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Governing Resilience Planning: Organizational Structures, Institutional Rules, and Fiscal Incentives in Guangzhou

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Abstract: Researchers and policymakers have long called for a collaborative governance process for climate adaptation and flood resilience. However, this is usually challenging when urban planning is supposed to be integrated with water management. Using the Chinese city of Guangzhou as a case study, this study explores the long-term disadvantaged conditions of urban planning in flood governance and how this situation is shaped. The findings show that, in comparison to the increasingly dominant position of water management in flood affairs, the urban planning system has had weak powers, limited legitimate opportunities, and insufficient fiscal incentives from the 2000s to the late 2010s. Those conditions have been shaped by organizational structures, institutional rules, and financial allocation in urban governance, whose changes did not bring benefits to urban planning. The emergence of the Sponge City Program in China in 2017 and its implementation at the municipal level is deemed to be a new start for urban planning, considering the encouragement of nature-based solutions and regulatory tools in land use for flood resilience. Even so, the future of this program is still full of challenges and more efforts are needed.

Keywords: water management; urban planning; flood governance; climate adaptation; urban resilience

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1. Introduction

Academics and policy makers dealing with climate adaptation, disaster response, and resilience have highlighted the significance of governance or collaborative process in delivering interventions that respond to external shocks and pressures [1,2]. According to Ansell and Gash (2008) [3], governance refers to the procedures of decision making complying with laws and rules to coordinate the actions and positions of the different stakeholders from across various public agencies and non-state actors. Attention to this topic is increasing due to the uncertainty of future climate change, the wide-ranging negative impacts on exposed areas, and the complexity of policy making. The participation of diverse stakeholders is required to ensure inclusive and context-specific solutions [4,5]. However, narrowing down divergent interests across multiple stakeholders presents a major challenge for policy making and policy implementation. The same is true for improving coordination across levels of government and balancing the interests of citizens and market actors [6–9].

A similar situation arises within flood governance with links to climate adaptation [10–12]. It occurs when urban planning (or spatial planning) is supposed to work jointly with water management for adaptation actions and consider flood threats in their work [13]. Planning's enthusiasms can be impaired by conflicting policy sectors, 'fragmented and convoluted' frameworks and legislations, limited financial support, finite knowledge of nature and disasters, etc. [14–17].

The empirical material presented in this paper comes from the Chinese city of Guangzhou in the province of Guangdong. Earlier research indicated that municipal planning institutions' participation in flood affairs was minimal [18], and flood risks associated with climate change were neglected in planning policy documents [14]. Things seem to have changed around 2017 when *Guangzhou Sponge City Plan* was enacted at the municipal level in response to the *National Sponge City Program (NSCP).* The plan and program called for the proactive involvement of urban planning in flood governance and wide, cross-sectoral cooperation with disciplines in, for instance, flood risk management and hydrological engineering for flood safety and urban resilience [19]. Against the emerging transition in Guangzhou and China, much research and practice start to discuss better land development with the consideration of flood risk and climate change, and a collaborative management approach spanning boundaries between urban planning and flood risk management [20,21].

The research follows this transition and addresses the question: what are urban planning's changes related to flood governance and major constraints? The inquiries are answered by focusing on the nexus between urban planning and water management considering governance settings in Guangzhou from 2000 to 2021. The exploration responds to recent calls to integrate urban planning with flood risk management [13], while also resonating with broader governance literature stressing how different contextual factors (e.g., powers and resources allocations, institutional arrangement, and incentives for stakeholders to participate) can hinder or facilitate the governance process in the face of climate change and natural hazards [8,22,23]. These perspectives are increasingly recognized by many scholars but are still underdeveloped in the planning literature.

The remaining paper is divided into seven parts. The first part introduces the theoretical basis that inspires this study. The second part outlines the background of the case study and the methods employed in the study. The following three parts uncover the position of urban planning in flood governance by tracing the dynamics of organizational settings, institutional rules, and fund allocation. The paper closes with a discussion of the research findings and a proposal for future research agendas.

2. Theoretical Basis and Dimensions for Analysis

Preliminary research indicates a range of constraining factors that put planning institutions at a disadvantage in the decision-making process of flood affairs. These include limited access to data and weak knowledge grasp, misfit organizational structures [24], undefined roles of authorities [25], budgetary constraints [26], divergent (and often conflicting) mindsets among stakeholders, etc. [27]. Unfortunately, they gave limited clues about how to build or change the disadvantages. This study partly fills the gap by casting light on the ways those constraining factors are shaped and proposing the ways out based on the Chinese experience.

Organizational structures, the roles of authorities, and budgets are three key factors, which are deeply discussed in this paper. In practice, they are often interwoven in flood governance. A typical case is a Dutch program, *Room for The River.* It was proposed in the 1990s to reduce flood risk. Foreseeing problems, such as fragmented policy institutions, conflicting objectives between politicians, potential exceeding budgets, and postponements, challenged the Ministry of Infrastructure and Environment to formulate relevant policies [28]. These difficulties were addressed by an alternation of rules between players to reach a consensus and avoid deadlocks. The main target for flood protection was broadened to a multi-target agenda, including, e.g., spatial quality, tourism, harbor expansion, new forms of housing (on the water), and new economic activities [28,29]. The adjustment created flexibility for different stakeholders to organize a process of give-and-take negotiation, involving, e.g., concessions to pay for the cost of widening and deepening rivers which benefited harbors' development [29].

In the following analysis, we first concentrate on the organizational structures of flood governance with links to urban planning. We regard structured organizations as the conse-

quence of stakeholders' selection process in a political or financial arena. Stakeholders with strong powers are more likely to be invited to join a decision-making process and result to more likely be in a dominant position, which is referred to as holding an organizational monopoly [30,31]. Weaker stakeholders are often left out and selected exclusively. The research on this topic helps to reveal the role of urban planning in multi-stakeholder planning and the barriers to cooperation among the policy actors which is needed to address complex challenges.

Secondly, this study explores institutional rules or protocols that are developed for urban planning to play a role in climate adaptation. They are often presented as laws, regulations, memos, technical tools, or guidelines, while also embedded in informal rules such as institutional ethics, political culture, tacit agreements, and shared understandings between the policy stakeholders. These rules set the principles and procedures that stakeholders should follow and determine the scope for them taking certain actions (legitimate opportunities) rather than others in flood governance [32].

