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Viennese urban water features:
Institutionalist and environmental justice perspectives on
the planning of urban blue infrastructure

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Abstract

Water fountains and misting systems are becoming increasingly common in urban streets and parks. These small-scale blue infrastructures provide heat mitigation, increase the quality of public space, deliver drinking water, and foster human health and well-being. Facing the climate crisis, urban water features can function as nature-based solutions for climate adaptation that can be relatively easily implemented by urban planning. Yet, unjust outcomes of blue and green infrastructure planning have been documented in the past, which have reinforced existing inequalities. Therefore, this research engages with the planning of urban water features and its recognition of environmental justice. Particular analytical attention is given to the planning context and the institutional framework that structures the outcome of blue infrastructure planning. The aim is to identify how institutions affect both the planning of urban water features and the extent to which principles of environmental justice are considered. Using Vienna as a case study area, a qualitative research design allows for a holistic engagement with the planning system in its Austrian context. The research integrates an analysis of relevant planning documents with expert interviews. The semi-structured interviews were conducted with representatives of six different municipal departments involved in urban water feature planning in the Viennese city administration. Through looking at the structures and institutions of planning, an attempt is made to understand its aims, processes, and outcomes, specifically regarding the just or unjust production of health and well-being-supportive urban blue infrastructure. The results show that both formal and informal institutions have profound influence on how urban water features are planned in the City of Vienna and on the extent to which distributional, procedural, and recognitional justice are integrated in this. As institutions provide both possibilities and constraints, their specific local configuration needs to be taken into account when planning for blue infrastructure that supports environmental justice, human health, and well-being.

Keywords: Urban water features, Blue infrastructure, Urban planning, New institutionalism, Environmental justice, Nature-based solutions, Vienna

Zusammenfassung

Trinkbrunnen und Sprühnebelanlagen sind immer häufiger in städtischen Straßen und Parks anzutreffen. Diese kleinräumigen blauen Infrastrukturen liefern Trinkwasser, sorgen für Abkühlung, verbessern die Aufenthaltsqualität und fördern die Gesundheit und das Wohlbefinden der Menschen. Angesichts der Klimakrise können solche urbanen Wasserelemente als naturbasierte, und relativ einfach umsetzbare Lösungen zur Klimawandelanpassung beitragen. Jedoch wurde im Kontext der Planung von blauer und grüner Infrastruktur auch immer wieder die Verstärkung bestehender Ungleichheiten problematisiert. Die vorliegende Forschung beschäftigt sich daher mit der Frage, wie urbane Wasserelemente geplant und inwieweit dabei Prinzipien der Umweltgerechtigkeit berücksichtigt werden. Besondere Aufmerksamkeit wird auf Institutionen im Planungskontext gelegt, da diese den Rahmen für planerisches Handeln und die Planung von blauer Infrastruktur bilden. Das Ziel der Arbeit ist es, herauszufinden, inwiefern Institutionen sowohl die Planung städtischer Wasserelemente als auch die planerische Berücksichtigung von Umweltgerechtigkeit beeinflussen. Als Fallstudie dient die Stadt Wien. Durch ein qualitatives Forschungsdesign, welches die Analyse relevanter Planungsdokumente mit Expert*innen-Interviews verbindet, wird ein umfassender Einblick in die Planung von Wasserelementen der Stadt Wien im Kontext des österreichischen Planungssystems gegeben. Anhand der Analyse der Planungsstrukturen und -institutionen wird versucht, deren Ziele, Prozesse und Ergebnisse zu verstehen, insbesondere hinsichtlich der gerechten oder ungerechten Schaffung und Verteilung von städtischen blauen Infrastrukturen. Die Ergebnisse zeigen, dass sowohl formelle als auch informelle Institutionen einen bedeutenden Einfluss auf die Planung von Wasserelementen und die Berücksichtigung von Verteilungs-, Prozess- und Anerkennungsgerechtigkeit in den Maßnahmen der Stadt Wien haben. Da Institutionen sowohl Handlungsspielräume eröffnen als auch planerische Einschränkung mit sich bringen, müssen die lokal spezifischen institutionellen Strukturen bei der Planung einer möglichst gerechten blauen Infrastruktur berücksichtigt werden. Die Perspektive der Umweltgerechtigkeit ist von zentraler Relevanz, da urbane Wasserelemente potenziell positive Auswirkungen auf die Gesundheit und das Wohlbefinden der Stadtbewohner*innen haben.

Keywords: Urbane Wasserelemente, Blaue Infrastruktur, Stadtplanung, Neo-Institutionalismus, Umweltgerechtigkeit, Naturbasierte Lösungen, Wien

Table of Contents

Acknowledgements	i
Abstract	iii
Zusammenfassung	iv
1 INTRODUCTION: Topic, relevance and research questions	1
1.1 Aims and research question	3
1.2 Structure	5
2 CONTEXTUALIZATION: Urban water features in the academic discourse	6
2.1 Design and role in public spaces	6
2.2 Health and well-being impacts	9
2.3 Water features' potential as nature-based solutions	11
2.4 Engineering, economic, and justice perspectives	14
3 THEORY: Planning and urban water features planning	16
3.1 What is planning?	16
3.1.1 The broad strokes of planning history	16
3.1.2 Contemporary urban planning	17
3.2 Institutional context of planning	19
3.2.1 Rational-choice institutionalism	20
3.2.2 Historical institutionalism	21
3.2.3 Sociological institutionalism	22
3.2.4 Planning culture	23
3.2.5 Planning systems	24
3.3 Substantive content and concepts of planning	25
3.3.1 The sustainable city	26
3.3.2 The green city	27
3.3.3 The resilient city	28
3.3.4 The just city	28
3.3.5 The smart city	30
3.3.6 The healthy city	30
3.3.7 The water-sensitive city	31
3.4 Planning processes	32
3.4.1 Strategic planning	33
3.4.2 Communicative planning	34
3.4.3 Planners as actors	35
3.4.4 Power of and power relations within planning	36
3.5 Planning water features	37
3.5.1 Urban blue-green infrastructure planning	37
3.5.2 (In)justices in urban blue-green infrastructure	39

4	VIENNA: Description of the case study area	42
4.1	General information	42
4.2	Planning context.....	43
4.3	Viennese water features	46
5	CONCEPTUAL FRAMEWORK: New institutionalism meets environmental justice.....	49
6	METHODOLOGY: Qualitative analysis of documents and interviews	52
6.1	Research design.....	52
6.2	Background research.....	54
6.3	Qualitative data collection: policy documents and expert interviews	56
6.4	Data analysis.....	59
7	RESULTS: Effects of institutions on urban water feature planning and environmental justice	62
7.1	Regulations and laws.....	62
7.2	Aims and strategic context.....	64
7.3	Administrative structures.....	67
7.4	Planning processes	70
7.5	Informal institutions.....	72
7.6	Distributive justice aspects.....	75
7.7	Procedural justice aspects.....	76
7.8	Recognitional justice aspects	77
7.9	Human health and well-being	78
8	DISCUSSION: How institutions matter	81
8.1	The influence of institutions on the environmental justice of urban water features	81
8.2	Institutional constraints to urban water feature planning.....	84
8.3	Theoretical reflection	85
8.4	Limitations.....	86
8.5	Avenues for further research	87
9	CONCLUSION: Viennese urban water features planning from an institutionalist and environmental justice perspective.....	88
10	Bibliography.....	91
11	List of figures.....	108
12	List of tables.....	108
13	Appendix.....	109
13.1	List of reviewed articles for contextualizing urban water features.....	109
13.2	List of policy documents for analysis.....	112
13.3	Interview guide.....	114
13.4	Informed consent sheet	115

1 INTRODUCTION: Topic, relevance and research questions

We live in the climate crisis. Global temperatures keep increasing and the 1,5 °C goal is out of reach (IPCC, 2023). Human-induced greenhouse gas emissions have caused widespread changes in the atmosphere, biosphere, oceans, and cryosphere. As a result, weather patterns change; the frequency and intensity of climate extremes increases (IPCC, 2023). Europe is affected by above-average temperature rises. Heatwaves, droughts, extreme precipitation, and pluvial floodings will be occurring more regularly in this region (IPCC, n.d.; Severin & Michalíková, 2024). This has severe negative implications on human health and well-being, for instance through increased exposure to heat stress and allergens. Thus, the climate crisis is also argued to be a health crisis (Nieuwenhuijsen, 2024).

Cities and urban citizens are particularly exposed to the effects of climate change because of the high density of built structures and sealed surfaces that intensifies for example heat and flooding and due to the growing number of people who live in cities, both in relative and absolute terms (UN-Habitat, 2024). In 2018 urban areas were home to 55% of the world's population, in Europe this number was 74,5%. By 2050, the share of people living in cities is projected to increase to 68% globally and to 85% in Europe (United Nations, 2019). At the same time urbanization and land-use changes are a major source of greenhouse gas emissions (IPCC, 2023; UN-Habitat, 2024).

However, urban areas are also seen as “hubs for climate action” (UN-Habitat, 2024, p. 2) that can provide solutions that not only target climate change adaptation but at the same time promote health and well-being (Nieuwenhuijsen, 2024). Typically, emissions per capita are lower in urban areas compared to rural areas. Spatial proximity offers great potential for the sharing and efficient use of resources. In addition, building compact city structures helps to reduce land use, create attractive public transport systems, and foster active mobility (UN-Habitat, 2024). Urban areas are seen as significant contributors in building climate resilience through localized mitigation and adaptation efforts. While mitigation refers to the reduction and prevention of greenhouse gas emissions, adaptation relates to reducing the vulnerability of cities' structures, institutions, infrastructures, processes, and, ultimately, citizens to climate change and its current and expected impacts (UN-Habitat, 2024).

One leverage point for fostering both urban climate adaptation and human health and well-being is the planning of nature-based solutions and blue and green infrastructure (UN-Habitat, 2024). Blue and green infrastructure refers to interconnected water and/or vegetation elements in urban areas that can foster human well-being through providing ecosystem services (Pauleit et al., 2017). This is closely linked to the concept of nature-based solutions, which promotes “the maintenance, enhancement, and restoration of biodiversity and ecosystems as a means to address multiple concerns simultaneously” (Kabisch et al., 2016, p. 1). These approaches aim to mitigate hazards evoked by climate change while promoting socio-ecological resilience through the imitation and use of natural processes in urban areas (McNabb et al., 2024; Pauleit et al., 2017). Nature-based

solutions are commonly developed for urban climate change mitigation and adaptation and involve the conservation and restoration of ecosystems to support biodiversity (Kabisch et al., 2016). Both concepts, nature-based solutions as well as blue and green infrastructure, are human-centered. Even though the protection of nature is a central element, the underlying goal is the improvement of both living conditions and health for humans through an enhancement of the environment and the ecosystem services it performs (Pauleit et al., 2017).

Commonly appreciated co-benefits of urban blue and green infrastructure, besides fostering biodiversity, temperature reduction, rainwater infiltration, improving air quality, and carbon sequestration, are the creation of recreational areas promoting active lifestyles and improving physical, mental, and social health (Foley & Kistemann, 2015; Kabisch et al., 2016; Kajosaari & Pasanen, 2021; UN-Habitat, 2024; Veerkamp et al., 2021). In the literature three pathways of how urban green and blue infrastructure nurtures human health and well-being are conceptualized, firstly, reducing harm (i.e., mitigation), referring to a relief of stressors like heat, noise, and air pollution, secondly, restoring capacities through stress recovery and psychological restoration, and thirdly, building capacities by fostering physical activity and social contacts (i.e., instoration) (Markevych et al., 2017; White et al., 2020). Urban blue and green infrastructure is also promoted by the European Union to stimulate sustainable development and build climate resilience (European Commission, 2019; Severin & Michalíková, 2024).

Most academic literature engages with urban green infrastructure, whereas blue infrastructure is less studied; particularly small-scale interventions were found to be underrepresented in the literature (Li & Trivic, 2024; Veerkamp et al., 2021; White et al., 2020). Blue infrastructure refers to “a network of multifunctional water bodies, waterscapes, and water features. It can include ponds, rivers, lakes, canals, wetlands, and other natural or engineered water management solutions” (Chowdhury et al., 2025, p. 2). Small-scale blue infrastructure, like fountains, pools, ponds and water infrastructures in gardens and streetscape can be planned within existing city structures at the neighborhood scale without depending on the availability of large land-plots. In addition, these water features are easily and frequently accessible for people in their everyday lives, offer high flexibility in usage, encourage regular physical activity, and enhance urban livability and individual health (Li & Trivic, 2024). Furthermore, small-scale blue infrastructures are appreciated for their aesthetics, visual stimuli, safety, and interactive design elements, which were found to positively influence happiness and mental well-being (Gao & Fang, 2025). Dedicating a whole book to water in the city and its different materializations, functions, attached meanings, and practices, Sophie Watson lively describes how fountains can animate public spaces through creating places that enhance sociality and interaction. Through this, urban water features can become symbolic sites of meaning besides providing water for thirst quenching. Fountains can furthermore assist in the regeneration and revitalization of urban centers and are thus utilized for place-making and city branding (Watson, 2019). Moreover, misting systems, i.e., small water features that create water mist or water spray, are appreciated for effective micro-climatic heat mitigation, their cost-effectiveness, versatility, and easy implementation (Ulpiani et al., 2020). All of this makes small-scale blue infrastructure a very interesting and relevant research topic.

The planning and management of blue and green infrastructure has not come without challenges, especially issues of injustice have been thematized in the literature. This includes questions of who has access, where the infrastructure is located, who is involved in the planning process, whose health and well-being is fostered, whether socio-ecological trade-offs are recognized, and how the planning intervention may influence property values and housing costs, possibly leading to displacement and so-called green gentrification (Canfield et al., 2024; Chu et al., 2016; Haase et al., 2017; Kronenberg et al., 2021; Laatikainen et al., 2015; Wolch et al., 2014). The implementation of urban blue and green infrastructure to improve the attractiveness of urban public spaces and foster citizens' well-being as urban renewal strategy has partly worsened inequalities. In some cases, the residents, towards whom the benefits were intended, were eventually pushed out of the area, sometimes even purposefully (Anguelovski et al., 2018; Haase et al., 2017).

