The State office of the Public Prosecutor monitors, pressures and prosecutes polluting activities, and sets targets for municipalities towards the universalization of sewage collection and treatment services. This has incentivized municipalities to regularize informal settlements to allow for sewerage infrastructure to be installed, as removing populations is often practically impossible (Interviews-B22/B23). The Public Prosecutor’s office was criticized for lacking technical knowledge and putting disproportionate blame on Wat&San utilities and local governments (Interviews-B5/B22/B23).

\textsuperscript{52} Initiatives such as the ‘Legal Water’ programme, initiated in 2016, aim to bring drinking water services to informal settlements (SABESP, 2018). This contributes to universalizing water supply services and reduces water losses from irregular connections. It represents a shift in urban policy towards proactively addressing the challenges of informal urbanization, through coordination between the utility and local government (Pasternark and D’Ottaviano, 2018). However, without land tenure, these interventions remain in a legal grey zone. Moreover, the physical layout can make the installation of sanitation infrastructure practically impossible.

\textsuperscript{53} The EMAE and DAEE can use the Pinheiros River as a reservoir when too much water accumulates in the Tietê River. A movable dam was built in the 1990’s between the two rivers for this purpose (Interview-B19).
6.3.4 **Metropolitan Level**

The MRSP was created in 1973 by Federal law (Brasil, 1973), as part of the technocratic and centralized planning apparatus of the military regime. The Federal Constitution of 1988 (Art. 25) delegated power to the states to institute metropolitan regions, urban agglomerations and micro-regions to bring municipalities together in the planning and implementation of public functions of common interest, such as Wat&San (Casa Civil, 2015). The MRSP almost entirely overlaps with the ATB (Alto-Tietê Basin), which indicates a significant opportunity for collective action and harmonized policies. Nevertheless, metropolitan and basin institutions largely act separately (Interviews-B4/B15).

In São Paulo State, the EMPASA (São Paulo State Metropolitan Planning Company) is responsible for regional and metropolitan planning, including the development of the Integrated Urban Development Plans (IUDPs) required by the 2015 Metropolitan Statute (EMPLASA, no date). It formulates policies at macro-metropolitan level on land occupation issues and compatibility with the region’s sustainable development. However, it lacks implementation power.

Inter-municipal consortia may also play a role in water governance at metropolitan level. They are legal entities with an autonomous governance structure and their own budget. They unite different municipalities in joint actions that, if produced individually by these municipalities, would not reach the same results or would require more resources (Vaz, 1997). Possible joint actions include public services (e.g. basic sanitation provision) and environmental protection. Some municipalities have formed consortia within the MRSP, with their success significantly dependent on coordination between local politicians and actors, as well as on available funding (Interviews-B8/B28/B22/B34/B36).

6.3.5 **Local Level**

The Brazilian Constitution of 1988 required that services of ‘local interest’ must be managed by municipal governments (Constitution of Brazil, 1988). This decentralized power and enhanced the role of local governments in a wide range of policy decisions, although limited resources sometimes stretched their ability to design effective policies. Municipalities in charge of Wat&San services (including drainage and solid waste management) were generally understood as being services of local interest. Some municipal attributions relevant to water governance also include land use management, urban planning, basic health care centres, drainage systems and local environmental issues (Formiga Johnsson and Kemper, 2005, p. 24). They are also responsible for the areas of springs in their territory. Municipalities can therefore significantly influence local and regional water resources in terms of quantity and quality.

54 Only five municipalities of the MRSP are not part of the basin.
55 The São Paulo macro-metropolis encompasses four institutionalized metropolitan regions: São Paulo, Campinas, the Baixada Santista and the Vale do Paraíba, and the Northern Littoral, and several urban agglomerates and micro-regions. In 2010, this region had over 30 million inhabitants (EMPLASA, no date).
Municipalities are also in charge of drainage and flood control, although the State is involved in macro-level aspects. Municipal civil defence authorities must cope with the immediate consequences of flood risks, which especially affect informal settlements in floodplains and unstable hillsides (Interviews-B8/B17). Municipalities must develop master plans that combine these various functions. However, these often overlook the basin plan (Interview-B16). Integration between the basin and city plans has been hindered by a lack of funding to facilitate their coordination, and political will by local officials (Interview-B36).

Municipalities choose whether to provide Wat&San services through a municipal company, to contract a private company or to delegate the responsibility to a state company—in the case of São Paulo State, to SABESP. Most municipalities within the MRSP have delegated these services to SABESP, but those that have not still bought at least part (and usually most) of their bulk water supply from SABESP, de facto connecting them to the Integrated Metropolitan System for bulk water management (Interview-B4). As groundwater was generally not considered a reliable or sufficient source, and many surface water bodies in the MRSP were contaminated, the reliance on water resources beyond municipal borders reduced local utilities’ autonomy. Their sewage was sometimes also treated in a regional rather than municipal treatment plant (Interview-B4). Regardless of the service provider, the municipality remains responsible for planning and for ensuring a minimum volume of water per person per day (Interview-B32). Although municipal Wat&San plans are mandatory, lack of human and financial capacity has often led to low quality plans or plans copied from those of neighbouring municipalities plans (Interviews-B4/B7/B12/B30/B32/B35). These should be updated every four years, which is rarely done, and often do not match their context’s reality (i.e. population growth, priority projects and investments), leading water companies to carry out their own planning in practice (Interviews-B11/B22).

After the approval of the 2007 Federal Wat&San policy, debate arose on the ambiguity surrounding who had the mandate for operating Wat&San services. The Law delegates the services to ‘titleholders’, but does not clarify who they are (Brazil, 2007). The issue of the mandate is controversial, as the military regime had pressured municipalities to delegate these services to state companies that were not regulated and received federal funds (De Sousa and Costa, 2016). In 2013, the Supreme Court ruled that municipal governments were indeed responsible for Wat&San services but that, within metropolitan regions, Wat&San services must be provided through shared management between municipalities and the State (Costa and Góes, 2013). This decision was largely based on the principle that such services were of common interest within metropolitan regions, rather than of local interest (Costa and Góes, 2013). This ruling led to uncertainty and significant debates on how to implement it in practice. The PLANSAB (see 5.3.3) has not yet been adjusted to include considerations for the Supreme Court decision.