Last but not the least, the study spares attention to budgets or funding allocation, which provide financial incentives for stakeholders in flood governance, as well as urban planning institutions. How funds are set aside determines the support for policy agencies and the expected achievements for the stakeholders. A lack of funds at the level of local communities can limit the development of approaches to support the implementation of property-level mitigation measures [26] and weaken the capacities of urban planners to ensure flood risk assessment in the planning process [33]. What is more, when introducing restrictions on land use, such as zoning, the legislation must offer financial alternatives to the landowner, or the municipality must buy the property to avoid negative reactions and disobedience. Financial support is, thus, related to the implementation of planning regulations [15].

Admittedly, many other factors are significant in flood governance. For example, institutional ethics can be partly a result of the history of conflict or cooperation between stakeholders [34,35]. However, it is impossible to cover all governance factors in one article, not to mention that some factors cannot be traced easily by policy documents or interviews. Thus, our research in Guangzhou is based on three dimensions. Empirically, organizational structures, institutional rules, and funds' allocation are fundamental characteristics of a governance setting, difficult to be changed, and thus any adjustments or reforms can change the macro policy arena and make a difference in resilience governance.

3. Methodology and Case Selection

3.1. Background to the Case Study

The case study underlying this paper spans roughly 20 years, from the early 2000s to 2021. During this period, Guangzhou experienced a dramatic urbanization process and rapid urban sprawl into flood-prone areas, which are highly exposed to floods (Figure 1) [36]. In the same period, water affairs-related institutions endured structural changes, which, in turn, have shaped the current political rules and forms at the local level (discussed in Sections 4–6).

It is notable that three major governmental institutions are related to flood affairs in Guangzhou: (1) the *Pearl River Commission* (regional flood control sector), (2) the *Water Affairs Bureau* (municipal water engineering sector), and (3) the *Planning Bureau* (municipal planning sector). At the regional level, the institutional environment concerning flood affairs has been quite stable since 2000 and is seldom affected by the recent *National Sponge City Program (NSCP)*. The *Pearl River Commission (PRC)* leads coastal flood defense regionally (within and also beyond Guangzhou's territory) under the supervision of the national sector *Ministry of Water Resources* (MoWR), and focuses on designing, building, and consolidating dyke systems. These dyke systems, which are supposed to handle a flood return period of 50–300 years (interviewees 1, 2), work as a safety baseline in the Pearl River Delta, which protects the southern lowlands from rising sea levels, sea tides, and inland flood basins from major river branches, e.g., North, West, and East Rivers.

By contrast, the territorial responsibilities of the *Water Affairs Bureau* and *Planning Bureau* at the municipal level changed a lot from 2000 to 2019, which is the main focus of this study. In the early 2000s, the Reform for "Water Affairs Integration" was launched in China nationwide. It encouraged a comprehensive water management system to provide constructures, services, and solutions to agriculture irrigation, urban water supply, water purification, flood risk management, canal dredging, etc. Guangzhou, in this context, built a professionalized *Water Affairs Bureau* in 2007, and the water management sector started to lead all flood affairs locally.

In the 2010s, things changed a bit. The *National Sponge City Program (NSCP)* was launched in China to manage pluvial flood risk, calling for the integration between engineering solutions, nature-based solutions, and non-structural regulations [19,37,38]. This program was initiated by the *Ministry of House and Urban-rural Development* (MoHURD), the *Ministry of Water Resources* (MoWR), and the *Ministry of Finance* (MoF), across professions and administrations. Among them, the MoHURD and MoWR are the highest central sectors relevant to urban planning and water management.

When it comes to municipalities, the *National Sponge City Program* leaves flexibility for local authorities to choose institutional leaders in a multi-disciplinary and multi-stakeholder context, combining national requirements with local needs for concrete implementation [21]. For instance, in Guangzhou, the *Land Resources & Planning Commission* (a governmental institution focusing on urban planning with limited experience and knowledge in flooding issues) was designated as the leader of the *Sponge City Plan* locally. The *Guangzhou Water Affairs Bureau*, even though naturally seen as the first candidate for leadership, was appointed as a supporter to assist the planning sector.

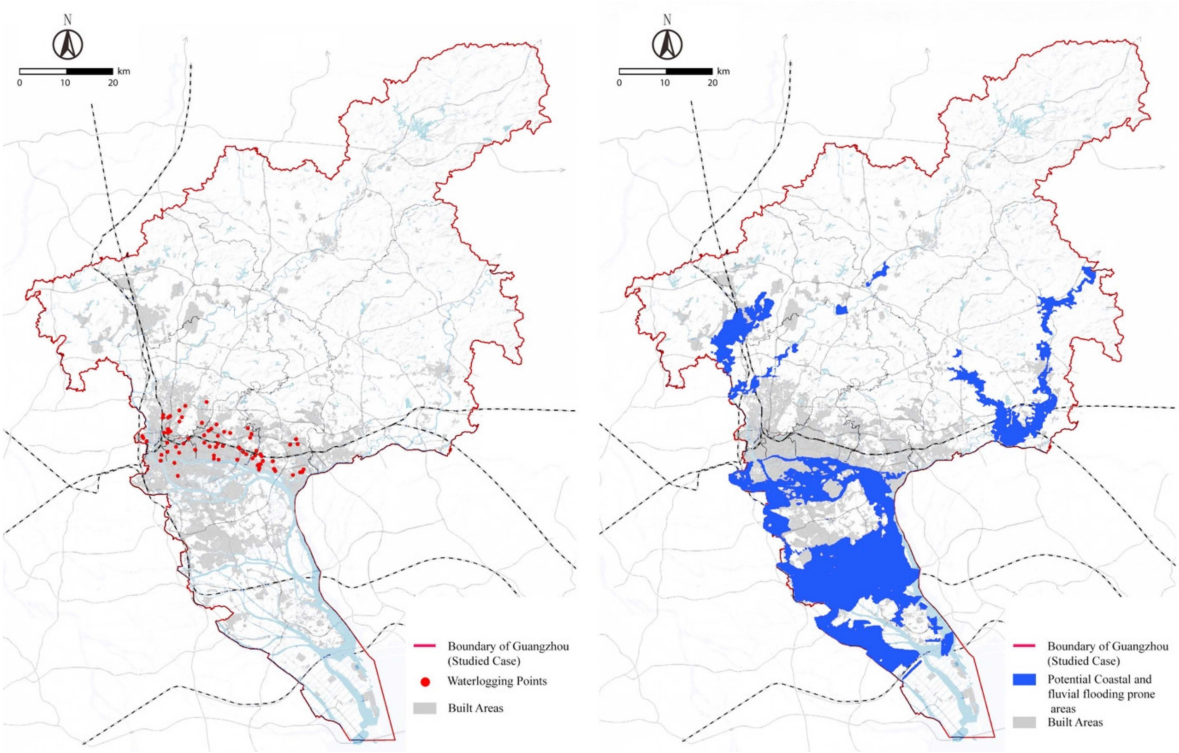

Figure 1. The waterlogging points in Guangzhou (**left**), and the areas prone to potential coastal and fluvial flooding (**right**), based on Guangzhou Sponge City Plan 2016–2030 [39].