The creation of urban blue infrastructure and urban water features is negotiated in urban planning, which is seen as an important lever for steering just and human-health- and well-being-supportive climate adaptation (Nieuwenhuijsen, 2024). Planning provides the context, structures, and procedures through which interventions can be realized (Gunder et al., 2017; Wiechmann, 2019c). As urban water features are deliberately created, special attention has to be paid to equity concerns in the planning process. If this is not done sufficiently, the interventions run the risk of reinforcing existing environmental inequalities and deepening the marginalization of already disadvantaged groups (Calderón-Argelich et al., 2021; Haase et al., 2017; Wolch et al., 2014). This is of particular importance when urban blue infrastructure is implemented for climate change adaptation. The negative impacts of climate change disproportionately affect already marginalized groups and sometimes intersectional marginalizations are even perpetuated through urban adaptation and mitigation efforts (UN-Habitat, 2024). Therefore, the UN advocates for people-centered, inclusive climate action planning that "[leaves] no one behind" (UN-Habitat, 2024, p. 25). The development of small-scale interventions, like urban water features, has been highlighted to enhance the health supportive and environmentally just characteristics of urban blue infrastructures (Gao & Fang, 2025; Wolch et al., 2014).

1.1 Aims and research question

The present thesis investigates the planning of urban small-scale blue infrastructure and how environmental justice is considered in this context. Small-scale blue infrastructure for this research is defined as elements in public spaces that involve flowing or standing water, like drinking fountains, misting systems, ornamental and pavement fountains, water play elements, as well as water surfaces and ponds. These are also referred to as urban water features. Planning is understood as public planning in urban areas, performed by city administrations with the aim to serve the common good (Pahl-Weber & Schwartz, 2018). In this thesis, particular attention is given to the role of institutions, which are "sets of rules and shared understandings that shape action" (Sorensen, 2017, p. 251), and how they structure, enable, and restrict planning. New institutionalist theory highlights the important influence of institutions on the outcomes of planning (Gailing &

Hamedinger, 2019; Healey, 2007; Sorensen, 2017). Generally, formal and informal institutions are differentiated with the former including laws, regulations, and organizational structures, and the latter referring to shared values, frames of meaning, attitudes, and practices (Gailing & Hamedinger, 2019; Hall & Taylor, 1996; Sorensen, 2017). Regarding environmental justice, this research draws on the definition of Kuehn, who delineates it as concerned with environmental benefits and burdens “where one lives, works, plays, and goes to school” (Kuehn, 2000, p. 10681). Particularly, the three dimensions of distribution, process, and recognition are explored. Human health and well-being is acknowledged as intimately connected with issues of environmental injustice, specifically in the context of the climate crisis (Kuehn, 2000; Schlosberg & Collins, 2014). Therefore, this thesis’ understanding of environmental justice always also refers to health and well-being outcomes.

The aims of this study are to firstly describe how urban water features are planned, to secondly analyze the influence of institutions on the planning process, to thirdly explore the extent to which environmental justice principles as well as human health and well-being considerations are included in urban water feature planning, and to fourthly identify drivers of environmental injustice that arise from the institutional setting. Vienna is chosen as a single case study for this research endeavor as the city administration has planned a great variety of small-scale water features in the last years (Wiener Stadtgärten, 2023). The realized water features include public drinking fountains, water playgrounds, misting systems, and cooling zones. The guiding research question of this thesis is:

Drawing on new institutionalism, how do institutions affect the planning of urban water features in Vienna and the extent to which environmental justice principles are considered?

An exploratory and descriptive qualitative research design is chosen to collect relevant data and draw conclusions concerning the research question. The analysis of policy documents of the City of Vienna is combined with semi-structured expert interviews with representatives of municipal departments that are involved in the planning of urban water features. The chosen documents are institutions themselves that strategically guide planning; the interviewed experts are planners that act in the context of these and other planning institutions.

Urban planning has been identified as a potentially significant field of action to adapt to climate change while at the same time improving the environmental justice, health, and well-being of urban residents, which makes it a very relevant subject of research. This investigation contributes to research about blue infrastructures as nature-based solutions for climate adaptation through analyzing the role of institutions in shaping environmentally just and human-health- and well-being-supportive outcomes. This aligns with the United Nations’ Sustainable Development Goals, specifically goal 3 “Good health and well-being”, goal 10 “Reduced inequalities”, goal 11 “Sustainable Cities and Communities” and goal 13 “Climate action” (United Nations, 2025). Furthermore, the empirical research complements the discourse on new institutionalism through corroborating that institutions matter in planning processes with specific case-based examples. In

striving to understand why and how urban water features are planned and what influence institutions have on this process, this thesis especially ties in with the planning discourse that looks at governance, structures, and relationships in planning (Gunder et al., 2017). Moreover, this study addresses a gap in the literature about the nexus between the role of institutions and their influence on the consideration of environmental justice in the planning of urban water features, which, to the knowledge of the author, has not been studied so far.

1.2 Structure

The thesis is organized as follows: After the introduction, the second chapter presents a review of academic research on urban water features. In the third chapter a theoretical overview on planning and the planning of urban water features is given. The fourth chapter presents the case study. The fifth chapter explains how the theory was operationalized to guide the empirical analysis. In the sixth chapter the methodological approach, the chosen research methods, and the collected and selected data is described. The seventh chapter presents the empirical results, which are discussed in the context of the theory in chapter eight. The final chapter concludes this thesis by summarizing the results.

2 CONTEXTUALIZATION: Urban water features in the academic discourse

Research about urban water features spans across different disciplinary boundaries, among them geography, landscape architecture, engineering, urban planning, water management, psychology, and ecology. Attention has been given to different topics in relation to water features. Thematically, many studies have been written about their design and role in public parks and places. Moreover, a substantial fraction engages with the effect of urban water features on health and well-being. A third section of the literature thematizes its potential as nature-based solutions, for instance, for stormwater management, biodiversity, and heat mitigation. Furthermore, literature about water features has discussed engineering aspects, economic implications, and justice consideration. An overview of the different research topics in relation to urban water features and what can be learned from them about the objects of investigation is given in the following. Where reasonable, research on water features is embedded in the greater discourse on blue infrastructure and blue spaces.

2.1 Design and role in public spaces

In the book “The social life of small urban spaces” the US-American urbanist William H. Whyte (1980) already emphasized water as an important design element for urban plazas. Similarly, more recent research highlighted that water features considerably increase the value of public places, concerning their use, image, cultural and social factors (Langie et al., 2022). Besides, water features have been important in shaping European public spaces in both past and contemporary urban planning (Nowacka-Rejzner, 2019). A recent US study, conducted in the desert city of Phoenix showed that water features are a decisive local park infrastructure that encouraged visitation (Nelson et al., 2024). In “Basic elements of landscape architectural design” Norman Booth (1989) dedicated a whole chapter to water. He described its characteristics, including plasticity, motion, sound, and reflectivity, as well as its uses like consumption, irrigation, climate control, sound control, and recreation. The author distinguished between flat or static water, flowing water, falling water, jets, and combinations of water features (Booth, 1989). Langie et al. (2022) analyzed and categorized redesigned city squares in Europe, North America and Australia for their water features and developed the following typology: basin fountain, cascade fountain, pavement fountain, urban trickle, reflective pool, mist fountain, screen (2d, 3d), swimming pool, water square, semi-natural pond and percolation trench (see Langie et al., 2022, pp. 6-7 for illustration). The authors agreed that public spaces with water have a higher social and aesthetic value and added that urban water feature functions can be places of urban biodiversity, which answers to current urban planning challenges (Langie et al., 2022).

The literature shows that different types of water features have varied effects on people, and that different groups of people express various preferences regarding their design. In research about how people respond to various water features in urban plazas, Nasar and Lin (2003) conducted a survey in Ohio, where participants rated pictures of different water features according to their preferences and assigned suitable adjectives. The results showed that still water features, for example as in ponds, pools, or lakes, were more calming for people, and moving water, like fountains, cascades, or flows across steps, are experienced as more exciting. The most preferred water features involved moving water, particularly jets and combinations of flowing and falling water that include jets (Nasar & Lin, 2003). In Caymaz and Şimşek's (2022) study of Turkish public spaces survey participants preferred water features with natural forms over such with geometric forms, lighter colored floors in fountains, and natural light over artificial and colorful lighting of water features. Bozkurt and Woolley (2020) investigated how children interact with water features in urban open and green spaces and distinguished between natural and constructed water features. For the authors, the former include water bodies like rivers, and the latter refer to the specific purpose for which they were built, for example a water park for playing or fountains for aesthetic pleasure. Furthermore, active and passive interaction with water were differentiated; while active interaction requires physical contact with the water, like playing with water or running and jumping in it, passive interaction is a calmer activity without direct contact with water, for example, observing and listening to water and spending time next to it. Bozkurt and Woolley (2020) found that constructed water features like water play parks are more attractive for children's play than natural water features. Moreover, it is described that especially younger children like to actively engage with water (Bozkurt & Woolley, 2020).

Concerning the specificities of water features, the possibility to experience it with multiple senses through interacting with it is persistently highlighted. The Danish urban planner Jan Gehl, for example, appreciated the aesthetic qualities of water and wrote that "water, fog, steam, materials, colors, surfaces, light and sound in many combinations can contribute to an attractive diversity of sensory impressions in city space" (Gehl, 2010, p. 181). Whyte emphasized the tactile experience or feel of water and insisted that "it's not right to put water before people and then keep them away from it. [...] Water should be accessible, touchable, splashable." (Whyte, 1980, pp. 48–49). In an experimental study the authors Abdulkarim and Nasar (2022) tested Whyte's claim that water and particularly accessible water makes urban public spaces more attractive and found partial empirical support. In two experiments they evaluated the effect of the presence of different types of water fountains and active storefronts respectively. They found that the presence of water improved the attractiveness of public squares, which was statistically significant across demographic characteristics. That the water is accessible, however, only made the plaza more attractive for people between 25 and 45 years old. Those between 18 and 24 years and older than 45 years seemed to prefer inaccessible water fountains (Abdulkarim & Nasar, 2022).

Water features also have been studied for their acoustic function in public spaces and the capacity of water to mask other sounds like road traffic noise. An environmental assessment study of Parisian parks with a focus on audio-visual interaction suggested that acoustic satisfaction might be

even more important for overall environmental satisfaction of park visitors than visual satisfaction (Jo & Jeon, 2021). The authors found that water features, as well as greenery, contribute to both acoustic and visual satisfaction and thus recommended them as effective design factor for urban parks (Jo & Jeon, 2021). Yet, not all water sounds are perceived equally pleasant. Calarco and Galbrunn (2024) established that natural streams are acoustically enjoyable when the environment is rather quiet, that waterfalls and jet fountains work for louder environments, and that if road traffic is very loud, then water features might not be able to improve the soundscape. Other authors likewise cautioned that creating an enjoyable auditive atmosphere is more complex than just adding water elements. From an in-situ study of the soundscape in a Swedish park, Axelsson et al. (2014) concluded that firstly, some sounds from water features were similar to road traffic noise and thus might be confused with each other, and secondly, that water sounds not only masked road traffic but also natural sounds like bird song, which had been found to increase the pleasantness of the soundscape (Axelsson et al., 2014).

Many articles investigate user preferences for public parks and places where water features are only some of the analyzed place characteristics but typically without an intensive theoretical debate about them. For example, Nordh and Østby (2013) inquired which park components foster psychological restoration, meaning the ability to rest and recover, in the Scandinavian context. They showed various pictures of small urban parks to respondents, who had to assess on a 10-point Likert scale how likely they would sit down and rest when being mentally exhausted. In the end the respondents had to list, first, park characteristics that foster and, second, that deteriorate their restoration potential in small urban public parks. Water features were among the top three park components that contributed to perceived restoration likelihood, besides the presence of a lot of grass and many flowers and plants. The authors highlighted the value of integrating natural components in small urban park design (Nordh & Østby, 2013). Similarly, a US study found that the presence of a pool and/or water features in a park is positively associated with its use by residents of surrounding neighborhoods especially among children and youth (Baran et al., 2014). Also, it has been suggested that urban water features contribute particularly to everyday recreation (Kičić et al., 2025). Likewise, Rout and Galpern's study (2022) of how outdoor design features are perceived and used on a university campus showed that water features were acknowledged to support well-being and are regularly used by the research participants. Thus, it is concluded that water features should be prioritized in campus design (Rout & Galpern, 2022). In a review of factors that contribute to the use of small urban parks, Balai Kerishnan and Maruthaveeran (2021) confirmed that water features are highly appreciated by visitors. Furthermore, the authors established that water features in pocket parks contribute to mental well-being and promote socializing (Balai Kerishnan & Maruthaveeran, 2021). This brings us to the second major part of the literature on water features that evaluates its effect on human health and well-being.

2.2 Health and well-being impacts

Very closely linked to the question of design and effect of urban water features is their impact on human health. As was described above, many studies that investigate user preference do this with the aim of increasing quality of stay and restoration. Völker et al. (2016) conducted a qualitative survey and observations in German cities and found that besides being highly aesthetically appreciated, fountains positively facilitate the experience of water, promote interaction, and are commonly used as places to eat and drink. Moreover, water play features and ponds are especially significant in promoting physical activity, with the former also being important for entertainment, place attachment, and interactions with friends, and the latter fostering an in-depth experience of nature and water as well as interaction with family (Völker et al., 2016). A Dutch research project aimed to design an inclusive and interactive water fountain that particularly promotes physical activity and social interaction (Van Renswouw et al., 2022). Through combining the research and design process, which included the development and testing of a prototype and a pilot study, they discovered that an interactively designed fountain sparked exploration and imaginations among the participants and people passing by. Thereby the fountain motivated them to physically engage and communicate with each other; though communication typically happened between people who already knew each other, and no new contacts were made (Van Renswouw et al., 2022). A recent study identified positive correlations between different types of urban blue space exposure and public happiness, with urban rivers showing the greatest impact, followed by artificial water features, which are appreciated for their aesthetics, attentional engagement, safety, ease of access, and the possibility to interact (Gao & Fang, 2025).