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56 Solid waste management is typically partially or entirely outsourced, whereas drainage services are mostly carried out by municipal authorities as these have not found a way to monetize these services (Tucci 2009).
57 An official from a municipality of the MRSP (Interview-B21) was unable to find the municipality’s plan after significant searching during an interview. An ARSESP respondent claimed that mayors are sometimes convinced that their municipality does not have a Wat&San plan (Interview-B11).
58 Even the municipality of São Paulo has not renewed its plan since 2009 (Interview-B12).
As can be seen, a mesh of actors is responsible for managing water in the MRSP, sketched by Figure 6.1 below.

**Figure 6.1** Basin and urban water stakeholders in the MRSP

*Source: Author*
6.4 INSTRUMENT ANALYSIS

The performance of policy instruments is examined in relation to water quantity, water quality, and adaptation to unpredictable and extreme water-related weather events, and their consistency across multiple levels of governance.

6.4.1 WATER AND SANITATION TARIFFS

Design

The 2007 Federal Law for basic sanitation, stipulates that utilities should ensure the financial sustainability of Wat&San services provision while striving for universalization of services and maintaining reasonable rates for consumers (Brazil, 2007). Contracts for water and sanitation services between a utility and a municipal government must also include targets for rational water use (Art. 11 (§2)(II)). The regulatory agency is responsible for defining economic criteria for these tariffs and potential subsidies (Ibid) (Interview-28). The basin committee is not involved in decisions, although ARSESP holds public hearings in which members can participate. SABESP applies the same tariffs in all the municipalities it operates in by using cross-subsidies, through which smaller, poorer municipalities are subsidized by more profitable regions such as the MRSP (Interviews-B5/B11/B28). In municipalities with other water utilities, tariff rates vary.

SABESP charges ‘increasing block tariffs’. For water consumption between 0 and 10 m³, SABESP consumers pay a fixed rate (ARSESP n.d.). The rate increases for each additional cubic metre and rises sharply above 20m³ to incentivize rational water consumption (Interview-B4). Most utilities charge one tariff for water supply and another for sewage collection and treatment, regardless of whether a household’s wastewater is treated (Interview-B28). As collecting and treating sewage is costlier than providing drinking water, there are cross-subsidies between these (Interview-B29). A higher tariff is applied to large consumers, such as industrial and commercial consumers (ARSESP, no date). However, their rates per cubic metre decrease as consumption increases above the volume negotiated through a contract agreement, and they are fined if consuming less (IDS and Aliança pela Água, 2017) (Interviews-B28/B29).

SABESP separates domestic consumers into three tariff categories: ‘regular’, ‘social’ and ‘favela’ (the latter is only implemented in the MRSP) (Interview-B4). In 2019, in the MRSP, the social tariff was USD 2.40 and the favela tariff was USD 1.82 for water consumption up to 10m³, compared to USD 7.04 for regular residential consumers (see ANNEX H – WATER TARIFFS). Consumers qualify for the social or favela tariff under certain conditions, although these are only valid for the first 10m³ of water (Interviews-B4/B11/B28). The social tariff involves a complex calculation to determine eligibility of consumers that meet at least one of the following criteria: A combined household income lower than three times the minimum

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59 Between 500-1000 m³, large consumers pay USD 3.8 per cubic metre. Above 40,000 m³ they pay USD 2.5 (IDS and Aliança pela Água, 2017).
wage, energy consumption below 170 Kwh/month, a dwelling with up to 60m² of surface area and employment status (unemployed consumers have priority) (ARSESP, 2009) (Interviews-B28/B29). Consumers paying social tariffs must reapply each year to prove their eligibility (ARSESP, 2009). Some municipal utilities also apply such a tariff (Brandeler, 2013) (Interview-B22).

**Effectiveness on actors in terms of mandated goals**

Drinking water provision is almost universalized within the MRSP (FABHAT, 2016). Around 99% of the population in the municipality of São Paulo has access to drinking water through the piped network and this reaches 100% in some wealthy metropolitan municipalities. However, access falls heavily in smaller, poorer municipalities of the MRSP (e.g. 63% of the population in Salesópolis, where the Tietê River has its springs, has access to drinking water) (SNIS, 2016). In many cases, residents in informal settlements access drinking water through clandestine means (by connecting their home to the official network themselves, thus not paying for their consumption), and this population is included within data on access to drinking water, thereby masking inequalities in terms of quantity and quality.

Nonetheless, special programmes to install water supply infrastructure that require authorizations of the municipality have been implemented in recent years. The average daily per capita consumption in the MRSP is around 130 litres, but this number blurs inequalities between rich and poor areas (SABESP, 2017). However, sewage collection rates are above 90% in only seven municipalities of the MRSP (including São Paulo), whereas ten have rates below 50% (FABHAT, 2016). Sewage treatment coverage varies from 0 to 100% across the MRSP. Consumers nevertheless pay for these services if they have access to drinking water (Interview-B19). While lack of land tenure in informal settlements is part of the explanation for the backlog in sewage collection and treatment, many formal neighbourhoods are not yet connected either.

Designing a water tariff system that is affordable to all consumers is challenging in a context of severe inequalities, where consumers have vastly different abilities to pay. The inclusion of ‘social’ and ‘favela’ tariff rates leads to more affordable services for many consumers, although fewer households receive this tariff than those who qualify for it (Interview-B29). The fixed tariff rate for consumption between 0 and 10m³, with rates increasing exponentially above that, encourages rational water use, but unfairly penalizes larger households for higher consumption even if their consumption per capita is reasonable (Interview-B11). The minimum bill for water consumption of 10m³ even for lower actual consumption also hampers affordability and reduces incentives to further conserve water (dos Santos et al., 2019) (Interview-B29).