3.2. Research Methods: Content Analysis, Literature Review, and Interviews

The research is built mainly on content analysis and literature review. The prime data sources are governmental policy documents, technical regulations, and government budget statements across disciplines including hydrology and urban planning, which are

open to the public and relevant to organizational changes, institutional rules, and spending. Research studies, historical archives, and media news are used as "grey literature" to uncover the background information relating to urban governance, such as restructures.

The "grey literature" is complemented by in-depth, semi-structured interviews for supplementary knowledge (Table A1 Interviews' logbook). It is used to collect information about institutional rules or internal ethics of urban planning and water management, which is not fully discussed in the literature. Interview questions include (1) How are flood affairs are managed? Any restructures in the implementation of the *Sponge City Program*? (2) How did (or do) planning authorities deal with the divergences from flood risk management? Any tools? (3) Any financial support for urban planning and flood risk management? (4) What challenges may hinder concrete flood resilience initiatives regarding the transition that Sponge City Program might bring? The responses from five interviewees are used to support the findings of this study.

4. Organizational Structures: Merger and Dominance

The local Guangzhou government witnessed reorganizations in 2008, 2014, and 2017, which caused long-term impacts even on how flood affairs are managed recently (Figure 2). The following section discussed them in detail on account of organization adjustments, driving forces, and the resulting impacts.

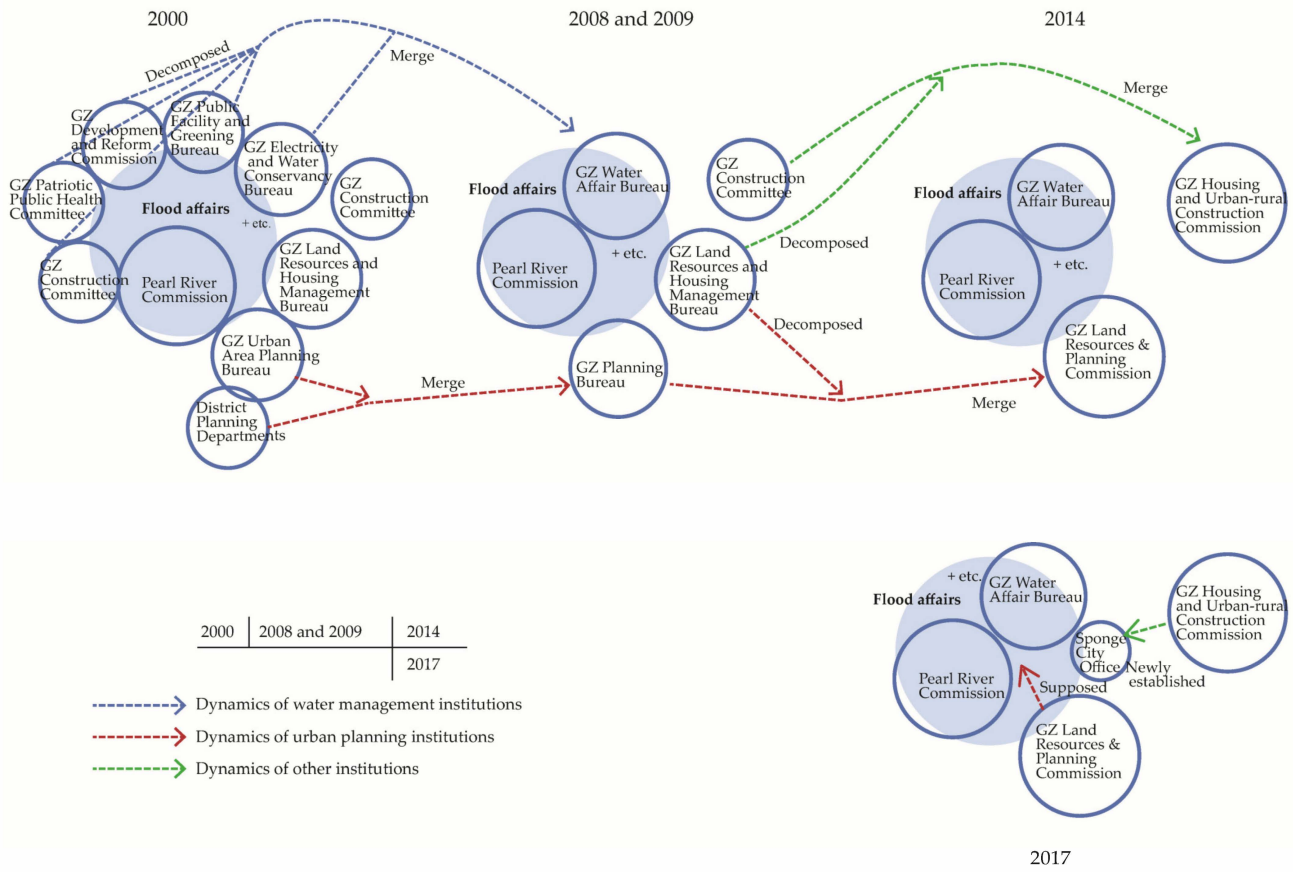

Figure 2. Dynamic organizational structures of Guangzhou (GZ).

4.1. The Rise of the Water Affairs Bureau in Flood Resilience Governance (2008 and 2009)

Generally, it is recognized that the establishment of the *Xiliu River Commission* in 1970 opened the era of professionalized water management in Guangzhou [40]. It focused on natural lakes and rivers' protection, reservoir construction, agriculture irrigation, hydroelectric generation, and flood drainage [41]. Even so, it merely served rural areas; urban areas were outside its administrative scope.

This way of water management was restructured in 2008 when the Xiliu River Commission's follower, namely the Guangzhou Electricity and Water Conservancy Bureau, was upgraded into the Guangzhou Water Affairs Bureau. The newly established Water Affairs Bureau converged the Guangzhou Electricity and Water Conservancy Bureau and partial functions in the Guangzhou Public Facility and Greening Bureau. The responsibilities and personnel on urban water affairs were added, e.g., the design, construction, and management of urban water supply, pipe-based flood drainage, wastewater treatment, canal dredging, etc. [42]. Consequently, the Water Affairs Bureau won the power to manage water affairs both within urban and rural areas.