A scoping review about health and well-being related outcomes of water features confirms that these infrastructures foster various health-related benefits (Xie et al., 2021). The authors focused on artificial water features, which they defined as “a type of landscape feature designed and constructed by human beings that involves water” (Xie et al., 2021, p. 2). This includes artificial ponds, fountains, water play elements, and artificial streams. Most evidence was found on their potential to support mental health through facilitating stress restoration and inducing positive emotions. Moreover, some studies showed positive effects of water elements on both physical and social health, as they promote physical activity through, for example, being a destination of walks and enabling social interaction (Xie et al., 2021). Concerning different types of water features, fountains and their effect on health were found to be most frequently examined, followed by artificial ponds; water play features, artificial waterfalls, and artificial streams are less studied. The types of water features, their characteristics like naturalness or motion as well as the surrounding environment seems to play a role for their effect on humans. The majority of the 21 reviewed studies focused on passive interactions with water, like watching, listening, and spending time close to water features, while active interactions like touching and playing with water features were less investigated. The authors concluded that there is little evidence on the health impacts of artificial water features but that existing studies suggest the stimulation of positive health-related

outcomes. Furthermore, it is argued that small-scale blue infrastructure holds great potential because of its easy implementation in many urban settings (Xie et al., 2021).

A major discourse in the literature on the linkages between water and human health and well-being happens around surface water in general, commonly referred to as (urban) blue spaces. Being aware that water features only partly fit this description (i.e., artificial ponds in parks do but drinking water fountains typically do not), a brief insight into this body of literature is given in the following. In a systematic meta-analysis of the literature, Völker and Kistemann (2011) identified an appreciation of the view, sound, and presence of water as well as emotional, restoration and recreational benefits associated with being in contact with blue spaces. Additionally, Gascon et al. (2017) found that previous studies point to a positive relationship between exposure to blue spaces and both mental health and physical activity.

Building on a framework by Markevych et al. (2017), which initially aimed to organize the linkages between urban green spaces and health, White et al. (2020) developed a model for examining the benefits of blue spaces on human health and well-being. According to this framework, three pathways of how blue spaces can affect health are differentiated, namely mitigation, restoration, and instoration. Mitigation refers to the reduction of harm through stressors like heat and partially noise (White et al., 2020). Research shows that air around water bodies shows lower temperatures compared to the greater surrounding across different climatic zones. Regarding noise mitigation, however, it is cautioned that some evidence shows that water bodies reflect sounds and thus can increase noise (White et al., 2020). Restoration, as the second pathway, links to stress reduction and cognitive or attention restoration. The effect of urban blue spaces on restoration seems to be strongest at the seaside (White et al., 2020) but evidence has likewise been found on positive linkages between urban water features and restoration (Xu et al., 2025). The “attention-holding properties of the water views” (Ulrich et al., 1991, p. 546 cited in White et al., 2020, p. 6) are emphasized as specificity of blue spaces.

The third pathway, instoration, describes water as capacities building through encouraging physical activity, promoting social relations, and building nature and place connectedness (White et al., 2020). Even though the physical activity itself frequently does not take place in the water, water is assumed to inspire especially walking in its proximity. Furthermore, blue spaces are regularly places that are visited with friends and family and thus thought to promote positive social relationships (White et al., 2020). In a systematic review that focused on physical activity and sedentary behavior, Motomura et al. (2022) found that places by water can invite both physical activity and sitting in its surrounding. Kajosaari and Pasanen (2021) discovered that while leisure-time physical activity is often of lower intensity in proximity to blue spaces, it nevertheless offers a high degree of restoration in terms of relaxation and stress reduction. Concerning nature and place connectedness, places by water seem to be common favorite places with emotional meaning to people (White et al., 2020), particularly in urban areas (Völker & Kistemann, 2013). Additionally, specific springs and wells that are appreciated as holy or healing places might provide direct, restorative and/or instorative spiritual health benefits (Völker & Kistemann, 2011). Yet, urban blue spaces can also have negative effects on health, for example, through the exposure to air pollution

that is emitted by water-based transport and industries as well as higher ultraviolet exposure through enhanced solar irradiance (White et al., 2020). Further risks associated with urban blue spaces comprise drowning, flooding, pollution, and water-borne diseases (White et al., 2020).

Considering the negative health implications of water features, research has mostly thematized threats due to water contamination. For instance, Santos et al. (2020) tested drinking water fountains and misting systems in public parks in São Paulo, Brazil and found that even though the water samples met the official quality standards, a share of them carried the bacterium *Staphylococcus aureus*, which can cause human infection. Looking for the virus SARS-CoV-2, Kozler et al. (2021) identified it at one of the 25 tested drinking fountains in different Israeli cities. Concerning trace elements and minerals, Birgin Iritas et al. (2019) showed elevated levels of, among others, iron, nickel and arsenic in public fountains in Turkey because of the geological structure of the region. It should moreover be noted that anthropogenic activities can cause pollution of drinking water, for example, through heavy industries or sewage leakage (Mahfooz et al., 2019). Another study investigated ornamental fountains in Cali, Colombia and found *Leptospira* bacteria, which is a tropical zoonosis, in about 40% of the samples and especially in decorative fountains located on plazas and sidewalks (Escandón-Vargas et al., 2019). De Man et al. (2014) evaluated the health risks of water play parks fed by rainwater in the Netherlands; after examining water quality, interaction, and exposure, they conclude that users may be exposed to the risk of infection due to the presence of pathogens. Likewise different bacteria were documented in drinking water-fed recirculation fountains in Hannover, with the accessible ones showing higher levels of microbacterial pollution (Carpio Vallejo et al., 2024). The authors suggested to establish water quality criteria for water features in order to minimize health risks particularly for children who might play with the water (Carpio Vallejo et al., 2024; De Man et al., 2014). A further health risk is posed through untreated standing waters that can act as habitat for water-borne diseases (Irwin et al., 2008); regarding urban water features this mostly applies on ponds in public parks.

Summarizing the research on health and well-being impacts of water features, benefits include mitigation of heat or noise, stress restoration, and building health capacities through, for example, encouraging physical activity or providing attractive places for social interaction, which encourages people to spend time and socialize (Balicka et al., 2022). Human health and well-being risks of urban water features mainly are due to contamination.

2.3 Water features' potential as nature-based solutions

In addition to recreational and health-related benefits, urban water elements provide important functions like stormwater management, urban biodiversity, and heat mitigation that can be discussed under the notion of nature-based solutions. As already mentioned in the introduction, nature-based solutions aim to address multiple, contemporary challenges like climate change adaptation and mitigation, disaster risk, and socio-ecological resilience through promoting the implementation of natural features instead of grey engineering solutions (Kabisch et al., 2016). As two fundamental aims are improving climate resilience of and living conditions in urban areas, the

already mentioned benefits of urban blue infrastructure and water features for the quality of stay and human health and well-being could also be discussed in the context of nature-based solutions. In the following different nature-based solutions performed by various blue infrastructures are presented.

Ponds and other urban water bodies can perform regulating ecosystem services like water purification, flood regulation, climate regulation; provisioning services regarding habitats, fish, or fiber; supporting ecosystem services such as nutrient recycling; and cultural services through providing aesthetic, recreational or spiritual benefits, which were already discussed above (Haase, 2015; Millennium Ecosystem Assessment, 2005a, 2005b). Likewise, McNabb et al. (2024) emphasized the bio-physical and socio-ecological benefits of providing open water bodies and planting diverse vegetation. These nature-based measures reduce rainwater runoff in volume and velocity through increasing infiltration and storage capacities, which decreases flood risk. Furthermore, higher evapotranspiration, i.e., the combination of evaporation from water surfaces and transpiration from vegetation, assists in reducing heat and improving air quality besides creating varied habitats in and around the water, fostering urban biodiversity (McNabb et al., 2024). Challenges of urban water bodies concerning biodiversity are, among others, high nutrient input and little vegetation, which impedes biodiversity; in contrast nutrient-poor, transparent waters with high vegetation sustain a much higher biodiversity that can also hold red-list species (Vermonden et al., 2009). With proper management it is argued that urban blue spaces can function as valuable habitat for aquatic species (Suhling & Johansson, 2022). According to a study in Indian cities, biodiversity is the most valued ecosystem service for visitors and users of urban blue infrastructures, which is followed by climate regulation (Chowdhury et al., 2025). Concerning the stormwater regulating potential of ponds and urban water bodies it should be added that not all stormwater systems include permanent water in their design but often involve permeable surfaces or swales that are only filled with water in the case of rain and thereby help to reduce surface runoff (Prudencio & Null, 2018).

Concerning heat mitigation, research has shown that the presence of water reduces the surrounding temperature mainly through evaporation. A review by Lai et al. (2019) demonstrated that a number of characteristics of water bodies are beneficial during heat periods. Firstly, its ability to evaporate water results in a direct reduction of air temperature; secondly, its high thermal capacity allows water to absorb a decent amount more heat than, for example, pavement materials, which results in a lower surface temperature of water; and thirdly, the heat transfer between air temperature and the water surface also contributes to reducing heat (Lai et al., 2019). It has been found that the cooling effect of water is greater on sunny days as evaporation is strongest under direct solar radiation. Yet, increased air humidity can negatively affect thermal comfort if general humidity is already high (Lai et al., 2019). Due to the high thermal capacity of water absorbing heat during the day, water bodies may warm their surrounding during the night when air temperatures are cooler and the stored heat is released (Jandaghian & Colombo, 2024). Moreover, water bodies cannot block direct solar radiation in comparison to urban geometry or vegetation, which is the reason why strategies of changing urban geometry and of planting

vegetation were considered more effective in reducing urban heat (Lai et al., 2019). Nevertheless, in an US study looking at the effect of constructed wetlands, Ruiz-Aviles et al. (2020) showed that small lakes in residential areas have a significant negative effect on surface and air temperature and positively influence human comfort during heat periods, which moreover is recognized by local residents. Research in India indicated that urban water bodies may be even more effective in climate regulation than vegetation, however, both cooling outcomes are very local as a geospatial analysis showed (Mitra et al., 2025). Wu et al. (2019) conducted research in central China and identified a strong negative effect of urban blue infrastructures on land surface temperature with cooling effects around 5,5 °C on average with a maximum of 8 °C temperature reduction in summer. The cooling effect is influenced by water area, shape, and vegetation around the water bodies, with vegetation in particular reinforcing temperature reduction and increasing the cooling area (Wu et al., 2019). Similarly, a study in Bangladesh found empirical support for the temperature regulation potential of water bodies with larger ones showing even lower surface temperatures than smaller ones (Faridatul et al., 2024). Additionally, the depth of the water and local climatic conditions like humidity, wind patterns, and ambient temperature are discussed as influential factors on the cooling potential of water bodies (Jandaghian & Colombo, 2024). Calls have been made to both strategically place water features and combine it with green infrastructure to address multiple urban challenges at once (Jandaghian & Colombo, 2024).

Climate regulation is likewise discussed in relation to smaller water features. For example, Gómez et al. (2013) studied the effect of water fountains with pools and jets on air temperature and found that the surrounding is effectively cooled. This, they explained, is firstly because of water's capacity to evaporate, which is supported by the jets, and secondly its surface capacity to absorb radiation instead of reflecting it (also referred to as low albedo value, which typically encompasses light-colored surfaces), especially when the sun stands high (Gómez et al., 2013). Similar to research about water bodies, it is argued that both the surrounding of the water feature (e.g., grass or pavement) and the wind play an important role in the cooling effect of urban water features, with grass and wind fostering a reduction of temperature (Gómez et al., 2013). Fahed et al. (2020) compared the effect of different heat mitigation strategies (vegetation, water features, and surface materials with low albedo value) and found that water fountains and misting systems were the most effective strategy to reduce urban heat. The maximum simulated temperature reduction of water features was 7 °C with the refreshing effect being noticeable up to 100 meters downwind. The authors furthermore analyzed pedestrian comfort and identified that while trees have the highest effect during the day, with local physiological equivalent temperature reductions up to 20 °C, water features improve pedestrian comfort during day and night (Fahed et al., 2020). The study concluded that water features offer great potential for urban heat mitigation, especially in narrow streets, where an increase of vegetation is difficult to implement (Fahed et al., 2020). Investigating misting systems and a water path in an urban park in South Korea, it was found that both lead to a reduction in surface and air temperature, with the former being more pronounced (Lim et al., 2024). The fog system was combined with a pergola that provided shade, creating a comfortable environment that also showed less fine dust and lower CO₂ levels, whereas around the water path

direct sun exposure did not make it as comfortable even though temperature was reduced (Lim et al., 2024). A systematic review of spray cooling demonstrates that water mist effectively cools the surrounding through evaporation across different geographical locations (Ulpiani, 2019). A study by Rising and Deng (2024) identified that not only ambient temperature but also mean body temperature is effectively lowered by the presence of water features. They examined the effect of a larger fountain that included pools and cascading waterfalls in Portland and identified a microscale cooling effect within close proximity, meaning less than one meter distance to the water feature (Rising & Deng, 2024). A recent US study confirms the cooling effect of misting systems to cool air temperature in a dry climate by up to 17,5 °C and to reduce human skin temperature by about 0,48 °C (Huang et al., 2025). When combining misting with sprinkling water on asphalt the highest decrease in both air and surface temperature can be achieved (Huang et al., 2025). However, the microclimatic context (temperature, air humidity, wind speed, solar irradiation) appeared to be an important factor influencing cooling capacity and human comfort (Huang et al., 2025; Ulpiani et al., 2020).

2.4 Engineering, economic, and justice perspectives

Other parts of the literature engage with the technicalities of small-scale water features, their impact on property values, or justice considerations like accessibility. The engineering focused research articles examine, for example, how the cooling potential of misting systems is influenced by different pressure systems or droplet sizes. While some argue for smaller droplets (Ulpiani, 2019), others do not find a significant difference for cooling (Hideki et al., 2008). Regarding property values, research identified a willingness among homeowners to pay higher prices for residential buildings in proximity to both urban parks with water features like ponds and larger urban blue spaces like rivers and canals, which provokes an increase in land value (Lin et al., 2013; Nicholls & Crompton, 2017).