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60 In Guarulhos, a municipality of approximately 1.3 million inhabitants neighbouring São Paulo, many residents have access to water every other day or less frequently (Brandeler, 2013) (Interview-B23).
61 Through its Legal Water Programme, SABESP aimed to install official water connections in 160,000 buildings, for 600,000 residents, in 2018. This corresponds to around 2.7% of the MRSP’s population (SABESP, 2017).
62 In comparison, in Spain the average person consumes around 140 litres a day, and this number is around 200 in the Netherlands and 60 in Slovakia (EurEau, 2017).
Some local water utilities charged higher tariffs than SABESP (e.g. Guarulhos, East of São Paulo), even though many residents received water only every other day (Brandeler, 2013) (Interview-B22). Higher tariffs could be due to reliance on SABESP for bulk water as they had insufficient water resources within the municipality’s borders (Interview-B12/B23). Some municipalities applied lower tariffs than SABESP, or did not even charge tariffs, due to widespread clientelism (interviews-B4/B5/B28/B30). This was criticized as ‘tariff populism’ by a SABESP representative, as local utilities – often closely connected to the municipal government – could strengthen local support by highlighting that their tariffs were lower than those of SABESP (Interview-B4). These local utilities largely rely on SABESP for bulk water, but some do not pay for this service, which means that SABESP’s own consumers ultimately subsidize water consumption in these municipalities (many of which are in relatively wealthier areas of the MRSP) (Interview-B4).

Finally, concerning the goal of financial sustainability, SABESP has been constantly profitable, although some local utilities have not been so. In 2018, SABESP’s net profits were USD 760 million. Between 2003 and 2014, the company redistributed between 26 to 60% of its net profits to shareholders (Schapiro et al., 2018). Economies of scale allowed for cross-subsidies across the state, which has helped expand access to services in rural and lower-income areas (Interviews-B4/B5). SABESP’s tariffs were relatively low compared to rates across Brazil, and SABESP executives argued that higher rates on regular consumers would accelerate investments towards the universalization of services and lower consumption (Interviews-B4/B28/B29/B33). However, SABESP’s profits could also indicate room for greater investments (e.g. in reducing leaks, increasing sanitation services) or for expanding social tariffs, rather than focusing on paying dividends to shareholders (Interviews-B4/B16/B13/B22/B29/B32/B36).

**Impact on inclusiveness and sustainability**

The tariff structure designed does not incentivize rational water use and investments in wastewater management (Interviews-B4/B6/B13/B22/B29/B32/B36). Water tariffs are subsidized for large parts of the population (Interviews-B4/B30/B34). For industrial and commercial consumers, the rate per cubic metre not only decreases as consumption increases, but this category of consumers must consume a minimum volume of water or pay a fine, which commodifies water and encourages wasteful practices (IDS and Aliança pela Água, 2017) (Interview-B29). This perpetuates the reliance on inter-basin transfers to meet demand, instead of investments in reducing water use or expanding the use alternative water sources (e.g. rainwater harvesting, wastewater recycling and reuse) (Interviews-B6/B29). Water losses (from leaks and clandestine connections) were estimated to be around 35% (Interview-B20/B28/B33). ARSESP did not introduce measures to verify the stability of water resources or the quality of wastewater treatment, further reinforcing the disconnect between the tariff

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63 Aquapolo, a large industrial wastewater reuse plant near the MRSP, produces 650L/s of reusable water for a petrochemical complex, a volume equivalent to the water supply of a city of 500,000 inhabitants (Aqpapolo, no date). Although this shows significant potential demand for greywater, laws and norms needed to be adjusted, and these practices needed to gain public acceptance (Interviews-B4/B34).
Another highlighted problem was that the tariff calculation was complex, and the tariff-setting process lacked transparency. Tariffs are mainly developed by SABESP, and ARSESP was described as a rubber-stamper (Interviews-B12/B29/B36). Although there are public hearings on tariff-setting, these are difficult to follow for regular citizens and CSOs, due to the topic’s complexity (Interview-B36). In addition, although the tariffs are the main contribution to investments in Wat&San, it is not clear who is involved in decisions regarding how revenue from these tariffs is reinvested (Interview-B29).

The lack of rational water use was brought to light during the 2013-2015 water crisis, partly due to SABESP’s and the state government’s slow reaction (Interview-B28). ARSESP does not have mandates over WRM (Interviews-B11/B29/B36). Nevertheless, during the water crisis, SABESP, with the approval of ARSESP, eventually implemented a system of bonuses and fines to incentivize consumers to reduce their consumption. Fines were applied to monthly water bills that were more than 20% above of the consumer’s average water bill of the past year, and bonuses for bills 20% below. Water consumption in the MRSP decreased from 169 l/day per person to 120 litres in 2015 (SABESP, 2017). By late 2017, consumption had rebounded to 130l/day per person (SABESP, 2017), but still remained below pre-crisis levels, leading some to believe the population had become more aware of the need for rational water use and had changed habits (Interviews-B4/B6/B7). Others claimed that water consumption will rise again as no permanent demand management measures were implemented and the focus remained on increasing supply (Interviews-B4/B29/B30).

However, during the water crisis, the MRSP’s periphery was reported by the media to be significantly more affected by water shortages, especially neighbourhoods uphill and far from water supply dams (Leite, 2014; Schmidt and Dezem, 2014; Lobel et al., 2015) (Interview-B38). The State government claimed that there was no water rationing and that shortages were connected to reductions in the systems pressure (i.e. to reduce leaks, which lowered water flow to the extremities of the system) (Schmidt and Dezem, 2014; Martin, 2015). Protests were organized by social movements that termed this situation ‘selective water rationing’ (Martin, 2015).

While ARSESP focused on affordable tariffs and financial sustainability, it did not establish clear social or quality standards for services (e.g. water quality) (Interviews-B4/B29). Many households in informal settlements still obtained water through clandestine means (Interviews-B19/B32/B33). Although special tariffs helped some residents in low-income households or informal settlements, land tenure and slum upgrading were not addressed.