In 2009, the Water Affairs Bureau's capacities were further strengthened by absorbing the partial functions of the Guangzhou Development and Reform Commission, Guangzhou Patriotic Public Health Committee, and Guangzhou Construction Committee [42]. Responsibilities and the skilled staff on schedule, monitoring, and financial management in relation to hydrological projects were separated from the abovementioned bureaus and merged into the Water Affairs Bureau, which led to its dominant position in flood affairs locally.

Two driving forces shaped these organizational reconstructions. The nationwide prevalence of the notion of Water Affairs Integration Management was one factor, which was initiated by Shenzhen in 1993 and officially introduced in Guangzhou in 2008 [42]. It praised an integrated and comprehensive system to address all water-related issues. In addition, there was a synergy between the promotion of Water Affairs Integration Management and a followed national call, namely 'Super-ministry Reform', which aimed to simplify governmental structures by cutting down redundant institutions and merging similar functions and was promoted in Guangzhou in 2009.

4.2. The Merger of Planning Bureaus for a Better Way of Land Use and Land Management While beyond Flood Affairs (2009 and 2014)

Guangzhou's urban planning system followed another way in organizational restructuring. Inspired by 'Super-ministry Reform', the *Guangzhou Urban Area Planning Bureau* and a number of *District Planning Departments* (working on rural areas in parallel) were united as the *Guangzhou Planning Bureau* in 2009. This transformation was to make municipal authorities fully in charge of district authorities and avoid the 'seesaw' leadership at the district level with one decision maker from the municipal planning bureau and another from the district (sub-municipal) planning department [1] [43].

In 2014, a following organizational change took place. This reorganization was operated in the context of the promotion of *Integrated Planning* nationwide. It was a concept calling for the coordination between economic, social, and development planning, urban–rural development planning, land use management, and natural environment planning, which were managed by multi-level and multi-divisional governmental sectors, usually mismatched with each other [44]. The *Guangzhou Planning Bureau* was merged with the partial *Guangzhou Land Resources and Housing Management Bureau* in relation to land management and mineral resources management, which led to a new institution called the *Guangzhou Land Resources & Planning Commission* [45]. The remaining of the *Guangzhou Land Resources and Housing Management Bureau* relating to housing management and real estate was incorporated into the *Guangzhou Construction Commission* and led to the *Housing and Urban-rural Construction Commission*.

These two institutional changes offered benefits for the urban planning system in land use management and economic development. Nevertheless, they turned out to have little influence on flood affairs and water institutions. The 2009 change narrowly focused on the merging of urban and rural development and the strengthening of vertical cooperation within the planning system [46]. The 2014 merger was to simplify the land development process and resolve mismatches between different policies, e.g., from the *Planning Bureau* and the *Land Resources and Housing Management Bureau*.

4.3. Minor Organizational Adjustments to Implement the Sponge City Plan (2017)

The promotion of the *Sponge City Program* brought no significant changes to the municipal structures but did trigger a minor change in the *Housing and Urban-rural Construction Commission* [2]. Beneath this municipal institution, a new municipal department—*Sponge City Office*—was founded in 2017. It was tasked with coordinating *Sponge*-related stakeholders, e.g., urban planning and water management institutions concerning making policies, monitoring construction progress, developing post-evaluations, and raising public awareness (interviewees 3, 4). Within the urban planning and water management sectors, there were no concrete organizational adjustments.

4.4. Summary

Since 2000, the central theme of organizational exploration has been building simplified but professionalized governmental sectors to deal with urban problems. In this process, the *Water Affairs Bureau* gradually took over the responsibility of municipal and rural water management and became a leading institution in flood affairs. Flood-related departments and staff were merged and accumulated under its wings, which strengthened its power. By contrast, the planning sector was disadvantaged in flood governance, missing water-related benefits in organizational structure and knowledge support.

5. Institutional Rules: Wet Territories vs. Dry Territories

Our exploration of the institutional rules focuses on how flood affairs were managed between the water management and urban planning sectors in territories or physical spaces (see Figure 3). In Guangzhou, the *Water Affairs Bureau* is mainly responsible for any constructions in 'wet territories' (or water bodies), including canals, rivers, natural lakes, and the infrastructures attached to them, e.g., dykes, levees, and pumps. By contrast, the *Guangzhou Planning Bureau* (and its follower, the *Guangzhou Land Resources & Planning Commission*) is mainly responsible for the land development beyond water bodies, namely 'dry territories'. These basic institutional ethics lead to a kind of territorial segregation physically.

5.1. Broader Executive Scope of the Water Affairs Bureau (2008)

Since 2008, the *Water Affairs Bureau* has endured the major responsibilities of flood issues in the regime of the municipality of Guangzhou through a combination of the *Guangzhou Water Conservancy Bureau* and *Public facilities and Greening Bureau*. Figure 3-early 2000s and Figure 3-2008 indicate this newly established bureau and its subordinated institutions (e.g., district Water Affairs Bureaus) own legitimacy to deal with flood issues within 'wet territories' and attached water-related public facilities no matter whether in urban or rural areas. Concrete initiatives included managing (1) defense walls along minor river branches and canals; (2) flood storage and buffer areas, such as large-scale wetlands, natural lakes, and reservoirs; and (3) water passages, e.g., urban discharge and sewer pipe systems and agricultural irrigation systems.