Employing an environmental justice perspective on urban blue spaces, Canfield et al. (2024) conducted a review and identified “justice concerns connected to all types of waters and roles of waters” (Canfield et al., 2024, p. 130), referring to inequalities in both benefits derived from access to water like recreation as well as risks associated with water like, for example, flooding. Thornhill et al. (2022) found an uneven distribution of blue spaces in Mexico City and Bristol with the availability of water bodies being related to higher socio-economic status. Similarly, research from the US showed that people with higher socio-economic status showed greater familiarity and usage of urban waterways (Haeffner et al., 2017). A study of German cities identified that people with migratory background live in closer distance to urban blue spaces, but, nevertheless, have lower coverage of water in their area (Wüstemann et al., 2017). Research in Florida disclosed disparities in quality, diversity, and size of stormwater ponds between an inner-city district and the remainder of the city (Wendel et al., 2011). It should be mentioned that much of the environmental and climate justice discourse and research has taken place in the North American context and has emphasized the role of race in environmental discrimination. In Europe, evidence points to

immigrant groups having less access to urban green spaces (Kabisch & Haase, 2014). Moreover, comparing different accessibility measurements, Laatikainen et al. (2015) found the existence of inequality in access to urban blue spaces in the Helsinki Metropolitan Area, especially along lines of car ownership and income status. The overall pattern of social inequalities in availability of and access to urban blue and green infrastructures is confirmed by a systematic literature review in the European region (Schüle et al., 2019). However, to the author's knowledge, water features like fountains or misting systems have not yet been studied from a justice perspective.

Urban water features are recognized to play a decisive role in the design of public spaces, to impact human health and well-being, and to provide various ecosystem services as nature-based solutions. Nevertheless, environmental justice concerns remain debated, particularly spatial proximity and access to blue infrastructure is thematized in the literature. Many of the reviewed studies do not specify what they refer to when using the term water feature, and a variety of terminology is used to describe the same water feature – for example, misting systems have also been called spray systems, spray cooling, and fog systems. The diversity in both the expressions and involved academic fields may hinder the establishment of a specific strand of research. This might reflect some difficulties the author faced when conducting the literature review, for example finding search terms that return a substantial amount of relevant research papers. Specifically, literature about health risks of water features due to pollution, performed ecosystem services, and justice issues regarding urban water features had to be manually added as it was attached to different keywords.

3 THEORY: Planning and urban water features planning

This chapter offers insights into the planning literature to provide the basis for a comprehensive engagement with the planning of urban water features as small-scale blue infrastructures in the Viennese context. It starts with a definition of planning and then describes its development, contemporary understanding, and actors. This is followed by an overview of how planning can be conceptualized and researched through the planning dimensions of context, content, and process. The last section brings these three dimensions together and investigates the specific planning of urban water features and their justice implications.

3.1 What is planning?

Planning has been described as “the instrument of managing change in the built and natural environments” (Gunder et al., 2017, p. 2). In the German speaking literature, planning is characterized by its attempt to anticipate the future guided by aims and values and to shape it through a formalized procedure (Fürst, 2018, p. 1712). The object of spatial planning is land, which, as a natural resource, is inherently limited. The task of planning, thus, is to organize and steer the use and development of land in order to limit land use conflicts and ensure its potentials are developed and used. To cater to this, planning includes the processing of information and resolving of conflict (Fürst, 2018). In its emphasis on spatial organization, spatial planning can be distinguished from sectoral planning with spatial impact, which includes, for example, landscape planning, mobility planning or environmental planning (Diller, 2018). Spatial planning needs to negotiate between a multiplicity of stakeholders and interests while, particularly in the case of public planning, being accountable to the greater public, as planning questions are closely linked to distributional issues. Through the application of regulated procedures and methods public planning aims to create a legally verifiable process that provides legal certainty and limits the individual agency of both planners and stakeholders (Fürst, 2018). Nevertheless, planning, as it is guided by specific aims, values, and assumptions, is a normative endeavor. Common challenges of planning include the mediation between different actors, the development of consensual and forward-looking solutions, and uncertainties about the future (Fainstein & DeFilippis, 2016; Fürst, 2018).

3.1.1 The broad strokes of planning history

The image of planning and its tasks have changed significantly in the last century. Coming from a rationalist, technocratic understanding of planning, the 1960s promoted participatory practices, which until now have become an essential element in the strategic coordination of pluralistic interests (Fürst, 2018). Urban planning is said to have emerged in the 20th century as a response to the 19th century industrial city (Fainstein & Campbell, 2012, Chapter 1). Planning was rather reactive

in the beginning and strived to adapt to and resolve conditions like negative health impacts of large-scale industrial urbanization (Wiechmann, 2019c). In the first half of the 20th century planning became more forward-looking and adopted a rationalistic and comprehensive approach to space. The main aim was social improvement through developing masterplans that followed grand visions, and which should work as spatial blueprints (Faludi, 1970; Gunder et al., 2017; Healey, 2003). Planners were trained as architects and engineers and focused on the urban form as the main object of planning. Still, they perceived themselves as transformative actors, who substantially improved the life quality of urban citizens through creating functionally efficient and aesthetically pleasing cities in a modernist paradigm (Faludi, 1970; Gunder et al., 2017; Healey, 2012). The attitude was strongly rationalist in the sense that planners were seen as neutral agents who, through employing rigorous scientific methods, were able to identify and implement the objectively best solution (Gunder et al., 2017; Healey, 2012). This reflects a closed planning model that assumes complete information, unambiguous objectives, and the availability of all necessary resources (Siebel, 2006).

In the 1960s several critiques of this way of doing planning emerged. They problematized firstly, the technocratic processes of planning, which did not allow for any participation of those affected; secondly, the asserted positivity of planning and its claims to scientific knowledge; thirdly, questions of power and how planning was used as an instrument of state power; fourthly, social justice, poverty, and the negative consequences of planning for some groups in society; and fifthly, the environmental crisis (Gunder et al., 2017). This post-modern thinking brought attention to urban societies, how they shape both spatial organization and urban form (Healey, 2012) and to the democratic legitimacy of planning (Gunder et al., 2017). The criticism led to shift in planning practice towards including participatory methods and seeing planning more as a negotiating process between different actors as well as recognizing that knowledge is socially constructed and thus never neutral. This new paradigm commonly has been referred to as “communicative planning” or “collaborative planning” (Healey, 1992, 2003). Furthermore, greater attention was paid to the institutional and social context in which planning occurred, to the actors, power relations, and their influences on planning outcomes (Gunder et al., 2017; Healey, 2003, 2012; Wiechmann, 2019c). A contemporary understanding views planning as an incremental coordination of activities that is more flexible and permanently negotiates in an increasingly pluralistic and fragmented society but within a long-term guidance framework (Fürst, 2018).

3.1.2 Contemporary urban planning

Urban planning has been defined as the organization, steering, and development of city areas (Pahl-Weber & Schwartz, 2018). It is usually future-oriented, cross-sectional and strives towards spatially realizing the implementation of economic, ecological, and social goals. Urban planning is a public sector activity and therefore a subject matter of political decision-making processes at the interface of sectoral planning and politics (Pahl-Weber & Schwartz, 2018). City areas typically do not need to fulfill specific criteria (e.g., a particular number of citizens) to employ urban planning; the term is rather used to describe planning activities of municipalities of various sizes and legal categories. The core tasks of urban planning have been described as firstly, developing integrated

planning strategies that combine the consideration of infrastructure, land use, social, and ecological aspects, among others; and secondly, designing the planning processes (Fürst, 2018; Pahl-Weber & Schwartz, 2018). The characteristic output of planning processes are plans that define the structure, function, or form of a particular space. Planning thereby navigates between legal, administrative, land market, tax, and planning issues. Methods of urban planning do not differ substantially from general planning methods and include the methodical application of surveys, forecasts, and targeted development processes combined with creative design elements for spatial visions as well as process design and management (Pahl-Weber & Schwartz, 2018). Similar to the overall evolution of planning thought, urban planning came to emancipate from a technocratic approach that primarily looked at and developed the urban form from an architectural perspective. Instead, an interdisciplinary approach has increasingly been adopted and attention is given to the examination of social processes of spatial production as well as the coordination and negotiation of plans and projects with various stakeholders (Fainstein & Campbell, 2012; Gunder et al., 2017; Pahl-Weber & Schwartz, 2018).

Urban planning is not only performed by experts from public institutions but comprises a variety of actors, for example public sector employees, politicians, private sector companies like investors, civil society organizations, citizens, and those directly affected by the planning project at hand. Increasingly, an understanding of planning as steering societal processes through being an intermediary that mobilizes and coordinates activities of different actors has been adopted (Fürst, 2018). This orientation away from perceiving the municipality as sovereign-hierarchical actor towards a more cooperative and inclusive approach is also referred to as governance (Benz & Kilper, 2018; Rydin, 2021, p. 84). Governance is both descriptive and normative, as it, on the one side, aims to more accurately reflect planning practices in planning theory and provides analytical tools for this, but on the other side, argues for the importance of cooperation in networks, coordination, and interaction between the state, economy, and civil society to foster a more democratic and effective way of planning (Benz & Kilper, 2018; Gailing & Hamedinger, 2019; Rydin, 2021, p. 85).

Wiechmann (2019c) characterized three dimensions for investigating planning, namely context, content, and process. Context addresses the institutions, structures, norms, and organizations that influence and legitimize planning and provide it with its scope of action. Content engages with the substance of planning, meaning the problems, tasks, goals, and values of planning practice, including its visions and concepts as well as the content of its plans. Process evaluates the procedures of planning, the consensus, conflicts, power relations, and actors, answering to the question 'how' is planning done. The author emphasizes that the dimensions cannot be separated as to fully understand a planning problem all three must be examined because of their profound interlinkages and interdependencies. Still, for the analytical reason to reduce complexity and center the investigation, it can be reasonable to put the primary focus on one of the dimensions as long as the others are recognized (Wiechmann, 2019c).

These three dimensions organize the following chapters of the literature review on planning, firstly discussing the institutional contexts of planning, secondly describing different substantive approaches towards urban planning in the form of city concepts, and thirdly thematizing planning

processes. It needs to be highlighted that different approaches and bodies of theory exist about planning and the following attempts to give a brief overview across the different discourses, which sometimes stand in contrast to each other or overlap. Thereafter, the planning literature on urban blue and green infrastructure and urban water features is reviewed. Particular attention is paid to justice considerations.

3.2 Institutional context of planning

The context of planning, or the planning environment, as the spatial planning theorist Andreas Faludi calls it, refers to institutions, the political system, administrative structures, underlying norms and values, and how they influence the scope of action of planning as public task (Faludi, 1970; Wiechmann, 2019c). The urban geographer and planning and institutionalism theorist André Sorensen (2017) writes:

It seems obvious that a robust theorization of institutions is important to planning theory, as institutions and institutional design are central to the planning project of creating better, more just, more liveable and more sustainable cities. Cities are densely institutionalized spaces, with multifaceted institutions shaping everything from the regulation of sidewalks to conceptions of good neighborhoods to the legal structure of property. (Sorensen, 2017, p. 250)

Gailinger and Hamedinger (2019) agree that an institutional perspective, which is interested in the rules of planning, assists in understanding structures and activities of planning as these sets of rules frame, enable, and restrict societal action. Similarly, Patsy Healey, a planner as well as a planning theory and planning education researcher, argues that “analysts of planning activity and those designing planning interventions need to develop the capacity to grasp and describe the ‘situatedness’ of planning activity” (Healey, 2007, p. 64). With ‘situatedness’ she refers to the context of planning and the locally specific institutional arrangements that shape power relations and planning opportunities. An example Healey (2007) gives is from Newcastle, UK, where transformational attempts in urban planning partly failed because the role of institutions and their complexity was underrecognized and therefore not appropriately addressed. But planning is not only structured by institutions, it also creates and changes institutions.

The planning scholar Ernest Alexander (2005) sees the role of planners not only in navigating their institutional environment but also in actively designing it. This ‘institutional design’ or ‘institutional transformation’ is described as deliberate process, which requires familiarity and knowledge of the institutional context. Alexander (2005) identifies three levels of institutional design. The first relates to macro-societal processes and institutions; an example is the adoption of supra-national policies. The second level refers to meso-structures like the design of realization processes; here planners are assigned a key role in creating, for example land-use policies and shaping how political goals are put to spatial practice. The third level addressed intra-organizational design; examples involve the management of planning processes or project implementation (Alexander, 2005). Sorensen (2017) recognizes the role of planners in creating and changing institutions: „Planners have been

the authors of many institutions designed to manage processes of urban change, from land-use zoning to infrastructure building and management systems” (Sorensen, 2017, p. 250). Here Sorensen refers to the second and third level of institutional design that are identified by Alexander (2005). Institutionalism thus focuses on the interplay between actions and institutions in planning (Gailing & Hamedinger, 2019).

But what are institutions, how can they be defined? Contrary to everyday usage, institutions are not understood to be organizations (Healey, 2007). Sorensen describes institutions in the framing of new institutionalism as “sets of rules and shared understandings that shape action” (Sorensen, 2017, p. 251), which encompass both formal and informal rules. This distinguishes it from the ‘old’ institutionalism that produced rather descriptive accounts of formal institutions, like the structure and functioning of public administrations (Sorensen, 2017). New institutionalism recognizes the importance of formal institutions for the decisions and actions of actors but additionally emphasizes the influence of informal structures, like norms and values, assumptions, and practices (Gailing & Hamedinger, 2019). However, there are different definitions of what exactly institutions are, which build on different schools of thought and partly are rooted in different ontologies (Gailing & Hamedinger, 2019; Hall & Taylor, 1996; Sorensen, 2017). It should be noted that new institutionalism did not evolve in the planning theory field but in wider social science theory, drawing on and influencing political science, sociology, economics, and geography, among others (Sorensen, 2017). Commonly, three different approaches are distinguished: rational-choice institutionalism, historical institutionalism, and sociological institutionalism (Hall & Taylor, 1996; Sorensen, 2017). All of them “seek to elucidate the role that institutions play in the determination of social and political outcomes” (Hall & Taylor, 1996, p. 936). They differ not only in how they define institutions but also in how the relationship between institutions and behavior is conceptualized and how processes of institutional creation or change are explained (Hall & Taylor, 1996).

3.2.1 Rational-choice institutionalism

Rational-choice institutionalism emerged out of studying the US-American congress and more specifically the observation that the institution of congress helped in solving collective action dilemmas (Hall & Taylor, 1996). This means that individuals did not strive for their personal most ideal outcome but agreed on a solution that maximized collective preference under the assumption that the other individuals complied, even though it is assumed that each actor for themselves behaves very rationally and tries to maximize their own preferences. Institutions are thus understood as providing information about the strategic actions of others, guaranteeing complementary behaviour, and minimizing transaction costs (Hall & Taylor, 1996). Institutions, in rational-choice institutionalism, are defined as “rules of the game in a society or, more formally, [...] the humanly devised constraints that shape human interaction” (North, 1990, p.3 in Sorensen, 2017, p. 254). This definition of institutions encompasses formal rules, informal constraints, and enforcement mechanisms (Sorensen, 2017).