The fact that some local utilities did not pay for bulk water could have contributed to higher tariffs, as SABESP had to compensate its financial losses (Interviews-B4/B5/B28). Moreover, some municipal utilities receiving bulk water from SABESP were reported to sell it to industrial users (Interviews-B5/B30). The local utilities claim that SABESP’s bulk water fees are excessive. The situation has led to conflicts and lawsuits, creating additional pressure for these municipalities to transfer the services to SABESP (Interviews-B5/B11/B20/B36).
6.4.2 Macro-drainage

Design

Macro-drainage is defined as drainage and flood control measures for inter-municipal rivers and is the responsibility of the State government. The Macro-drainage Master Plan of the Alto-Tietê Basin (MMP-ATB) is focused on the ATB as a whole and led by the DAEE, which brings together the State, municipalities and the basin committee. It aims to foster integrated stormwater and flood management by coordinating actors and linking public policies through both structural (i.e. reservoirs) and non-structural measures (i.e. flood insurance, risk mapping, zoning, monitoring and warning systems, emergency plans) (DAEE, 2012; FABHAT, 2016). Structural measures include mainly grey but also green infrastructure, such as the development of linear parks along floodplains and the expansion of permeable areas (DAEE, 2012). The plan’s guiding principles are: An interdisciplinary approach in diagnosing and solving floods; The basin as the planning unit; Engineering solutions based on the valuing and rehabilitation of the environment; Economically viable solutions; Containment of excess surface runoff upstream; Control of impacts from new developments on the drainage system; Priority towards the control of soil-sealing; a 20-year planning timeframe (DAEE, 2012).

The first version of this plan, elaborated in 1998, was based on the principle of restricting flows and storing water rather than increasing canals (Abril, 2016). The MMP-ATB, now in its third version, has been incorporated into the new basin plan (Interview-B6). It promotes a regional view of water-related risks and is implemented within 12 Drainage Districts, based on sub-basins divisions (FABHAT, 2016). The main funds come from municipal and state budgets (DAEE, 2012). The MMP therefore functions mainly to guide municipal governments to adjust their local drainage plans, and for state investments. In 2010, the Supreme Court established that the adoption of a ‘drainage tax’ as a financial mechanism was constitutional, and it has been implemented in at least one municipality (STF, 2010; DAEE, 2012). The ATB committee also funds certain projects through the FEHIDRO (FABHAT, 2016). Other sources of funding that the State and local governments can try to obtain include international funding (e.g. World Bank, IDB), federal funding (e.g. the National Bank for Economic and Social Development) and state funding (e.g. FEHIDRO, public-private partnerships) (DAEE, 2012).

The plan emphasizes that urbanization and soil-sealing aggravate flood risks and shows the importance of coordinating municipal drainage plans with the macro-drainage plan. It also involves partnerships between the DAEE and municipalities for infrastructure works, and with the EMAE for flood control and information-sharing (Interviews-B4/B19). By integrating both urban and basin considerations, it thereby links to both IRBM and UWM.

Effectiveness on actors in terms of mandated goals

In practice, the DAEE takes on a dominating role. There seems to be more coordination between the DAEE and individual municipalities than between neighbouring municipalities (Interview-B8/B17). For instance, the DAEE sets flow quotas for municipalities and these are generally respected (Interview-B24/B30). The lack of horizontal coordination is a challenge
because municipalities, through their civil defence departments, are still largely responsible for dealing with water-related risks, and they act in an isolated and reactive manner. They must develop a drainage plan, but many municipalities still lack one (FABHAT, 2016). They often have limited financial resources and are reluctant to spend these outside their own borders through regional-level measures, despite sharing rivers and streams with neighbouring municipalities (Interview B17). Between municipalities of different political parties, cooperation is even more limited, and tensions can be high (Interviews-B17/B23/B24).

The Macro-drainage plan is not integrated with Wat&San planning, even though large volumes of wastewater are diverted into stormwater drains and streams (Travassos and Momm-Schult, 2013) (Interviews-B4/B5/B22/B24/B30/B32). Solid waste also aggravates flood risks, by blocking drains and channels, but this is not addressed in the Macro-drainage plan (DAEE, 2012). Local governments are also responsible for land use management and urban planning. However, they have often been unable to prevent the informal occupation of areas at risk, and as a result, there is increasing support for regularizing and re-urbanizing informal settlements (Interviews-B4/B17). While the Macro-drainage plan devides technical, economic and environmental solutions surrounding larger rivers, it cannot directly act on land use management and urban planning. Local-level and basin planning identify vulnerable areas and potential responses, but ultimately only have limited powers to guide municipal urbanization and development (Travassos and Momm-Schult, 2013).

While the third version of the MMP-ATB aims to contain deforestation, preserve riverbeds and retain waters upstream, most actions of the first and second version of this plan have focused on storing and diverting excess rainwater, dredging and other engineering works such as river channelling (FABHAT, 2016) (Interview-B8). This reflects the plan’s conventional, linear approach to UWM. One of the main infrastructural measures are the concrete reservoirs known as ‘large pools’ (piscinões), which receive and hold excess water runoff and prevent flooding during heavy rains (FABHAT, 2016). The idea of storing excess water to mitigate flood risks was a departure from the previous approach focused on rapidly discharging water downstream (Travassos and Momm-Schult, 2013). The piscinões have been criticized, as they tend to accumulate sediments and require extensive maintenance, they ignore the roots of the problem (e.g. erosion from land use changes upstream, soil-sealing), and the ecosystem functions of floods in certain environments, such as aquifer recharge and the transportation of sediments (Travassos and Momm-Schult, 2013) (Interviews-B17/B30). In addition, while they may address small and medium-sized flood events, they may not be sufficient for larger events (Travassos and Momm-Schult, 2013).