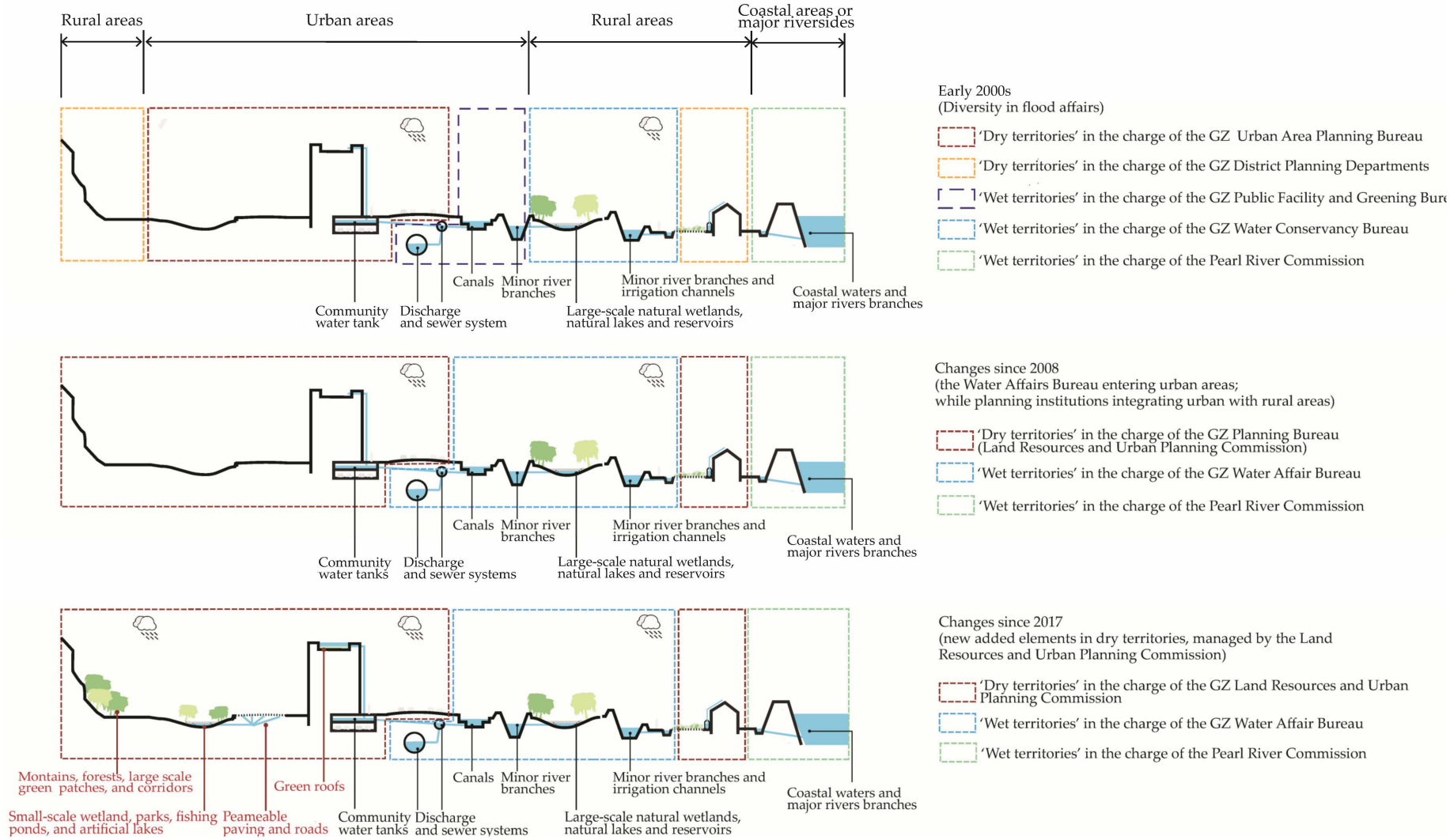

Figure 3. The Responsibilities of the Pearl River Commission, Guangzhou Water Conservancy Bureau (Guangzhou Water Affairs Bureau after 2008), and Guangzhou Urban Planning Bureau (Urban Planning Bureau after 2009 and Land Resources & Urban Planning Committee after 2014).

The *Water Affairs Bureau* and its subordinated institutions focused on infrastructures with a lower safety standard in contrast to the *Pearl River Committee*. As the interviewees added (no. 3, 4 and 5),

> "The defense we dealt with is generally supposed to face flood events less than 1 in 50 years return period; pipe systems have a lower standard, merely 1 in 10 years in the built area and 1 in 5 years in the high-density city center".

5.2. Less Visible Work on Flood Affairs of the Urban Area Planning Bureau (or Urban Planning Bureau) (2008)

The adjustment of planning organizations around 2008 was busy with the internal integration between municipal and district levels, which have jurisdiction over urban and rural areas in their respective fields. Flood affairs were less visible in their formal work. As Figure 3-early 2000s and Figure 3-2008 indicate, wet territories and attached water-related public facilities were beyond the responsibilities of the *Urban Area Planning Bureau* (or *Urban Planning Bureau* after 2009), which mainly focused on land development in 'dry territories', as opposed to floods and water development.

There are, of course, exceptions. In the preparation for the 2010 Asian Games in Guangzhou, two artificial lakes (Haizhu Lake and Baiyun Lake) were planned and constructed around 2010 to improve the urban environment [34]. These pilot projects are natured-based solutions to store rainwaters jointly managed by the *Water Affairs Bureau* and *Urban Planning Bureau* across 'wet territories' and 'dry territories', concerning the construction and maintenance of lakes, canals, pump stations, and the land adjustment and land acquisition due to water infrastructures.

5.3. Legitimate Opportunities of the Land Resources & Urban Planning Committee to Deal with Flood Affairs within Dry Territories (2017)

There were major changes in urban planning in 2017 when the *Guangzhou Sponge City Plan* launched. The *Sponge City Plan* called for innovative initiatives to deal with the flood risk within 'dry territories'. As a result, managing flood affairs were incorporated into the territorial domain of urban planning, giving the *Land Resources & Urban Planning Committee* legitimacy to enact flood resilience interventions as a newcomer (see Figure 3-2017), even without a change in its organizational structure and administration scope.

At the municipal level, new nature-based solutions have been promoted to supplement drainage pipes and river systems in absorbing peak run-off. These solutions included (1) preserving forests, large-scale green patches, green corridors, and rural lands to decrease run-off at the sources; (2) making use of small-scale wetlands, artificial lakes, and fishing ponds to store run-off, etc. At the neighborhood level, relevant solutions have been encouraged such as replacing paving and asphalt roads with permeable materials, building rainfall gardens, and using green roofs to collect rainwater.

Regulatory tools have also been developed in spatial planning to implement these nature-based solutions [32]. Figure 4 gives an example of how, according to the *Guangzhou Sponge City Plan*, urban planning is supposed to use run-off control regulatory codes to ensure permeable landscapes and limit impermeable surfaces in urban development. These codes specify the amount of rainfall that has to be stored on every plot of land. For instance, in area code 05-05, 74% of the rainwater has to be retained and only 26% can flow directly into the drainage system. Nature-based permeable solutions have a higher capacity to hold water than impermeable roofs, roads, and paving. Thus, building density is strictly controlled and open spaces are reserved to reach the targets of these regulatory codes.