Rational-choice institutionalism argues that institutional creation is highly purposive and intentional (Hall & Taylor, 1996), even though there has been debate about how successful deliberate institutional design actually is (Alexander, 2005; Sorensen, 2017). Within the planning field rational-choice institutionalism has been applied to justify planning by, for example, explaining the existence of formal land-use planning through transaction-cost theories instead of commonly used market failure arguments (Sorensen, 2017). This means that public planning actively took on the task of land-use planning because it both increased certainty and reduced transaction cost for other actors (the market failure argument would posit that land-use planning is necessary because the market would not be able to manage this properly). Simultaneously, rational-choice institutionalism scholars question if a public organization of land-use planning is the most efficient solution (Sorensen, 2017). This institutional approach has been criticized for its perception of individual as rational and self-interest maximizing actors, the disregard of social structure, and a simplified view on institutional complexity (Gailing & Hamedinger, 2019; Sorensen, 2017).

3.2.2 Historical institutionalism

Historical institutionalism is theoretically based on structural functionalism and group theories in political science. From this approach institutions are defined as “formal and informal procedures, routines, norms, and conventions embedded in the organizational structure of the polity or political economy” (Hall & Taylor, 1996, p. 938). Thereby, the authors refer to formal organizations and their rules or conventions, for example, constitutional order, the operating procedures of state organization or agreements in trade-union behaviour (Gailing & Hamedinger, 2019; Hall & Taylor, 1996). Historical institutionalism pays close attention to why actors behave as they do, how institutions distribute power unequally, the role of path dependency as well as unintended consequences and inefficiencies that are created by institutions, while recognizing that institutional analysis alone cannot fully explain the complexity of human behaviour (Hall & Taylor, 1996; Sorensen, 2017).

Institutional creation and change, particularly large-scale and long-term developments, are important research topics within historical institutionalism, for example Mahoney's (2010) investigation into how colonial institutions continue to influence post-colonial development (Sorensen, 2017). These processes are seen as embedded in already existing institutions and their power relations (Hall & Taylor, 1996) and happen either incrementally or at ‘critical junctures’ due to external pressures (Sorensen, 2017). Path-dependency is an important concept within this approach. It is argued that self-enforcing positive feedback loops enable a specific set of opportunities that are grounded in the previous development of the institution. Because of path-dependencies some options are simply precluded (North, 1990). The explicit power-political dimension of historical institutionalism is notable. Institutions are understood as “distributional instruments that allocate resources unevenly and thereby help constitute asymmetrical collective actors” (Mahoney, 2010, p. 15 in Sorensen, 2017, p. 252). This means that some actors always benefit more from a specific institution even though it may seem neutral at first glance. Further, it is argued that those actors with more political power can mobilize more resources to maintain or

create institutional structures that favor them (Sorensen, 2017). Therefore, it is important to recognize institutions “as objects of contestation among actors ... [to] capture the prominent role that power and conflict play in actual processes of institutional formation and change” (Mahoney, 2010, p.16 in Sorensen, 2017, p. 257). Also, some scholars within historical institutionalism highlight that institutions might not only coordinate action in a positive sense, like rational-choice institutionalism would argue, but can coerce and dominate in a repressive way (Sorensen, 2017).

Feminist, discursive, and constructive institutionalism are identified as one branch of historical institutionalism that specifically focuses on the interaction of discourses, ideas, norms, and legitimation with institutions (Sorensen, 2017). According to Sorensen (2017, p. 259), historical institutionalism has had “surprisingly little influence” on planning theory, so the author sets out to delineate some potentially productive discussions. Among them are questions of institutional formation and change, where concepts of historical institutionalism could provide a meaningful framework for analysis. Further, issues of path dependencies and reinforcing feedback loops in planning or of power relations that shape planning institutions’ unequal distribution of benefits could be analyzed through historical institutionalism (Sorensen, 2017). Mäntysalo and Bäcklund (2017) agree that an investigation of path-dependency is very meaningful in planning as institutions have the tendency to ‘stick’. This is because of high set-up costs, the functional role the institution fulfills in the larger system, and the distribution of power that enables those benefiting from the institution to reinforce it to maintain their power, and the existing legitimacy of the institution (Mäntysalo & Bäcklund, 2017). Here, historical institutionalism can assist particularly in comparative planning studies to understand planning systems in their wider context of other institutions, where institutional change is continuously contested among actors as some always benefit more than others (Sorensen, 2017).

3.2.3 Sociological institutionalism

Sociological institutionalism was developed in sociology, precisely in organizational theory. This approach adopts the broadest definition of institutions to “include, not just formal rules, procedures or norms, but the symbolic systems, cognitive scripts, and moral templates that provide the ‘frames of meaning’ guiding human action” (Hall & Taylor, 1996, p. 947). Thereby the commonly made conceptual difference between institutions and cultures is dissolved as culture itself is understood as an institution. Here, the role of institutions is defined from a social constructivist perspective, meaning that institutions both display and influence shared values, in other words what is socially appropriate, and shape individuals’ preferences, identities, and self-images (Hall & Taylor, 1996). Institutions are further perceived as important factor in reproducing cultural practices, systems of beliefs, frames of references, and logics of power (Healey, 2007). Thereby institutions directly influence how individuals understand situations and impact what actors perceive as possible choices (Sorensen, 2017).

Institutions are not deliberately created from this perspective but evolve slowly over time, responding to changes in the wider cultural and normative context (Sorensen, 2017). They however can be affected by individuals, as they, through their actions that are influenced by institutions, in

turn reproduce these institutions. Therefore, institutions can be changed and are reinvented through human agency (Healey, 2007). This line of argument builds on the structuration theory of Anthony Giddens that posits that societal structures are not determining social action but that they both influence but also are reproduced by agency (Giddens, 1997; Sorensen, 2017). However, other authors have interpreted sociological institutionalism as largely deterministic by arguing that if everything that guides human action is institutionalist, there is no room left for individual agency (Mayntz & Scharpf, 1995).

In planning, sociological institutionalism has particularly contributed to the analysis of the institutional situatedness of planning practice and the role of institutions in transformative processes, thereby showing that simply investigating the formal procedures of government offers an incomplete picture of reality (Healey, 2007; Sorensen, 2017). Rather attention is given to “interactions of the inheritance of actors, arenas and networks, discourses and practices and modes and cultures of governance in a locality with all kinds of exogenous factors [which] mold the power of agency” (Healey, 2007, p. 81). Furthermore, the municipal level is appreciated as incubator of transformational efforts as it can foster the institutionalization of new understandings, norms, and ideas regarding local places (Sorensen, 2017). In addition, sociological institutionalisms’ approach towards the social-constructedness of human action (being influenced by and influencing institutional structures) emphasizes that the future cannot be fully predicted and designed and planning, therefore, cannot be only technical but instead needs to be aware and reflective about the dynamic and complex local governance landscape (Healey, 2007).

3.2.4 Planning culture

Another theoretical approach to the context of planning is planning culture. Knieling and Othengrafen (2015) developed an analytical model to examine and compare the effect of local cultural factors on planning. The cultural context is understood as unquestioned assumptions, routines, emotions, shared meanings, and power relations that underlie planning processes and outcomes and affect how certain instruments, rules and procedures are applied. Also, the particularities of historical developments and traditions are recognized as influential on planning practice (Knieling & Othengrafen, 2015). To systematically analyze the cultural context of planning, the authors propose the ‘culturalized planning model’, which includes three dimensions, namely, planning artefacts, the planning environment, and the societal environment. Planning artefacts refer to visible urban structures, the local characteristics of the planning system, for example centralized, and type of organization, as well as the features of planning product like scope and bindingness of plans. The planning environment describes “the assumptions, frames and values of urban and regional planners that are learned” (Knieling & Othengrafen, 2015, p. 2138) and includes objectives and aims of planning, traditions, decision-making processes, as well as the (self-)conception of planning. The societal environment relates to the societal context in which planning acts such as societal norms and beliefs. For planning, the general consideration of nature, the understanding of time (past/present/future), conceptions of justice, the socio-economic and socio-political environment, and general characteristics of the society like, for example, important values

or level of individualistic thinking are relevant (Knieling & Othengrafen, 2015). The culturalized planning model has been conceptually sharpened and applied to a regional scale, differentiating between 'cultures of regional planning' (shared understandings of how planning should be) and 'regional planning cultures' (the artefacts and ways of how planning is done) in order to analyze transformative effects of innovative practices (Purkarthofer et al., 2021). Planning practices are the focus of investigations on planning culture with the central aim to understand them more deeply as embedded in local space (Othengrafen et al., 2019).

Parallels can be drawn to new institutionalism theory, with 'regional planning cultures' and planning artefacts including mostly formal institutions while 'cultures of regional planning' and both the planning and the societal environment describe informal institutions as referred to in historical and sociological institutionalism. Whereas planning culture is very suitable for comparative studies of planning, new institutionalism also allows the analysis of a singular case and is therefore more appropriate for the investigation at hand. Furthermore, the planning culture approach has been criticized for its disregard of individuals and their scope of action in influencing planning outcomes (Purkarthofer et al., 2021). Even though the further development of the culturalized planning model attempts to partly dissolve this issue, new institutionalism still provides a more applicable theoretical framework as it enables the combined analysis of agency and structures.

3.2.5 Planning systems

Both the institutionalist perspective and the planning culture approach direct analytical attention to the influence of the administrative structure and political system, in other words the planning system. The work on planning systems emphasizes the embeddedness of planning in the national context (Pallagst, 2018). Characteristics include state structure (centralized or decentralized organization), tiers of planning (which planning competences federal, land, regional, municipal level have respectively), legal foundations, planning instruments, and material content including the perspectives that are outlined for spatial development (Turowski, 2002). Other authors also argue for the influence of governance structures, the economic system or the maturity of hierarchies and coordination mechanisms (Pallagst, 2018). However, no single definition of the planning system exists and many overlaps with new institutional theory or planning culture are evident. Various projects have endeavored to establish a categorization of European planning systems by comparing planning in the different national states (Pallagst, 2018). One example is the refined typology by Farinós Dasí et al. (2007) in an EU project about the governance of territorial and urban policies on different government levels.

Comparing primarily the legal system and administrative structures of European countries, the authors identify four main planning systems. The first is the comprehensive integrated approach, the second the regional economic approach, the third the land use planning approach, and the fourth urbanism (Farinós Dasí et al., 2007). Comprehensive integrated planning mainly works through a stable and mature multi-level planning system with great variety of planning instruments and regulations. It aims to coordinate the spatial implications of various policy fields, however, is rather inflexible. Countries where this planning system is in place are, among others, Austria,

Denmark, Poland, and Finland. The regional economic approach offers a broader understanding of spatial planning and includes social and economic aspects. It is characterized by a powerful national level in mostly centralized national contexts and an active regional level with planning responsibilities. Main goals include the reduction of socio-economic disparities between regions. The typology does not show countries that purely comply with a regional economic approach but several where a mixture of the comprehensive integrated and regional economic planning system can be found, namely, Germany, France, Sweden, Norway, Slovakia, Hungary, and Portugal (Dühr, 2011; Farinós Dasí et al., 2007; Humer, 2022). The third type land use planning mainly engages with the regulation of land use and property transfers with pronounced competencies at the local level and only coarse guidelines from higher levels. It thus is narrower and more flexible but also criticized for being uncoordinated. Private actors are more actively engaged. This planning system can be found in the Czech Republic and partly in the UK, Ireland, Belgium, Spain and Portugal. Planning in countries characterized by urbanism, the fourth planning system, like Italy, Greece, and Spain, similarly focuses on the local level. Topics mostly include urban design, architecture, zoning, building permits, and individual projects without much strategic programs. It is characterized by a strong private sector and rather top-down planning processes without participatory involvement (Dühr, 2011; Farinós Dasí et al., 2007; Humer, 2022). However, it is emphasized that planning systems are not static but dynamically change e.g., through the (de-)centralization of planning competencies, regionalization tendencies or by improving citizen participation in planning processes (Farinós Dasí et al., 2007; Nadin et al., 2018; Pallagst, 2018).

Depending on the planning context, planners apply different methods, instruments, and procedures. These can be either formal or informal in nature, which refers to their legal binding capacity (Pallagst, 2018). Formal instruments are regulated in legal guidelines, this means their application is legally binding and their structure and processes are largely pre-defined. Examples include spatial plans or land use plans (Diller, 2018). Informal planning instruments are neither legally prescribed nor structured and include strategies and visions on different levels of government. One example is the European Spatial Development Perspective (ESDP) that aims to coordinate the spatial planning in the EU member states. While the planning instruments, especially the legally defined ones, are described as very stable, an increase of informal planning instruments has been observed (Diller, 2018). Advantages of informal planning instruments include the flexibility in both application and design, which can foster regional governance networks or enable greater citizen participation. Disadvantages are that, firstly, they are not legally binding and only have a recommending character, which can restrict their impact, and secondly, that they are not democratically legitimized through legally defined processes (Diller, 2018).

3.3 Substantive content and concepts of planning

This section thematizes the tasks, goals, and values of planning practice through reviewing common urban planning concepts and their problem framings. Urban planning concepts or city concepts describe ideals and designs, contain diagnoses and analyses, voice critiques towards urban

developments and trends and propose programs and visions for a different and better city in the future (Rink & Haase, 2018a, p. 10). They seek to act as leitmotif and guide urban developments through providing solutions for current problems and challenges in great diversity and breadth (Rink & Haase, 2018b). An example of a city planning concept that normatively steered urban development is the modern, car-centric city that was widely implemented in the 1950s and 1960s and that has an effect up until today. One of its key premises was the spatial separation of different urban functions like housing, work, and leisure. This consolidated the reliance on motorized private transport to commute between the different places. In the past, the paradigm of functional separation has slowly been replaced by an emphasis on mixing functions in urban space (Kuder, 2004). Now, in the 21st century, a great variety of city concepts aim to formulate visions and designs for how cities should look, how they should be organized, and which urban processes should be placed at the center of attention (De Jong et al., 2015; Rink & Haase, 2018b). Generally, the negotiation of problem framings and concepts to be applied to a city is a political discussion. Planning departments' role is to then specify and implement the politically agreed-on visions. Thus, the following reviews current city concepts that offer a direct engagement with urban blue and green spaces as public infrastructures, namely the sustainable, green, resilient, just, smart, healthy, and water-sensitive city. Both the just and the healthy city concept are of particular significance for the empirical analysis of this thesis.