Nature-based solutions for stormwater infiltration and water treatment measures are not given emphasis or have been implemented sporadically by various municipal departments, without a basin logic, inter-sectoral coordination and maintenance (Machado, 2017; Cavalcanti, 2018). São Paulo City has expanded green infrastructure measures through its dykes, drainage systems and green areas in an area along the Tietê River. The municipality of Guarulhos, on the other side of the river, was not informed or involved in these works, leaving it more vulnerable as river flows could only spill to one side (Interview-B24). As erosion and siltation are cumulative problems that are not immediately apparent, they do not receive adequate attention (Interview-B17).
Municipal Master Plan for Drainage and Stormwater Management, launched in 2010, which envisioned “another relationship between the city and its rivers”, combining the river basin, land use and green infrastructure (Bis, 2017) (Interview-B24). However, most municipalities of the MRSP do not have such a plan at municipal level. A basin-wide project of the Macro-drainage plan is the Tietê linear park, which would extend along 75 km, from São Paulo to the springs of the Tietê River and is under development (DAEE, 2012).

Impact on inclusiveness and sustainability

Almost two decades after the implementation of the first Macro-drainage plan, flooding remains a recurrent challenge in the MRSP. According to the new basin plan, 50% of municipalities in São Paulo State and most of the ATB’s municipalities were affected by floods (FABHAT, 2016) (Interviews-B5/B17). Flooding events in the municipality of São Paulo increased from 736 to 1191 between 2007 and 2016 (Bis, 2017).

Residents in informal settlements located in floodplains or steep hillslopes are the most exposed to water-related risks (Interviews-B8/B24). These areas often lack adequate infrastructure for sanitation, drainage and solid waste collection, which increase the risks, through contamination and clogged drains (Hordijk et al., 2016) (Interview-B24).

Many of the measures in place to address flood risks, such as dredging, are costly and address only the symptoms of the problems (Interviews-B17/B19). The total dredging of the Pinheiros river would require removing around two million cubic metres of accumulated sediment and other materials (Interview-B19). Due to contamination, the transportation and disposal of these sediments is an added challenge (Interview-B17). As opposed to services such as drinking water provision and sewage collection and treatment, stormwater management does not generate any revenue and often relies on federal and state funds (Interviews-B18/B24). In low-income and informal settlements, residents are often left to their own devices to prevent flooding, and improvise walls and other measures to cope (Brandeler, 2013; Hordijk et al., 2016).

6.4.3 INTEGRATED SEWAGE SYSTEM

Design

As with water supply, SABESP developed an integrated system for sewage collection and treatment at the metropolitan scale as part of the Tietê Project, now in its fourth phase (see Box 6.1). This was based on the premise that integrating sewage mains across the metropolis and building fewer, larger sewage treatment plants would enhance efficiency through economies of scale (Interviews-B5/B11). This system reflects the interconnections between metropolitan municipalities, as pollution flows downstream (Interview-B5). SABESP divides the basin into sewage discharge basins that follow hydrological boundaries and guide the spatial planning of sewage collection and treatment (FABHAT, 2016). Six large treatment plants spread across the MRSP’s core and roughly three times as many smaller plants were part of ‘isolated systems’ in the periphery, where the more distant location, low-density of population and other physical
factors made this more cost-effective (FABHAT, 2016). The number and the capacity of individual treatment plants is in constant expansion, as SABESP pursues the goal of universalizing these services, and some municipalities of the periphery still discharged their sewage *in natura*. Some of the municipalities with local utilities, particularly those more centrally located within the MRSP, transported part of their sewage to SABESP’s treatment plants (FABHAT, 2016).

**Box 6.1 The Tietê Project**

In the early 1990’s, SABESP introduced the Tietê Project after growing public outrage with the Tietê’s contamination, a successful petition by the NGO SOS Mata Atlântica (SOS Atlantic Rainforest), and the added media attention from the Rio 1992 Conference (Interviews-B3/B31). The project aimed to expand sewage collection and treatment across the MRSP to prevent effluents from reaching the Tietê River or its tributaries. Critics argued that progress had been slow despite around USD 2.7 billion invested over the last 25 years (Mori, 2017). The 2013-2015 water crisis was a further setback as investments were divested towards water supply, and the pollution of the river expanded from 65 km to 130 km (Interview-B31).

One of the largest wastewater treatment plants in Latin America is located in Barueri, a municipality of the MRSP downstream of São Paulo. It treats a large proportion of the MRSP’s sewage, and the municipality of São Paulo is involved in investments and decision-making regarding the plant (Interviews-B11/B12).

*Effectiveness on actors in terms of mandated goals*

In 2010, 87.3% of households in the MRSP were connected to the sewage network, up from 81.4% in 2000 (FABHAT, 2016). Peripheral municipalities had lower sewage collection levels, even though many are located in sub-basins with important springs (FABHAT, 2016). However, not all sewage collection pipes are connected to treatment plants and much of the collected sewage is discharged in waterways without treatment (FABHAT, 2016; Goldenstein, 2017) (Interviews-B4/B7). Some local utilities have high rates of collection and treatment, mainly those in relatively wealthy municipalities, and others do not. The municipality of Guarulhos, with approximately 1.3 million inhabitants, had a municipal utility and only treated around 5 to 8% of its wastewater, although it collected around 89% of it (Interviews-B22/B28). Most of the collected wastewater was directed towards stormwater drains and into streams, even though SABESP had a sewage treatment plant nearby (Interviews-B5/B22). This may be due to inter-municipal rivalries and Guarulhos avoiding the loss of future revenue opportunities (SOS Mata Atlântica, 2017). The Barueri treatment plant is surrounded by municipalities with some of the lowest rates of collection and treatment in the MRSP (FABHAT, 2016). In part this is because connecting such a large region requires installing an extensive network of pipes and large sewage mains. However, in many cases the sewage interceptors and treatment plants in the central areas of the MRSP are in place, but there is only a low flow of wastewater towards the treatment plants due to the difficulty of installing sewer mains in riverbeds of the tributaries,
due to their informal occupation (FABHAT, 2016). This also concerns SABESP’s isolated systems and those operated by municipal utilities in some metropolitan municipalities (FABHAT, 2016).