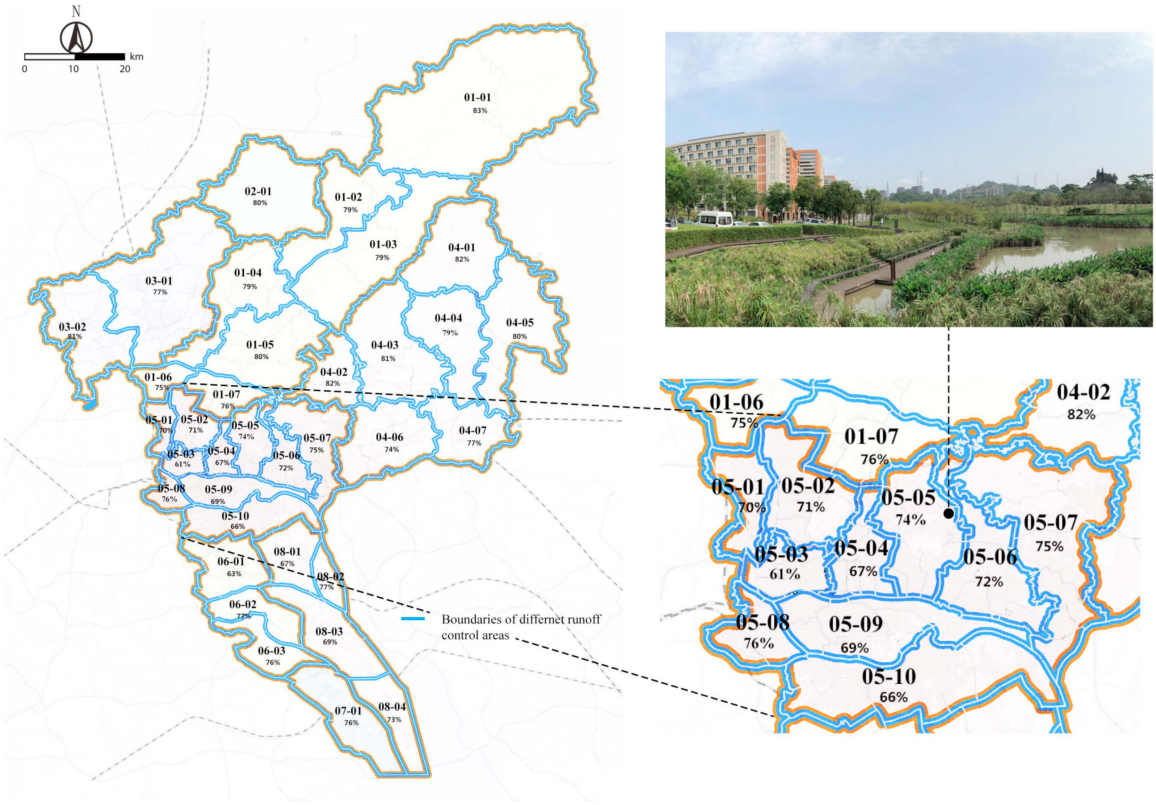

Figure 4. Run-off control regulatory codes for flood resilience and Daguan Wetland Park in Tianhe District under the Guangzhou Sponge City Program, based on the Guangzhou Sponge City Plan 2010–2030 [39].

The *Guangzhou Sponge City Plan* has not caused big changes in the *Water Affairs Bureau* and *Pearl River Committee*. Both of them work on flood affairs as routines in their "wet territories" concerning water-related facilities.

5.4. Summary

The changes in institutional rules triggered by the *Sponge City Plan* offer planners new opportunities to implement flood resilience activities in dry territories relying on nature-based solutions. Still, the urban planning sector is a chaser in flood affairs, compared with the water management sector which acts as a forerunner owning its long-established legal authority in flood agendas.

6. Funds Allocation and Incentives

Flood-resilient infrastructures in the Sponge city trend are expensive [47], and the construction does not bring economic benefits in the short term. This section explores how funds, as one source of institutional incentives, are projected and spent on flood issues in water management and urban planning. The analysis consists of two inquiries: funds allocation at local and national levels. The first local inquiry traces two indicators in the public financial statements between 2008 and 2017 before the launch of the *Guangzhou Sponge City Plan* (Table 1). The raw data are from the financial reports published by the *Water Affairs Bureau*, *Planning Bureau*, and *Land Resources & Planning Commission*. Two indicators were traced, namely (1) water conservancy and flood affairs (W) and (2) urban and rural community development (U). The second national inquiry added the macro background information of the *National Sponge City Program* to the local context based on policy documents, notes, and news reports.

Table 1. Budget and spending relating to flooding issues of the Water Affair Bureau, Planning Bureau, and Land Resources & Planning Commission from 2008–2017, based on [48–63].

Organizations	Indicators	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Water Affairs Bureau/ USD (million)	W budget	104.96	73.51	NA	59.55	64.39	100.64	74.61	61.76	76.11	104.92
	W spending	103.09	76.27	NA	72.32	61.02	63.75	110.42	66.46	75.07	106.43
	U budget	150.50	12.73	NA	1.22	1.16	14.26	15.43	2.43	3.96	3.78
	U spending	150.76	12.35	NA	1.22	1.16	14.26	15.40	2.44	3.96	3.79
	W + U budget in total	255.45	86.23	NA	60.77	65.54	114.90	90.04	64.19	80.06	108.70
	W + U spending in total	253.84	88.61	NA	73.54	62.18	78.01	125.81	68.90	79.03	110.21
Organizations	**Indicators**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016 ***	**2017 ***
Planning Bureau and Land Resources & Planning Commission/ USD (million)	W budget	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	W spending	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	U budget	NA	NA	NA	30.73	24.52	32.90	23.61	25.95	2714.27 *	2311.06 *
	U spending	NA	NA	NA	27.70	27.56	32.21	23.63	26.06	2714.27 *	2310.91 *
	U + W budget in total	NA	NA	NA	30.73	24.52	32.90	23.61	25.95	2714.27 *	2311.06 *
	U + W spending in total	NA	NA	NA	27.70	27.56	32.21	23.63	26.06	2714.27 *	2310.91 *

Currency rate: USD 1 = CNY 6.7845; Date: 24 January 2023. 1: W: water conservancy and flood affairs facilities; U: urban and rural community development; NA: not available; 2: * data exceptions.

The indicator water conservancy and flood affairs (W) reflects the budget and spending on major flood resilience infrastructures. It has a similar meaning in both water management and urban planning fields: it is concerned with the cost of (1) the construction and maintenance of major hydrological infrastructures, e.g., dams, dykes, reservoirs, lakes, canals, irrigation channels, and pump stations; (2) the management of water resource, e.g., hydrological monitor, flood prediction and alarm, and water quality inspection; (3) flood migration; and (4) administration and wages.