3.3.1 The sustainable city

The concept of sustainability gained political importance at the United Nations conference in Rio de Janeiro in 1992 (Rink, 2018). Sustainability is commonly defined as effort to meet “the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987, Section 1, ch. 3, subsec. 27) as codified in the UN’s Brundtland Report with the title “Our common future”. Commonly, the three dimensions of ecological, social, and economic sustainability are differentiated. Soon after the Rio conference sustainability was translated to urban areas with aims including the reduction of urban material and energy consumption, land consumption and sealing (ecological sustainability), the support of local decision making, inter- and intragenerational justice (social sustainability), the use of regional resources, and the promotion of circular economy (economic sustainability) (Rink, 2018). Over the years the focus changed from environmental protection in urban areas towards a discourse on transformation and an emphasis on climate protection (Rink, 2018).

In planning practice, the concept has been first taken up on the national level through its political relevance in the international environment, followed by regional and communal stakeholders engaging with it. In the 1990s and 2000s globally many local government initiatives were founded to foster consultation with local citizens towards local sustainability goals, supported by various city networks (Rink, 2018). The sustainable city has been criticized for being an empty signifier but at the same time is acknowledged as a legitimate guiding principle. As its origin is political and normative, the theoretical engagement with the concept of the sustainable city has been rare and its analytical dimension is not very pronounced. Furthermore, few empirical success stories of the

sustainable city have been found (Rink, 2018). Rink describes a weak institutionalization of the normative concept of sustainability in urban areas and that it has rarely guided planning actions and decisions because usually economic interests dominate (Rink, 2018). Still, the sustainable city can be seen as a highly influential urban planning concept that problematizes climate change and resource consumption and that can be understood as an overarching policy orientation under which other relevant city concepts (like green, resilient, or just city) can be framed (Rink, 2018).

3.3.2 The green city

Land consumption and the accompanying displacement and disappearance of nature, ecosystems, plant and animal species, and cultural landscapes are at the center of the green city's problem framing (Haase, 2018). The concept focuses on the ecological dimension of sustainability looking at the relation between humans, nature, and urban areas. It emerged out of environmental movements in the 1970s and gained inspiration from the sustainability debate (Haase, 2018). The aim is to integrate human-made cities with nature to foster interaction and make use of the services provided through ecosystems (the already discussed ecosystem services). Besides plant and animal species and their habitats, water bodies are mentioned as important elements in green cities as well as soil, water, and energy cycles (Haase, 2018). The concept strives towards the idea of literally green cities with diverse and interconnected green spaces of high quality that perform various ecosystem services, are self-regulating and resilient, cover as much urban area as possible, and are accessible to all city residents so that they can serve as everyday places. The green city gives some consideration to the social dimension of sustainability, besides the ecological one, by discussing just accessibility and health implications (Haase, 2018).

In planning, the presence of the green city discourse is seen in environmental agencies of most city administrations as well as the compulsory strategic environmental assessment, which is applicable to most plans and programs within the EU and integrates environmental considerations and protection with the goal of promoting sustainable development (European Commission, n.d.; Haase, 2018). Nevertheless, Haase argues that environmental and ecological considerations are still subordinate to economic interests and social matters. Thus, both funding for construction and maintenance of urban green spaces as well as the political priority to foster urban ecosystem services are rather weak (Haase, 2018). Yet, in urban marketing the importance of green spaces as tourist destinations has been recognized. On a strategic planning level, the green city and provided ecosystem services are increasingly seen as solution for multiple urban challenges, including public health questions (Haase, 2018).

Related to both the sustainable city and the green city concept is the idea of the eco city, which follows the ecological principle to live within the means of the environment and to build cities in balance with nature (De Jong et al., 2015). Measures include green roofs, local urban agriculture, restoring urban natural areas, renewable energy supply, water and waste recycling, and carbon-neutrality. The latter is also targeted in the narrower concept of the low-carbon city that directly reacts to climate change and rising CO₂ emissions. The key aims of the low-carbon city are to reduce natural resource consumption and foster renewable energy (De Jong et al., 2015).

3.3.3 The resilient city

Likewise connected to efforts towards the sustainable city is the concept of urban resilience. Resilience refers to the capability of systems to sustain essential functions even when experiencing disturbance or stress and to flexibly adapt to changing circumstances (Kuhlicke, 2018). The concept arose in ecosystem sciences and was transferred onto social-ecological systems, which has not been without criticism in the literature. In the urban debate the concept no longer is descriptive-analytic but rather a normative ideal of how cities should be planned and organized (Kuhlicke, 2018). Commonly natural disasters like floods or heat waves but also pandemics or economic structural change are conceptualized as threats to urban areas and their citizens. The aim is to increase the resilience of, for example, critical infrastructure, public space, or housing. Elements of ideal resilient cities list, among others, the capability to deal with change and uncertainty, the enablement of self-organization, diversity, robustness, redundancy, decentralization, flexibility, and future-oriented planning (Kuhlicke, 2018). A common critique towards resilience regards the inherent contradiction in expecting systems to sustain and preserve their functions and at the same time flexibly adapt and change. Another criticism stresses the claimed neutrality of resilience efforts, framing it as being naturally in the interests of all citizens without fostering a discussion on what risks are relevant to target at which scale, how and for whom (Côte & Nightingale, 2012). This can lead to a depoliticization of the discourse and the deepening of inequalities (Kuhlicke, 2018).

In the German speaking planning practice, the uptake of the resilient city has been very limited and according to Kuhlicke it is seldomly mentioned in strategic plans and programs. The discourse on the resilient city is more pronounced in English or Spanish speaking regions and in international organizations like the UN or ICLEI¹ (Kuhlicke, 2018). Nevertheless, it has some conceptual connections to disaster risk management and climate adaptation specifically regarding extreme weather events, and hence promotes the uptake of blue and green infrastructures in urban areas (Voskamp & Van de Ven, 2015). Particularly the discourse on urban heat resilience evidently argues for urban green and blue spaces as effective measure to reduce heat load in cities (Keith et al., 2023; Koopmans et al., 2018).

3.3.4 The just city

The just city concept focuses on social questions regarding equity and equality in cities. The discourse around it criticizes existing urban circumstances, analyzes the (re)production of unjust structures and relationships, negotiates normative goals, and suggests principles of action to foster justice (Großmann, 2018). The literature on the just city ranges from descriptive documentations of urban injustices by, for example, Charles Booth and Friedrich Engels in the 19th century, across David Harvey and Henri Lefebvre's societal critique of the cities that capitalist systems produce in the 1960s and 1970s to feminist work on the need for recognition of diversity and difference by, for example, Iris Young or Andy Merrifield and Erik Swyngedouw (Großmann, 2018). Susan Fainstein

¹ ICLEI is a network of "Local Governments for Sustainability" that strives to connect actors and policies globally for sustainable development (ICLEI, 2025).

(2011) defines three principles for urban planning: equity, diversity, and democracy. Equity refers to both distributional justice and equal opportunities and strives to explicitly support those groups and people that are worse off more than those that already benefit, thereby following Rawls' theory of justice. Examples for urban planning encompass decentralized, social housing, mechanisms against displacement, gentle urban renewal, improvement of public spaces, and provision of affordable and effective public transportation (Fainstein, 2011; Großmann, 2018). Diversity highlights the need to acknowledge and respect differences between social groups. Plural values and life plans should be recognized, and discrimination combated. For urban areas public infrastructures and spaces are seen as crucial places that should work for all people and groups (Fainstein, 2011; Großmann, 2018). Democracy as third principle emphasizes that planning should be an argumentative praxis instead of an implementation of technocratic expert knowledge in order to give room to different problem definitions and life realities. Citizen participation should be fostered in planning processes to increase procedural justice (Fainstein, 2011; Großmann, 2018). Fainstein argues that even though all three principles are of paramount importance to foster just cities, the equity of the outcome should be more important than the equity of the process (Fainstein, 2011).

Besides a general discussion on the equity of urban areas there are more specific discourses regarding different infrastructures and services, like energy, the environment, or mobility (Großmann, 2018). Particularly the concept of environmental justice is of interest when investigating urban blue and green spaces. Environmental justice puts its attention to the unequal access to environmental goods and impacts of environmental bads and concerns range from public health and workers safety to natural resource conservation (Großmann, 2018; Kuehn, 2000). Different types of movements have engaged with and used the concept of environmental justice (Bullard, 1993; Schlosberg & Collins, 2014). While nature protection is in the focus of mainstream environmental justice movements, organized as so-called elite environmental nongovernmental organizations (Schlosberg & Collins, 2014), civil rights and healthy environmental conditions for marginalized communities are advocated for by grassroots environmental justice movements (Bullard, 1993). The latter recognize the interconnectedness of social, environmental, climate, and labor inequalities and argue for a functioning environment as a necessary condition for any justice considerations (Schlosberg & Collins, 2014). Climate justice can be seen as a sub-discourse of environmental justice, which focuses on the effects of climate change on health and well-being and adds intergenerational justice aspects (Schlosberg & Collins, 2014; Sultana, 2022). This literature can offer some interesting insights for the topic at hand, as water features are frequently installed to function as heat mitigation measure. Applying the theory of environmental justice and the just city concept on urban blue and green infrastructures suggests that they should be equally distributed across the urban area, be participatory planned in collaboration with residents and local stakeholders, recognize various needs, interests, and ways to spend time in and around them, and preserve its services for future generations.

3.3.5 The smart city

New information and communication technology as solution to urban challenges is at the center of the smart city concept. Smart refers to intelligent, innovative, efficient, integrative, or interlinked, and various definitions of the smart city exist (Libbe, 2018). The normative concept with a technical and economic orientation emerged in the 1990s. Aims include optimizing urban processes, strengthening innovation, improving competitiveness, increasing energy and resource efficiency, promoting urban safety and adaptability of urban infrastructures as well as enhancing coordination and governance processes between politics, bureaucracy, and civil society. Even though the smart city is sometimes seen as an end in itself, the concept rather offers technical possibilities to serve aims that are defined in the public interest, like, for example, sustainability, social participation, or the improvement of urban life quality (Libbe, 2018).

In German planning, the smart city concept has not yet been extensively applied and mostly is discussed in connection with digitalization (Libbe, 2018). Yet, there is substantial critique towards this urban planning concept because of its highly technical orientation and the technocratic nature of planning processes, where it has been applied in practice on a greater scale. Besides the lack of citizen participation, concerns about data transparency and data security as well as tendencies towards privatization prevail. Industry and economic actors, who are guided by their own profit interests, exert a high influence on smart city (research) projects (Libbe, 2018). Furthermore, the concept hardly offers statements about the structural and spatial constitution of urban areas and has not frequently been applied as analytical framework. Still, it has become one of the most discussed city concepts beside the sustainable city (Libbe, 2018). Regarding urban blue and green spaces, the smart city aims to foster technological and interlinked solutions like green roofs, green facades, or rooftop gardens with monitored, optimized and sometimes automated water and nutrition supply (Haase, 2018) and smart rainwater harvest technologies (Livesley et al., 2021).

3.3.6 The healthy city

Human health, well-being and its promotion lie at the center of the healthy city concept (Corburn, 2009; Schlicht, 2017). It builds on the premise that a person's health is influenced by its natural, built, social, and technical environment through affecting their behavior, thinking, and sensing (Gatrell & Elliott, 2015; Schlicht, 2017). In the vision of the healthy city concept urban areas are places of well-being that promote healthy behaviors and enable a long and healthy life. Human health and well-being refer to physical, mental, and social aspects and includes indicators such as mortality, morbidity, diseases, psychological disorders, subjective well-being, or life satisfaction (Tzoulas et al., 2007; Wang et al., 2024). The healthy city concept evolved from reacting to and trying to minimize harm and disease towards a health promoting perspective that includes not only individual but also health determining factors like the urban environment. The aim is to bring planning in closer cooperation with public health practitioners and ecology experts to preserve the natural basis of life, enable social participation, and develop health-promoting urban solutions (Corburn, 2009; Schlicht, 2017).

The healthy city engages with questions of urban design, the distribution of social groups and infrastructures, the effects of climate change and strives to mainstream health as a goal in all policy areas. Nature-based solutions, like blue and green infrastructure, are understood as crucial health resources with positive impact on human health and well-being (Bowler et al., 2010; Nieuwenhuijsen, 2024; Schlicht, 2017). In an attempt to operationalize the health city objectives for urban planning and design, Ziafati Bafarasat et al. (2023) developed indicators that include, for example the share of neighborhoods that have a park, the extent of public consultation before, during, and after interventions, the number of land use types per neighborhood, the public transport connection to urban forests or the share of the population with obesity. Corburn (2009) emphasized the importance of governance structures and planning processes on place-based health outcomes and Nieuwenhuijsen (2020) illustrates that striving for a healthy city also contributes to making it more sustainable and carbon neutral.

In planning practice, a study in the UK found that a clear separation between spatial planning and health professions inhibits active planning for health (Bond et al., 2013). Even though the mandatory strategic environmental assessment should include a health perspective, in practice strategic health authorities and public health experts are only irregularly consulted. This leads to the topic of health only being considered in half of the development plans to some extent and in less than one third of the plans to a larger extent. Thus, the authors conclude that the consideration of health in the practice of spatial planning is limited and that a lack of reciprocal understanding between the professions further impedes active health improvement planning (Bond et al., 2013). Similarly, calls have been made for a more extensive integration of health aspects in urban planning in the German speaking discourse, which requires a greater understanding of the other disciplines, including their procedures and instruments (Köckler & Rüdiger, 2024).

3.3.7 The water-sensitive city

The main challenge from the perspective of the water-sensitive city are future uncertainties regarding urban water supplies (Wong & Brown, 2009). The principal idea of the concept is to combine urban design with a consideration of the urban water cycle to both restore it and harness its full potentials (this is also referred to as water-sensitive urban design) (Ashley et al., 2013). The import of potable water to and export of wastewater from the urban area should be minimized, the use of water resources within the city optimized, the impacts of climate change on aquatic environments buffered, ecosystem services preserved or re-established, and ecological landscapes built (Wong & Brown, 2009). Key aims include fostering a diversity of water sources and water infrastructures, advancing the provision of ecosystem services, for example through constructed wetlands for stormwater management, rehabilitating degraded urban waterways, and building water-sensitive communities, which accept and politically support water-sensitive decision making and behaviors (Wong & Brown, 2009). Related to the water-sensitive city is the concept of the sponge city, which primarily focuses on the collection of stormwaters through urban blue-green infrastructure (Baur & Schirmer-Abegg, 2023). Roof gardens, facade greening, permeable surfaces, green spaces, and daylighted urban water courses should enable rain to infiltrate, retain or

evaporate in place instead of being washed into the sewer and sewage treatment plant. Besides the stormwater management function, sponge city elements are argued to reduce heat and contribute to the creation of high-quality open spaces with positive effects on life quality, human health, and well-being (Baur & Schirmer-Abegg, 2023).