Part of the population in areas not covered by the public network have self-built and unregulated sceptic tanks (D’agostino, 2013) (Interview-B21). Alternative solutions, such as adequately built and regulated sceptic tanks or small-scale decentralized treatment plants could support an expansion of sewage collection and treatment in marginalized areas, but such options are not mainstreamed. Resistance from governments at different levels and SABESP towards such solutions, even for informal settlements, are likely due to the need for a significant cultural change among water sector professionals, politicians’ fondness of large and visible public works (believed to bring more votes) and the practical challenges of maintaining and regulating multiple, dispersed plants (Interviews-B30/B32).

As mentioned before (see 6.3.5), municipalities with lower financial and human capacity, had non-existent, outdated or inadequate Wat&San plans. Municipalities require such plans to qualify for federal funds to invest in sanitation. For ARSESP, inadequate plans are also problematic as the agency relies on them to evaluate whether utilities are fulfilling their responsibilities (Interview-B11). Despite interconnections through water flows and large-scale infrastructure, municipal Wat&San plans are developed in an isolated manner (Interviews-B12/B36). They are neither coordinated with the Wat&San plans of neighbouring municipalities, nor with other sectoral plans within their own borders, leading to contradictions between the identified needs and goals of different sectors (Interviews-B6/B23).

The lack of local level planning leads SABESP to develop its own, informal plans (see 6.3.3). Although cross-subsidies between municipalities allows SABESP to expand services while charging the same tariff, poorer and smaller municipalities tend to be left behind. One of the MRSP’s municipalities with the lowest rates of sewage collection and treatment, Mairiporã, had not had new investments in sanitation since the 1970’s (Correio Juquery, 2017). There is little transparency on how SABESP makes investment decisions in different municipalities. In addition, tensions may arise from the fact that municipalities within metropolitan regions generally subsidize others due to their relatively lower costs, and this can contribute to arguments in favour of re-municipalisation (Cruz et al., 2016).

Furthermore, unplanned urbanization hinders utilities’ ability to install sewage infrastructure (Interviews-B22/B32). This is especially challenging for municipalities that are largely or entirely contained within an APRM due to restrictions on development (see 5.4.4), although even some wealthy areas of the MRSP are not connected to sewage treatment plants (Interview-B31). The goals and mandates of the Wat&San utilities, the environmental sector and municipal governments are set at different levels: Protected Areas and water contamination are regulated at state level (by CETESB), the responsibility for providing Wat&San and managing land use is municipal, but infrastructure that prevents sewage contamination is mainly managed by a state-level entity (SABESP) (Interviews-B4/B5/B15/B22/ B32). The urban and environmental agendas are at odds, with some actors pushing for better protection of areas of springs and others supporting land tenure and upgrading of informal settlements in these areas so that they can receive sanitation services (Interviews-B4/B5/B25). This has led
to a deadlock, where informal settlements are neither relocated nor regularized or upgraded, and residents continue to have inadequate sanitation that contaminates water bodies (Interviews-B4/B5/B6/B7/B15/B19/B32/B33). This reflects a lack of a common vision of the urban/metropolitan water cycle (Interviews-B4/B25).

Impact on inclusiveness and sustainability

The lack of sewage collection and treatment across the MRSP has caused the contamination of waterways and of the Tietê River far downstream, decreasing water availability (Interviews-B7/B16/B17/B20/B36). The cost of the contamination of the Tietê River by the ATB is estimated at more than USD 19 million per year, based on the volume of Organic Water Pollutant in the yearly discharge of sewage within the basin and the fees charged for wastewater discharge (SOS Mata Atlântica, 2017). Sewage contamination causes visual pollution and discomfort from its smell, threatens public health (e.g. dengue, leptospirosis, and diarrhoea) and water systems, substantially reduces potential water uses and leads to the loss of commercial value of riverside areas (Brandeler, 2013; Goldenstein, 2017) apart from the damage to the ecosystems that are affected (see Figure 6.2).

Figure 6.2 View of the Billings Dam where the Pinheiros River flows in

Source: Author
Industrial contamination has decreased through stricter regulations and the move of industries to neighbouring basins such as the PCJ basin, but it has remained a challenge within the MRSP (SOS Mata Atlântica, 2017) (Interviews-B7/B31). Data from 2008 on over 26,000 industries linked to SABESP’s sewage system showed that only 43% were connected to a treatment plant (FABHAT, 2016). A 2014 study estimated that 28% of industrial wastewater in the MRSP was discharged untreated into rivers and streams (Oliveira et al., 2014). Monitoring illegal discharges remains a challenge (Interview-B31). Inadequate solid waste management, particularly in informal settlements, and insufficient environmental awareness and education has also affected water quality (Interviews-B19/B20/B36). The EMAE removes around 10,000 tons of solid waste (and a few corpses) from the Pinheiros River each year, which accumulate in their dams (Interview-B19).

Water contamination and increased water demand have led to conflicts between users. Moreover, the extreme contamination of the Pinheiros River, and thereby of the Billings Dam, has threatened the reservoir’s water supply potential. As a result, since 1992, water from the Pinheiros River is only released into the dam after heavy rains, as a flood control measure, and the dam’s hydropower potential has been reduced (Interview-B19).

6.5 INSTRUMENT ASSESSMENT AND REDESIGN

Although Wat&San, stormwater and flood risks are mainly local responsibilities, state-level actors played important roles in the MRSP’s UWM. Informal urbanization and inadequate urban planning are a major obstacle for all three of the analysed instruments (see Table 6.3).
<table>
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<tr>
<th>Instrument design</th>
<th>Effect on actors</th>
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<tr>
<td>Water tariffs</td>
<td>[++] Differences between utilities, but most of the MRSP has tariffs designed to be affordable and financially sustainable</td>
<td>Ecol: [--] Tariff structure does not incentivize rational water use, nor link to water availability. Bonuses and fines during the water crisis helped reduce consumption but were discontinued. Soc: [++] Overall affordable, but many households that qualify for social/favela tariffs do not receive these, even though SABESP has significant profits. Econ: [-] SABESP’s recurrent profits suggests to some that it could invest more heavily in sanitation and reducing losses. Ignoring this will lead to higher costs in the future. Rel: [-] Lack of transparency in tariff calculation. The regulator is much weaker than SABESP.</td>
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| Macro-drainage plan | [++] Multi-stakeholder planning with structural and non-structural measures, managed at sub-basin level | Ecol: [-] Hard engineering focus that ignores ecological functions. Upstream erosion and solid waste are not addressed. Soc: [-] Floods and mudslides have a heavy toll, disproportionately affecting poorer, marginalized inhabitants. Econ: [-] Flood costs are high, enhanced by the focus on measures that address the symptoms rather than the causes. Rel: [0] Significant responsibility remains at municipal level, so poorer municipalities are less prepared. However, this basin approach provides them more support. |