The indicator of urban and rural community development (U) differs between the water management and planning sectors. For the *Water Affairs Bureau*, this indicator concerns the budget and spending on (1) the construction and maintenance of water supply, flood discharge, and water treatment infrastructures in communities, (2) the land adjustment and land acquisition due to water infrastructures, and (3) administration and labor wages.

For the planning sector, the indicator of urban and rural community development focuses on (1) land use planning and regulation, (2) the construction of urban infrastructures, (3) land adjustment, land acquisition, and land transfer, and (4) administration and labor wages. Admittedly, the indicator covers more than the budget and spending on flood resilience in the planning process. After all, economic development is planning's main focus while spending on flood-relevant assessments or designs is only a small portion. We, in this section, keep the information of this indicator on account of the potentiality that partial funding related to floods, including the designs of green-blue infrastructure for water storage in the planning process, and land use adjustment from buildable land (e.g., for residential use) to unbuildable land (water buffer zones).

6.1. Limited Incentives to Push Urban Planning to Address Flood Risk

We must point out, however, data exceptions occur in the budget and spending of urban and rural community development (U) from 2016 and 2017 relating to the *Land Resources & Planning Commission*. This situation is caused by the merger of the *Guangzhou Planning Bureau* and partial *Guangzhou Land Resources and Housing Management Bureau* in 2014, which changes the statistical methods in 2016. The budget and spending of land adjustment, land acquisition, and land transfer increase dramatically accounting for the vast majority of urban and rural community development up to 97%. These special cases cannot reflect the potential cost of flood-related issues and are excluded in the discussions below.

The statistics between 2008 and 2015 indicate that the financial resources allocated to the *Water Affairs Bureau* were higher than the *Land Resources & Planning Commission* (including the total budget for water conservancy and flood affairs (W) and urban and rural community development (U)), ranging from 2.0 times (min) in 2011 to 3.8 times (max) in 2014. Similarly, the total spendings on water conservancy and flood affairs and urban and rural community development of the *Water Affairs Bureau* were also higher than the *Land Resources & Planning Commission*, ranging from 2.3 times (min) in 2012 to 5.3 times (max) in 2014.

In terms of water conservancy and flood affairs (W), specifically, Table 1 further reveals that the *Planning Bureau* and *Land Resources & Planning Commission* had no budget and spending on this topic, while the *Water Affairs Bureau* had a large proportion of funds on it. The budget peaked in 2008, 2013, and 2017 with USD 104.96, 100.64, and 104.92 million. 2011 and 2015 are the two bottoms with USD 59.55 and 61.76 million. The spending follows a similar trend with three peaks, USD 103.09, 110.42, and 106.43 million in 2008, 2014, and 2017. This corresponds to the practice of the *Water Affair Bureau* which addressed flooding in wet territories by engineering infrastructures such as dams, dykes, irrigation channels, and pump stations. In another word, these infrastructures are mainly shouldered by urban water management rather than urban planning.

As with urban and rural community development, Table 1 shows stable money projected and used by the *Planning Bureau* and the *Land Resources & Planning Commission* ranging from USD 23.61 to 32.90 million. The spending on flood-relevant work in dry territories, despite the imprecise statistics, was less than the budget, only part of it. By contrast, the statistical results of the *Water Affairs Bureau* are clearer. In 2008, it had a large sum of budget in urban and rural community development for water-related public facilities, such as drainage systems, up to USD 150.50 million. The budget dropped sharply between 2009 and 2017, which ranges between USD 1.16 and 15.43 million.

6.2. National Subsidy: Another Way Out?

To promote the *National Sponge City Program*, the central government allocated a two-round specialized subsidy in 2015 and 2016 to support pilot cities [21]. Thirty standard-compliant cities have received three-year continuous funds much to USD 0.18 to 0.27 billion (CNY 1.2 to 1.8 billion) in total, depending on their significance and size [64]. However, this national support ceased in 2017 and the Guangzhou government did not win the subsidy ever, let alone a second re-allocation to the urban planning system.

A new round subsidy has been launched in mid-2021. This round was inspired by the *Fourteenth Five-Year Plan (2021–2025)* [3] and the *Long-term Vision for 2035*. Both of these national policy documents highlighted the significance of urban resilience and flood mitigation [65]. In this context, a new wave to support concrete Sponge initiatives seems to start in late 2021.

Guangzhou has been appointed as one pilot city in this wave to promote resilient infrastructures at the citywide level and the Guangzhou government is supposed to receive three-year financial support from the central government, much to USD 0.13 billion (CNY 0.9 billion) [66]. It is not clear how this national subsidy will be used and whether it will change the role of the planning bureau. Further observation is needed to verify the long-term impacts of the new financial incentives.

6.3. Summary

Compared with water management, the planning sector in Guangzhou lacks strong incentives in finance to support their participation in flood affairs. The allocation of the daily municipal budget concerning floods has been limited and vaguely defined. The opposite is true for the water management sector. They own clear and abundant budgets to spend for policies and infrastructures on flood affairs. These distinct financial situations in the two sectors can result in a preference to stick to traditional engineering solutions by civil engineers from the water management sector. By contrast, there is a probability

of a decrease in the diversity of the possible (and much-needed) resilience initiatives that planners could contribute to. The impacts of the recent subsidies on the implementation of the Sponge City Plan are as yet unconfirmed, calling for further research.

7. Discussion

The exploration of governance settings partly portrayed the development of flood governance in Guangzhou throughout roughly 20 years and the interaction between water management and urban planning for climate adaptation (see Table 2 below). The ways of organizational structures, institutional rules, and funding allocation strengthened the capacities of the water management sector while it did not shape favorable conditions for the planning sector to be involved in flood affairs.

Table 2. Organizational structures, institutional rules, and funding allocation in flood governance: water management (WM) vs. urban planning (UP), source: authors.

Changes	Impacts	Potentialities of Urban Planning in Flood Governance If Any Changes Are Needed
	Power	
Organizational structures WM: an agglomeration of water affair-related institutions UP: limited changes in relation to flood affairs	WM: strong power of water management with advantages in terms of organizational infrastructure and qualified personnel (+) UP: weak power in terms of disadvantaged organizational infrastructure and qualified personnel (−)	The weakness of UP sector hampers the application of the SCP. Address this need by strengthening the specialized water knowledge and capacity of the UP sector.
	Legitimate opportunities	
Institutional rules WM: long-established legitimate opportunities in flood affairs UP: newly confirmed legitimate opportunities in flood affairs	WM: long-term experience and efforts to address flood affairs in wet territories and major water-related public facilities (+) UP: incorporating flood agendas into planning's accountability formally with feasible spatial interventions in dry territories (+)	After-effects of the previous legitimate opportunities and path dependence make the UP sector oriented towards following conventions rather than new solutions. Address those needs by raising the awareness of planning's role and new adaptation measures in flood resilience.
	Incentives	
Funding allocation WM: clear and abundant budgets (and spending) for flood resilience UP: newly launched subsidiarity yet vague and limited daily budgets (and spending) for flood resilience	WM: strong and long-term financial incentives to attract hydrological engineers to take part in flood governance (+) UP: potential trigger caused by subsidiarity (+); limited financial incentives for the planning sector in flood governance (−)	Economic sustainability matters for SCP. For it, one needs more funds at hand and far-reaching reform of the spending priorities of the municipalities or additional financial transfer to invest in the development of institutional capacity.