For planning practice, a Swiss article lays out the scope of action in municipalities to proactively plan rainwater management through legal provisions for urban design. This could include, for example, prescribing the share of green space, obligating owners to green flat roofs, or installing incentives for facade greening (Mennel et al., 2023). Yet, other authors highlight that interdisciplinary collaboration is required and that sponge city principles are not yet an integral part of planning, at least in Switzerland (Baur & Schirmer-Abegg, 2023). In Australian cities water-sensitive urban design has been applied more frequently and comprises measures to harvest roof run-off waters and treated wastewater to be used for bathrooms and laundry, which significantly reduces the required amount of freshwater (Wong & Brown, 2009). Still, path dependencies in traditional water management and the need to transcend institutional boundaries, for example, between water engineers, ecologists, public health professionals, and urban planners are mentioned as important barriers for the uptake of water-sensitive urban design in planning (Ashley et al., 2013; Wong & Brown, 2009). Nevertheless, it is argued that water-sensitive urban design is a fundamental step towards the sustainable city (Wong & Brown, 2009).

3.4 Planning processes

The following section takes a closer look at the procedures of planning and common planning processes, answering to the question of 'how' planning is done (Wiechmann, 2019c). Two currently relevant planning theories that focus on theorizing processes, namely strategic and communicative planning, are discussed, which is followed by an inquiry into the role of the planner and power relations, respectively, in planning processes.

Fürst (2018) describes an ideal sequence of a contemporary planning process: first, stands an analysis of the status-quo situation; second, follows the definition of objectives as well as values for future development; third, the need for change is determined; fourth, options for potential interventions are developed; fifth, possible impacts of these interventions are analyzed and the options evaluated; sixth, comes public participation and a consideration of the raised objections; seventh, the content of the plan is defined; eighth, the interventions of planning are realized; and ninth, the activities are evaluated and, if necessary, corrected. Specific methods, for example, for the status-quo-analysis, the treatment of uncertainty in forecasts, the evaluation of alternatives, strategies to reach an agreement, and for evaluation or monitoring, are applied (Fürst, 2018). Following the same logic, Pahl-Weber and Schwartze (2018) outline similar, but broader steps: firstly, the spatial problem is identified, this could be, for instance, a political objective; secondly, the needs are identified; thirdly, guidelines, objectives, and spatial concepts are drafted; fourthly, different options are considered; and fifthly, decisions are made by political actors. It is noted that in the practice of planning this process is both more iterative and messier (Fürst, 2018).

Nevertheless, or rather exactly because of that, the described approach to planning processes reflects strategic planning.

3.4.1 Strategic planning

Strategic planning originates in management and organizational studies and has received more attention in planning discussions since the mid 1990s (Hutter et al., 2019). Key characteristics of strategic planning include the development of long-term goals, which act as a frame of reference and provide guidance to problem definitions and incremental measures, a clear target orientation, a multi-stage process, flexibility to adjust to changing circumstances, a discursive methodology that coordinates between a complex set of actors and allows for public participation, and learning-orientation (Hutter et al., 2019). Yet, strategic planning is not a homogenous theory with clear definitions, but different interpretations and priorities exist. Hutter et al. (2019) distinguished between three different approaches: the international discourse on strategic planning, strategic planning in management research, and its reception in the German-speaking regions. The international discourse has a strong emphasis on the normative dimension of strategic planning, which should promote justice and fairness and foster agreements on social, ecological, and economic goals between different actors from politics, public administration, economy, and civil society through a clear and democratically legitimate vision. Strategic planning is seen as situational and iterative social process, which grants participants room for action and enables learning processes (Hutter et al., 2019). In management and organizational research economic considerations and instruments, such as a strengths-weaknesses-opportunities-threats (SWOT) analysis, evaluation methods, and monitoring play a more central role. The linear sequence of planning and implementation steps that was described by Fürst (2018) above stems from this strand of literature. The so-called 'strategy change cycle' is designed as a cyclical, strategic model that, after reaching the last step, again restarts with the first and is characterized by a dynamic, iterative management that incorporates frequent feedback loops. The need for flexibility to adapting measures to a complex and dynamic environment is further accentuated (Hutter et al., 2019).

The uptake of strategic planning in the German-speaking countries shows influences from both previously described approaches, the international discourse on strategic planning as well as strategic planning in management and organizational research. While long-term goal setting, the high diversity of relevant actors and the attempt to overcome opposites through a situational and iterative process reflect the international discourse, efforts to transfer business management concepts to urban development can be traced back to management and organizational research. This is also discussed under the term 'new public management' (Hutter et al., 2019). In contrast to the international discourse, normative and ethical questions concerning planning processes are less prominent in the German-speaking discussions. Drawing on communicative planning theory, as well as new institutionalism and governance theory an analysis of both the external and internal context is taken into account and long-term goals are ideally developed collaboratively in strategic planning (Hutter et al., 2019). Argumentation in favor of strategic planning posits that with an increasing complexity of planning issues and the demand for more intensive coordination, strategic planning

can be more than just an informal supplement to formal planning. Rather it is claimed that strategic planning can also be applied within formal planning processes, due to its strength to determine the common good and provide legitimacy to planning processes (Hutter et al., 2019).

3.4.2 Communicative planning

Communicative planning is another theoretical approach to planning processes that emerged in the 1970s (Zimmermann, 2019). Communicative planning aspires to democratize the planning process in order to foster more equitable decisions that address inequalities in power relations and acknowledge difference in society (Healey, 1992, 2003; Zimmermann, 2019). At the core of communicative planning lie two observations: first, that knowledge is socially constructed, and second, that planning is political and guided by norms and values (Zimmermann, 2019). What follows is that planning problems differ fundamentally from other, e.g., scientific problems, as they are difficult to define, take place within a heterogeneous social context characterized by much uncertainty, in which there is no right or wrong, and where problem statements, explanations and solution approaches are dependent on the perspective (Rittel & Webber, 2013, in Zimmermann, 2019, p. 16). In order to achieve good planning, it should be the result of negotiation and agreement. This is also referred to as collaborative planning or “planning through debate” (Healey, 1992). Unequal power relations in planning, which root in unequal access to information, should be overcome by designing open and inclusive planning and decision-making processes (Forester, 1982, in Zimmermann, 2019, p. 17). Theoretically, the origins of communicative theory can be ascribed to Jürgen Habermas who argued that norms, which guide social action, must be justified through a transparent, communicative negotiation in which the stronger argument convinces, instead of based on authority or tradition (Zimmermann, 2019). What is key is that the “multiplicity of social worlds, ‘rationalities’ and practices that coexist in urban contexts and the complexity of power relations within and between” should be recognized (Healey, 2003, p. 107). Planning from this perspective is therefore understood as process that is looking to collaboratively negotiate how futures should look like in dialog instead of technocratically determining it in plans (Healey, 2003).

Zimmermann (2019) acknowledges the profound influence of the communicative planning approach on both theory and practice and gives a brief overview across raised critiques, among them the relation of theory to planning practice and the role of conflict. The former argues that the theoretically developed, ideal-typical communicative planning process design cannot be straightforwardly transferred to practice (Zimmermann, 2019). Hindrances are, for example, the use of empty formulas for consensus, unstable results, the neglect of powerful players, the domination of the process by active individuals or that important decisions are made somewhere else (Selle, 2004, in Zimmermann, 2019, p. 19). Additionally, it has been noted that even though communicative planning is valuable when thinking about the legitimation of planning processes and decision, it nevertheless disregards the problem-orientation of planning and the required theoretical knowledge (Mäntysalo, 2002, in Zimmermann, 2019, p. 20). A second critique regards communicative planning’s aim to achieve consensus. Several authors have criticized that conflict can play very productive role in negotiating planning, which does not always have to be resolved

(Mattila, 2020; Zimmermann, 2019). Rather, it seems more appropriate to these authors that conflict is inevitable when acknowledging a multiplicity of socially constructed perspectives in a critical discourse. What is instead seen central is a coordinated and moderated contestation that allows for deep engagement and reciprocal understanding, and that produces results that are never final (Mattila, 2020; Pløger, 2018). This argumentation is taken up by agonistic planning, which focuses on the underlying values of positions and highlights the existence and importance of value pluralism (McAuliffe & Rogers, 2019; Pløger, 2018). Questions of power play an important role in both communicative and agonistic planning theory (Mattila, 2020; Pløger, 2018). But before illuminating power in planning, the agency of planners is considered in the following section.

3.4.3 Planners as actors

It has been established that planning more and more mediates between different stakeholders (Fainstein, 2000). In this role planners are expected to have competencies as planners, researchers, policy consultants and experts for tasks such as scenario development, decision preparation, coordination, moderation, and integration (Pahl-Weber & Schwartz, 2018). This section takes a quick look at the agency and planners' influence on the planning process in a narrow sense as civil servants in public bodies.

Planning has been described as constituted through, firstly, the tasks that are given to planning from the society as well as the conditions under which these tasks are set, and secondly, the interpretation of these tasks by planners (Siebel, 2006). Thus, the agency of planners depends primarily on the institutional structure of the planning system (Purkarthofer, 2022). Discretionary planning systems, like in the UK, grant planners more agency and discretion, the latter referring to the "ability and right of making choices between courses of action based on one's assessment of a situation" (Feldman, 1992, in Purkarthofer, 2022, p. 87), than regulatory systems (eg. in Austria or Germany). This reflects the discussion on how structure and agency are interrelated. According to Giddens, structures are understood as stable rules and resources that are internalized and hence both enable and restrict the agency and behavior of individual or collective actors (Giddens, 1997; Purkarthofer, 2022). In order to exercise agency a reflexive control of action, including acting purposefully, having reasons for ones' actions and being able to explain them discursively, is decisive (Giddens, 1997, pp. 53–58). Actions also work to transform the structures (Purkarthofer, 2022), as has already been discussed in chapter 3.2. In planning it is argued that the relation between planners and the administrative system, institutions, and the organizational cultures are important for understanding the agency and actions of planners (Purkarthofer, 2022).

Another discussed topic is the role of internal conflict in planners, as they address conflicting interests and are accountable to a variety of stakeholders like politics, the law, the public interest, personal values, the wider community, clients, etc. (Purkarthofer, 2022). It has been suggested that planners should make their values clear and engage in an advocative form of planning, rather than obfuscating their own role (Davidoff, 2012). That planners are humans that experience emotions, which can influence courses of action has likewise been acknowledged. Nevertheless, a reflective approach is argued to be crucial for professional performance (Purkarthofer, 2022). Purkarthofer

(2022) highlights that especially with fuzzy and abstract concepts like sustainable urban development, planners may have substantial agency and play an important role in developing and implementing local and context-sensitive interpretations.

3.4.4 Power of and power relations within planning

Regarding power two different dimensions can be distinguished in planning: on the one hand is the power that is enacted through planning, the mandate and legitimation of spatial planning to cause change in the built environment. In Western countries the power of planning has been greatest in the post-world-war-2 period when the rationalist planning paradigm prevailed (Gunder et al., 2017). This comprehensive and technocratic approach to planning came under critique for not being able to unravel contemporary challenges and for channeling a considerable amount of decision-making power in the positions of planners, which were mostly bureaucrats and not politically elected representatives (Gunder et al., 2017; Healey, 2012). Similar criticism has been raised regarding colonialism, where planning had been utilized as an instrument of state power to control and oppress (Gunder et al., 2017). Yet, even outside of colonial rule, concerns have been raised about the role of planning in fostering modernization and 'Westernization' in the interest of local elites who, however, disregard the local context (Gunder et al., 2017, p. 2). Yiftachel (1998) criticized that planning is used as a state instrument for social control and oppression. Jabareen (2017) developed this idea theoretically further and described planning as a tool for marginalization and domination of social groups in the interest of ideological hegemony. Speak and Kumar (2017) stressed that discrimination through planning often occurs along lines of gender, race or ethnicity, especially in post-colonial states. They thematized the Northern perspective of many planning approaches, which can result in a mismatch between planning and its normative prescriptions with the lived realities of people (Speak & Kumar, 2017). Other authors have questioned the idea of the universal public interest as a justification of planning in a heterogenous, pluralistic society (Moroni, 2017).

On the other side is a debate on power relations within planning, referring to how processes and outcomes are influenced by different actors. It has been established that planning is a social process of consensus building (Fürst, 2010, Chapter XIX), and that planning and planners are "inevitably caught up in capillaries of power" (Huxley, 2017, p. 209). In contrast to rationalist planning, which perceived planners as neutral agents that make informed decisions based on objective data, new institutionalism, communicative planning theory as well as writings about agonistic planning actively problematize questions of power relations within planning (Healey, 2003; Mattila, 2020; Pløger, 2018; Sorensen, 2017). In the new institutionalist literature particularly the strand on historical institutionalism thematizes the important role of power in institutions (Hall & Taylor, 1996). It is argued that power is distributed unevenly across social groups through institutional structures, and that power plays an important role in the path dependency of institutions as those benefiting from an institution have an interest to preserve it (Hall & Taylor, 1996; Sorensen, 2017). Sociological institutionalism similarly highlights that planning as an activity is "inherently situated in a specific institutional space, with concrete manifestations of power and possibility" (Healey,

2007, pp. 63–64). In communicative approaches to planning attention is paid to power relations within and between the acknowledged variety of social worlds, knowledges, and practices (Healey, 2003). Yet, one of the major criticisms by agonistic theory towards communicative planning is that collaborative processes may be dominated by powerful actors and their interests (Hillier, 2002, in Healey, 2003; Pløger, 2018). For Fainstein (2012) two crucial aspects in equitable processes are first, the question of who has the power to define the agenda and second, to recognize that a democratic process will not necessarily produce equitable outcomes. Especially economic forces and neoliberal interests have been observed to exercise power in planning both influencing its outcome for their benefits and depoliticizing conflictual spatial claims and the politics of place making (Davoudi, 2017). Davoudi describes that “planning has changed from the regulator of the market to its facilitator. It is more about delivering economic growth and competitiveness than ameliorating social and environmental injustices” (Davoudi, 2017, p. 24). Thus, both the power of planning and the power relations within planning have profound implications on spatial and social spheres.