| Integrated Sewage system | [+] Planning within sewage discharge basins. Focus on centralized infrastructure and small systems in peri-urban and rural areas | Ecol: [-] Environmental damage from sewage contamination. Soc: [-] Waterborne diseases, smell and visual pollution. Econ: [-] Contamination remains high despite large investments in sanitation. Water has to be imported. Rel: [-] Marginalized residents are more exposed to contaminated water. Peri-urban municipalities receive less attention from SABESP. |

Relative assessment scores: ++ Very positive; + Positive; 0 Neutral; - Negative; -- Very negative (See 2.4)
**Redesign**

Based on the evaluation of the above instruments, the following redesign options are recommended.

**Water tariffs:** Currently, utilities are incentivized to increase water sales, leading to more water imports. Incentives for rational water use need to be better integrated into the tariff system. For instance, eliminating the decreasing volumetric rates of water consumption for industrial and commercial consumers (i.e. currently, the more they consume, the lower the cost of an individual cubic metre) could reduce the consumption of large water users. Water saving measures, such as fines for excessive consumption (based on average consumption) implemented during the water crisis, could immediately go into effect during water shortages (e.g. when water supply reservoirs drop below a specified level), as is done in the energy sector. Incentives for installing/retrofitting water saving equipment and appliances, such as subsidies or faster water use permit approvals, could further promote behavioural changes.

A significant obstacle is the disconnect between the tariff structure and water availability in the basin (with the exception of bonuses and fines applied during the water crisis). This is not only the case for SABESP’s tariff, which benefits from a discounted fee for water imports from the Cantareira System (see 5.4.3), but also for municipal utilities that receive bulk water from SABESP and do not always pay the latter for this service. These local utilities are then more likely to disregard water availability when setting their tariffs. To achieve greater environmental sustainability, ARSESP may include water availability considerations in tariff regulations and hold SABESP and other utilities in the MRSP accountable to higher standards (i.e. increasing rational use, reducing water losses), in addition to the narrow focus it has now. Furthermore, by increasing transparency, utilities could show the connection between the sewage tariff and investments in sanitation. This involves making information on investment spending more transparent and accessible, and discussing these decisions in public hearings. This could lead to greater social control, as consumers currently pay this tariff even if they do not receive sewage collection and treatment services.

In addition, a greater share of SABESP’s (significant) profits could be diverted towards subsidies for households that qualify but currently do not benefit from these. They could also be invested in programmes for expanding water supply services in informal settlements (when appropriate), which would benefit shareholders as well by increasing the number of paying consumers. If sanitation services are expanded to informal settlements, the reduced contamination in water bodies would reduce costs of treating and using this water.

**Macro-drainage plan:** To be effective, the Macro-drainage plan must be coordinated with municipal stormwater plans and other sectoral plans at local and state levels (Interview-B36). Local governments could attempt to harmonize their stormwater, Wat&San and solid waste management plans with the Macro-drainage plan to ensure synergies and coherence, with support from the basin committee and FEHIDRO funds. Although municipal governments generally coordinated their drainage-related policies and actions with the DAEE, they did not always cooperate with each other. Updating local stormwater plans in line with the macro-drainage can help ensure that local decisions do not cause externalities on neighbours.
In addition, expanding green infrastructure (e.g. bioswales, floodplain rehabilitation, community gardens, green roofs) could provide relatively low-cost alternatives to stormwater reservoirs, dredging works and other standard measures, while providing various ecosystem services. Cost-benefit analyses at regional level can estimate when such options are preferable. Areas further from the urban core are more likely to benefit, whereas the urban core generally lack the necessary space. The experience of existing green infrastructure projects indicates the need for both regional and inter-sectoral coordination, in particular the environmental, planning and housing sectors.

Climate change considerations are not incorporated into the Macro-drainage plan. This may be due to a lack of studies on expected local impacts. Such studies are crucial to develop resilient infrastructure and identify areas that could become more exposed to risks from extreme weather events.

**Integrated sewage system:** In comparison to water supply, where local authorities depend on water resources beyond their borders, requiring centralized management, wastewater can often be more effectively managed at smaller or intermediary scales (Interview-B30). Large sewage plants can foster economies of scale and are sometimes the most effective approach, but the MRSP’s largest treatment plant operates under capacity as many of the surrounding areas consist of informal settlements with no sewage connections. Other areas also fail to connect to this plant due to the lack of large sewage mains. Peripheral areas of the MRSP and other areas with specific characteristics may be better served by local treatment options. In particular, small-scale, local sewage treatment has greater potential in informal areas, including those in the APRMs where building or biophysical characteristics make it almost impossible to connect households to the sewage network. In such cases, local governments and utilities can collaborate on alternative solutions. Local governments can lead by indicating in their Wat&San plans where such alternatives would be viable. However, local governments also need greater support in enforcing land use restrictions and in upgrading informal settlements. Within the APRMs this could be through technical and financial support (i.e. FEHIDRO funds) from the basin committee. Access to these funds should also be conditional on the updating and harmonizing of Wat&San plans with the APRM’s plans.

Although there are smaller wastewater treatment plants across the basin, SABESP has a mega-plant downstream of the MRSP, along the Tietê River. The downstream location also prevents retaining and reusing treated effluents within the basin (for human uses or for ecosystems), thereby maintaining dependence on external water sources. Decentralized wastewater management, at sub-basin level, with larger or smaller treatment plants according to populations density would lead to plants operating at higher capacity and the repurposing of treated effluents within the basin.