The water management sector absorbed most departments and skilled experts associated with water in the restructures around 2008 and has been delegated to addressing flood affairs in both urban and rural areas ever since. They have come with a dominant position in flood governance. A kind of "organizational monopoly", a concept mentioned by governance scholars [30,31], seemed to be gradually emerging. This superiority is strengthened by stable and generous financial support, which ensures that the water management sector continues to have strong incentives to work on flood issues.

By contrast, the planning sector, as a newcomer, has owned a disadvantaged position in flood governance for quite a long time. They lost opportunities in organizational infrastructure and qualified personnel and lacked clear guidelines to lead their work to deal with flooding with water management jointly. What is more, the way of funds allocation provides limited rewards for the integration between planning and water management.

The changes caused by the *Sponge City Plan* are useful but limited. The new institutional rules have offered urban planning more powers to deal with flood affairs. Specifically, they have allowed the planning sector to take concrete measures such as nature-

based solutions and permeable–impermeable land use controls for flood resilience [32]. However, Rome was not built in a day. The new game rules could be challenged by the after-effects of the previous legitimate opportunities and powers that the actors have. According to numerous research papers examining the path-dependent feature of institutions in flood governance, agents are oriented to follow conventions rather than new routes, despite new options showing more benefits [67–69]. One reason is the extra cost of reversing established habits and staff training [70–72]. Furthermore, promoting the integration between planning and water management requires a financially sustainable approach. Whether the three-year national subsidiary can help build economical paradigms needs further observation.

What is more, the newly added measures relating to planning in the *Sponge City Plan* concentrated on flood problems in "dry territories". The foci are beyond coastal and river areas in 'wet territories', which water management mainly deals with. This situation led to the phenomenon of spatial segregation: flood-related actors work separately within their administrative scopes. It is different from a "more close cooperation" between urban planning and water management, encouraged by some scholars, in which actors share data and standards, and work across "wet" and "dry" territories together [13].

To address the disadvantaged conditions, some actions are needed for the urban planning system in Guangzhou, e.g., (1) strengthening the development of new skills among planners; (2) exploring the spatial impacts of resilience projects to attract planners' attention and build their awareness; and (3) seeking for multiple funds and far-reaching reform of the spending priorities. An in-depth exploration of this aspect, however, remains beyond the scope of this paper and should be conducted in future research.

The experience based on Guangzhou and China contributes to the literature focusing on strengthening local capacities to deal with flood hazards and climate change, specifically related to institutional structures, organizational and institutional capacity to implement adaptation responses, human capital (including skills and education), the availability and access to resources, and the boundary spanning literature in flood risk management [73–79].

8. Conclusions

This study explores the status and hindrances of flood governance in China with links to urban planning in Guangzhou. The dynamics and stabilities of organizational structures, institutional rules, and funding allocation since 2000 provide evidence for this target and, importantly, tell us how the constraints came about. Our findings indicated the local planning sector has been in a disadvantaged position when they are asked to work on flood issues, given weak powers, limited opportunities, and insufficient incentives. The unfavorable conditions are shaped by the weakness in organizational infrastructure and qualified personnel, lacking institutional rules for adaptation actions, and undefined budgets to ensure the planning process and implementation.

The *Sponge City Plan* in 2017 is a turning point, which changed the rules of urban planning a bit. This plan has given the planning sector legitimate opportunities to apply nature-based solutions and regulatory tools to address flood problems in the physical environment. Despite this progress, planning's working range is limited to its jurisdiction "dry territories", beyond "wet territories". The nexus between planning and water management is at an early stage and more efforts are needed for a collaborative governance process.

The *Sponge City Plan*, for now, has a limited role in improving other unfavorable elements that constrain planning in flood governance given organizations and budgets. Their impacts can be continuous, resulting in restricted capacities of planning actors as well as insufficient motivation and challenging planning procedures.

While the above findings may be context-specific, the methods and theories used in this paper could be applied in other coastal cities or delta cities, which are threatened by floods. They can be used to evaluate the performance of a system (regions, cities, communi-

ties, or institutions) and explore whether and how they can create conditions to strengthen the capacities to embrace flood resilience and climate adaptation.

Another takeaway lesson is that when introducing policy or institutional innovations to improve flood resilience and promote integration across policy sectors, one needs to consider the impacts that policy innovations cause, which may facilitate or hamper the implementation of those designs and, hence, determine the success or failure of a new policy. This principle applies in particular to organization restructures, institutional tools, and budgets because their settings are often stubborn once decided. It is a general lesson for any city.

The limitation of this study is that a longer time perspective is needed to fully evaluate the consequences of the recent changes in organizational structures, institutional rules, and financial incentives caused by the *National Sponge City Program*. Future research, thus, could explore this issue further, shedding light on the longer-term impact of these changes on the role of the urban planning system.

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Appendix A

Table A1. Interviews' logbook (2016–2018) *.

No. in This Study	Time	Interviewees	Field
1	30 November 2016	Senior Official, Pearl River Committee	Water Conservancy Engineering
2	31 November 2016	Senior Expert, Pearl River Committee	Water Conservancy Engineering
3	2 April 2018	Senior Official, Sponge City Office	Urban Water Supply and Drainage, Water Conservancy Engineering
4	2 April 2018	Senior Expert, Sponge City Office	Urban Water Supply and Drainage, Water Conservancy Engineering
5	20 November 2016	Senior Official, Liwan District Government	Urban Construction and Management

* Semi-structured face-to-face interviews.

Notes

[1] Before the merger, district planning departments owned rivalling powers to the municipal planning bureau. This situation sometimes caused difficulties to implement policies locally when the district departments were reluctant to follow municipal rules.

[2] It is the superior of Guangzhou Land Resources & Planning Commission.

[3] One of the most important national policies in China, which is launched every five years and claims the major directions of China concerning economic, environmental, and social development.

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