There have been suggestions for compensating the basin downstream of the ATB for the contamination of the Tietê River that it receives by redirecting (part of) the revenue from wastewater discharge fees to the neighbouring basin committee. This would be fair, but as the ATB committee currently receives these fees it is not clear whether it would incentivize greater investments in sanitation by SABESP and other utilities in the MRSP. However, it would
negatively impact the ATB committee’s project funding, including those related to increasing sanitation coverage.

Missing instruments

Regional policies: In the absence of an official state policy for Wat&San and the weakness of municipal Wat&San planning, SABESP has taken a dominant role in shaping both (Interviews-B4/B29/B30/B32/B34/B36). This has led to a regional and infrastructure-oriented approach to Wat&San for the MRSP, with the development of Integrated Metropolitan Systems for water supply and for sanitation. SABESP’s approach is top-down, and local governments, the basin committee and other state actors have little influence. The SSRH or DAEE could be the appropriate actor to develop a state-level Wat&San policy that oversees regional sanitation planning and harmonizes utilities’ plans. Water services could then also be better coordinated with the state water resources policy, as the DAEE has significant attributions in both areas (Interview-B36).

The development of the Integrated Urban Development Plan (IUDP) by the EMPLASA, (see 6.3.4), could potentially strengthen integrated planning, including for Wat&San, at the metropolitan and macro-metropolitan level. The advantage is that the macro-metropolitan scale allows for considering interlinkages between basins for bulk water supply. The ARSESP could oversee the implementation of the IUDP’s Wat&San plans, as this complements its evaluation of municipal plans. Knowledge and data-sharing between municipalities and compensation mechanisms (e.g. for downstream municipalities that receive contaminated waters) within the IUDP’s regional planning for Wat&San and water-related risks could further enable coherent regional planning. Local level knowledge tends to remain where it is produced and a participatory approach in regional planning is required to ensure knowledge sharing (Hordijk and Baud, 2006). Furthermore, coordinating a regional Wat&San plan with regional plans for environmental preservation, land use, urban planning and housing could lead to a more sustainable and inclusive strategy for informal urbanization (i.e. which informal settlements can be regularized, which must be relocated, which can be upgraded), as this represents the greatest challenge for expanding Wat&San services and addressing water-related risks.

Climate change approach: The local climate change impacts and adaptation were not high on the agenda for most municipal or state actors, despite frequent floods and the recent record-breaking drought, and the heat island effect was generally seen as a greater preoccupation (Interviews-B7/B8/B24/B32). A State Policy for Climate Change was adopted in 2009, establishing the State’s commitment towards climate change mitigation and adaptation, emphasising sustainable development, the polluter-payer principle, civil society participation and multi-level cooperation, among its main principles. It consolidates existing policies relevant for climate change mitigation and adaptation across departments (São Paulo Legislative Assembly, 2009). These focus mostly on mitigation measures, and even then, these are more about keeping inventories on emissions and disseminating information than about proactive measures (Interview-B7/B8/B9). While some activities in state departments such as CETESB have synergies with adaptation goals, there are few projects specifically aiming for this (Interview-B8).
Efforts can be made to mainstream climate change adaptation into sectoral plans and the river basin plan. Although climate proofing development involves costs, current strategies focused on increasing water supply through inter-basin transfers and mitigating floods through stormwater reservoirs will become increasingly expensive and prone to fail, as climate change is forecasted to lead to a decrease in precipitation but spread over fewer, more intense rainfalls. Measures involving water demand management, floodplain rehabilitation and environmental preservation would enhance climate change adaptation, thereby reducing future costs. As adaptation strategies need to be regional, in order to consider interlinkages between areas (e.g. areas that provide crucial ecosystem services, large-scale infrastructure that crosses the region, upstream/downstream effects), a key obstacle is coordination between actors and political will. Climate change adaptation should be a cross-cutting objective of the various sectoral plans of the IUDP. In addition, task forces could be set up between agencies at state and municipal levels to build on common challenges and goals and identify synergies. For instance, developing a network of linear parks along waterways and green areas in flood-prone areas brings together agencies for stormwater management, risk management, sanitation, recreation, urban planning, and housing, where their diverse interests converge around one project.

**Integrating urban and water policies:** Addressing the MRSP’s water-related challenges requires greater coordination between water and urban policies to jointly discuss how to address the challenge of informal settlements. They could identify areas to legalize and urbanize, facilitating the provision of basic infrastructure and services and thereby also reducing wastewater contamination in nearby water bodies. This concerns long-established settlements where eviction and relocation are not socially acceptable or financially viable options, but it cannot include occupations within floodplains, areas at risk and other areas where sanitation infrastructure cannot be installed (e.g. characteristics of housing construction) (Interviews-B4/B6/B22). Such occupations must be relocated to social housing projects, ideally nearby to be less disruptive.66 A regional strategy must identify areas available for these housing projects across the MRSP, including by revitalizing inner-cities and through densification policies. Municipal master plans must be harmonized with Wat&San plans and with the IUDP (Interviews-B4/B5). A regional strategy requires developing policies and plans that address regional inequalities across the MRSP and its rural hinterlands, as these put disproportionate pressure on peripheral municipalities with little capacity and that must preserve APRMs (Interviews-B4/B14/B15/B33). A regional strategy should develop financial instruments to support access to social housing for those who need to be relocated, such as cross-subsidies between high-end developments and low-income/social housing67, and compensation mechanisms for municipalities that face restrictions on their development in order to preserve areas with crucial ecosystems.68

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66 A former SABESP employee estimated that around 2.3 million people in the ATB live in areas of springs. He calculated their need for housing at 50,000 housing units, for some 200,000 people: “That is for those who would need to be removed, and the housing of another 300,000 or 400,000 would need to be upgraded, which would require land use regularization” (Interview-B6).

67 Suggestion by a respondent from the State housing department (Interview-B15).

68 As was included in the original NWL.