3.5 Planning water features

This section examines what is known about the planning of urban water features as urban blue infrastructure and how it relates to urban inequality. Urban blue infrastructure does not have its own body of research and is mostly discussed together with urban green space, even though calls have been made towards looking at water bodies and water features separately to consider their particular benefits and risks (Haase, 2015; White et al., 2020). Commonly, the literature analyzes green infrastructure, green-blue infrastructure, or blue-green infrastructure, sometimes using urban as prefix (e.g., urban green-blue infrastructure) but the terms are mostly interchangeable. In the following the term blue infrastructure is used preferably. In case the reviewed literature also includes green infrastructure in their conceptualization, the terms urban blue-green infrastructure and urban blue and green infrastructure are used. This is to foreground the focus of this thesis on blue infrastructure but to, at the same time, emphasize that little literature on the planning of blue infrastructure and urban water features specifically could be identified. Therefore, the following discussion additionally draws on studies about blue and green infrastructure more generally.

3.5.1 Urban blue-green infrastructure planning

The concept of green infrastructure emerged in the US in the 1990s with the aim to proactively and strategically plan public green spaces in urban areas in an interconnected and thought-through manner instead of relying on the left-over places of urban development (Pauleit et al., 2017). Besides ecological connectivity and integration with other urban infrastructures, multi-functionality regarding ecological, social, economic, biotic and cultural functions of urban green is a key principle (Hansen & Pauleit, 2014). The concept further spans multiple scales, ranging from neighborhood parks to interlinked regional green space networks, includes various objects, among them urban blue spaces, and strives to conserve urban green spaces and their benefits for humans in the long term (Hansen & Pauleit, 2014). Being rooted in landscape architecture and ecology, the concept of

urban green infrastructure applies a spatial perspective and helps to integrate nature-based solutions and ecosystem services into urban planning through its established instruments that include participatory planning processes (Pauleit et al., 2017). Thereby human health and well-being can be promoted. Rieke Hansen and Stephan Pauleit (2014) suggested a framework for planning green infrastructure that, first, performs a system analysis that includes both ecological (green infrastructure elements and conditions, network, supply of services) and social factors (demand for and access to green infrastructure benefits). Second, follows a synthesis that considers the integrity of green infrastructure, hotspots of multifunctionality, synergies and trade-offs, the supply and demand balance as well as stakeholder preferences. This informs plan-making, the third step, in defining priorities and strategies for action (Hansen & Pauleit, 2014).

Völker and Kistemann (2011, p. 458) stated that “there is still little respect for water and health in urban planning issues”. Recent research in the UK showed that especially blue infrastructure is overlooked in national planning policy guidance (Scott & Hislop, 2024). Generally, blue-green infrastructure planning was evaluated as significantly vulnerable against other policy priorities, which also is expressed in weak policy wording of national planning guidance (Scott & Hislop, 2024). An investigation of urban ecosystem governance in Rotterdam showed that local participation and bottom-up initiatives are underestimated, even though they are considered essential in the understanding, protection, and management of urban blue-green infrastructures (Tillie & van der Heijden, 2016). Impeding factors in the adoption of blue and green infrastructure include the time lag between the creation and the long-term duration of the benefits and conservative environmental regulation (Miller, 2008). Röschel et al. (2019) thematized the challenges of integrating disparate user preferences in the planning of blue-green infrastructure. They suggest using the Q-method to identify the main interests of the different stakeholders; the Q-method involves sorting different preference statements into a response grid from which the most common themes can be calculated. The authors found that it offers a resourceful mapping of the diversity of citizen preferences that can contribute to more inclusive and effective planning (Röschel et al., 2019).

Creating urban blue infrastructure can imply trade-offs between different interests concerning land-use and the needs of various urban inhabitants and may lead to unintended consequences. Kronenberg et al. (2021) show that this is especially the case when the complexity of both socio-ecological systems and contextual factors are underrecognized. They develop an analytical framework with the three dimensions of infrastructures, institutions, and perceptions that mediate the services provided by the blue-green infrastructure and its equitable availability, accessibility, and attractiveness (Kronenberg et al., 2021). Infrastructures describe physical structures like, for example, the existing network of urban green spaces or underground pipes, which could restrict the planting of trees. Institutions encompass legal concepts like ownership and user rights, as well as policy intentions, prescriptions, and stakeholder participation in planning processes but also social norms and the barriers that might arise from these for blue-green infrastructure planning. Perceptions involve the interpretations, values, and views of potential users of blue and green infrastructure, such as awareness of availability and benefits (Kronenberg et al., 2021). Through

applying the framework on projects in six European countries the authors identify several challenges towards blue-green infrastructure planning and management, which include properly recognizing and including the needs and perceptions of local residents, acknowledging different needs among the population towards provided ecosystem services, and aligning different objectives on different geographical scales. They argue for an awareness of trade-offs and unintended consequences as well as a recognition of the complexities inherent in urban social-ecological systems, involved infrastructures, institutions, and perceptions when creating blue and green infrastructure. This could assist in avoiding negative implications on environmental justice issues and instead foster distributional, procedural, and recognition justice (Kronenberg et al., 2021).

Deely et al. (2020) develop a barrier identification framework building on a systematic literature review about barriers in blue-green infrastructure creation and realization. They identify five categories of barriers, namely, institutional and governance barriers, socio-cultural barriers, knowledge barriers, technical and biophysical barriers, and funding and market barriers. The first category addressed challenges arising out of institutional and governance contexts. This includes a lack of clear leadership, lacking political will, unclear roles and governance responsibilities, interdisciplinarity and interinstitutional cooperation, lack of long-term vision and monitoring, impeding legislation or regulation, disregard of climate change in public policies, and competing priorities concerning resources, the political agenda or land uses (Deely et al., 2020). The second discussed type regards socio-cultural barriers, which describe embedded cultures, for example, among stakeholders, and their perception of and attitudes towards blue-green infrastructure. Furthermore, human behavior and community empowerment are mentioned as factors. The third category concerns knowledge barriers, which include a lack of awareness of and knowledge about blue and green infrastructure, institutional inexperience, lack of technical guidance and uncertainties about climate change (Deely et al., 2020). Fourthly, technical and biophysical barriers that address site characteristics like space limitations and urban morphology, design and construction challenges as well as maintenance are discussed. Lastly, funding is the most commonly mentioned barrier to successful blue-green infrastructure realization. Related are challenges regarding estimating the costs and benefits of these urban infrastructures and installing appropriate pay mechanisms. Besides funding, a lack of knowledge as well of guidance are major restraining factors in the development of blue-green infrastructures (Deely et al., 2020).

3.5.2 (In)justices in urban blue-green infrastructure

What the literature clearly shows is that spatial structures and their accessibility impact urban inequality. The uneven distribution of environmental hazard, further deepening social inequalities by affecting marginalized people most, led to the rise of the environmental justice movement in the 1980s in the US (Kuehn, 2000). The section on the just city (in chapter 3.3.4) has already explained the basic premises of environmental justice. Commonly, procedural and recognitional aspects are analyzed beside distributional ones (Kuehn, 2000; Schlosberg & Collins, 2014). Despite different definitions and conceptualizations of environmental justice (see chapter 3.3. on the just

city), it is beyond dispute that environmental and climate injustices exist within and across all regions with implications for health outcomes (Bullard, 1993; Kuehn, 2000; Schlosberg & Collins, 2014). A very similar argumentation is brought forward within health geography, which reasons that human health is “inextricably linked” to geographies (Gatrell & Elliott, 2015, p. 5). Inequalities in health have been documented largely across dimension of gender, ethnicity, socioeconomic status, age, and disability, which commonly tend to spatially cluster and can become self-reinforcing (Gatrell & Elliott, 2015, Chapter 5). The neighborhood context, referring to both the physical features (e.g., the availability of healthy environments and accessibility of services) and the social composition (socio-demographic and socioeconomic characteristics), has been recognized as an important determinant of health outcomes (Gatrell & Elliott, 2015, Chapter 6). Accordingly, the public health and planning scholar Jason Corburn asked, “How can modern city planning, a profession that emerged in the late nineteenth century with a goal of improving the health of the least-well-off urban residents but lost this focus throughout the twentieth century, return to its health and social justice roots?” (Corburn, 2009, p. 1).

The existence of unequal patterns of access towards urban blue and green infrastructure, and thus, to their health benefits, has already been presented in chapter 2.4. In the reviewed research on environmental benefits (which are far less studied than environmental hazards, e.g., proximity to industrial polluters or other hazardous sites), the majority of studies focuses on distributional aspects of environmental justice. Planning, in those articles, is mostly urged to recognize these environmental inequalities and to actively strive towards fostering equal access to blue infrastructures, while more research about implementation mechanisms is called for (Haefner et al., 2017; Laatikainen et al., 2015).

Investigations into the procedural and recognition environmental justice dimensions regarding blue and green infrastructure are fewer. One example is a study by Raymond et al. (2016) that went beyond distributional justice through not only focusing on distance and accessibility to urban blue spaces in relation to people’s socioeconomic characteristics, but by also taking into account place features and use patterns. They identified different combinations of activities and user diversity and highlight the complexity of place-specific environmental justice (Raymond et al., 2016). Through adding user and activity diversity, recognition aspects of environmental justice in the sense of acknowledging difference are considered besides distributional aspects. Kabisch and Haase (2014), in an environmental justice analysis of urban green spaces in Berlin, show that user preferences of immigrants are not met by a local park, which constrains this group’s potential usage of the urban green space. Furthermore, a recent paper by Oyshi et al. (2025) analyzed the recognition of environmental justice principles in stormwater infrastructure planning. The authors examined official planning documents in the US and South Africa that covered the whole stormwater infrastructure planning process, and which included the strategy development, design, implementation, and maintenance stage in the 25 most populous cities respectively. The environmental justice principles for analysis were derived from local environmental justice groups. They found that neither environmental justice principles nor marginalized communities are prioritized in stormwater planning. The majority of documents fail to even mention these issues

(Oyshi et al., 2025). The authors reason that blue-green stormwater infrastructure planning should consider environmental justice concerns and focus on benefitting marginalized communities as it offers a currently untapped opportunity to foster social and environmental justice and public health (Oyshi et al., 2025).

Another justice issue in blue-green infrastructure planning is the risk of eco-gentrification that comes with the redevelopment or new establishment of urban blue and green spaces. Haase et al. (2017) described the complex relation between ecological and social benefits in urban greening initiatives with the risk of furthering inequalities through an upgrading of the neighborhood. Eco-gentrification can be an unexpected result of urban green infrastructure projects, but these measures can also be deliberately employed to further capitalist interests (Haase et al., 2017). Therefore, they urge planning first, to acknowledge socio-spatial inequalities in planning, implementing, and monitoring greening projects. Second, they request the inclusion of different actor groups, including citizens, with various needs and opinions to the process. Third, the trade-offs between social and ecological benefits of urban green spaces should be recognized. Fourth, the places should be planned to enable encounters for and between groups with different needs and interests. Lastly, they argue that planning and research must pay attention to the political and economic context and potential power relations (Haase et al., 2017). Connected to this, Isabelle Anguelovski, an urban studies and planning researcher and environmental injustice scholar, together with other researchers, asked, “for whom is the new green city?” (Anguelovski et al., 2018). The authors criticized the predominant urban greening orthodoxy, which fails to consider power relations, democratic processes, and potentially negative environmental justice outcomes due to displacement effects. Instead, they call for a re-politicization of the discourse and attention towards equitable and transformative planning practices that recognize structural and institutional inequalities and its reproduction through blue and green infrastructure planning (Anguelovski et al., 2018). Put in other words, it is argued that by fostering procedural and recognition justice the legitimacy and equity of the intervention can be enhanced.

The planning processes and context themselves, however, are not frequently investigated in research about the linkage between urban blue infrastructure and environmental justice, even though calls have been made for an investigation of “the political institutions and governance processes that shape place-based outcomes and opportunities” (Corburn, 2009, p. 207). This is the literature gap this thesis strives to address by analyzing why and how urban water features are planned, what the influence of institutions and structures on this process is, and how this relates to (in)equality and human health and well-being. Through applying a planning theory and environmental justice perspective, this thesis aims to empirically contribute to the discourse on urban blue infrastructure, specifically urban water features, and their planning. Small-scale infrastructures, like urban water features, have been described in the literature as easily implementable measures of climate adaptation that might not be as much affected by certain risks of injustice, e.g., gentrification, and still have the potential to foster human health and well-being (Gao & Fang, 2025; Li & Trivic, 2024; Watson, 2019; Wolch et al., 2014; Xie et al., 2021). But before presenting the conceptual framework, the selected case study is described in more detail.

4 VIENNA: Description of the case study area

In city livability rankings, Vienna frequently performs well and was ranked first in the Economist's in 2024 (MA 23, 2024b). In addition, Vienna is internationally renowned for its successful urban planning approach, especially regarding housing, which has restrained the geographical clustering of socio-economic inequalities (Pamer, 2019). A study on environmental inequality in relation to industrial facilities attests the existence of environmental injustice along lines of unemployment, education levels and migration histories in Austria but not in Vienna (Glatter-Götz et al., 2019).

The City of Vienna has directed significant efforts to increase the quality and quantity of urban blue infrastructures, like shore areas of urban blue spaces but also drinking fountains, misting systems, and water playgrounds in the last years. The environmental report of the City of Vienna 2022-2023 lists 75 mobile drinking fountains with misting functions, 1.500 fixed public drinking fountains and numerous projects, where water features have been integrated into parks, playgrounds and public spaces (MA 22, 2024). Due to these planning activities, Vienna is a suitable and interesting case study. Hence, this thesis seeks to investigate the planning of urban water features as small-scale urban blue infrastructure in this context. The case-specific background is presented in more detail in the following, which offers general information about the City of Vienna, describes the planning system, and portrays Viennese water features.

4.1 General information

Vienna is the capital city of Austria and second largest German-speaking city with a population of 2.005.760 residents in 2024 (MA 23, 2024a, p. 62). The city is located in the north-east of Austria and occupies an area of 41.487 ha (MA 23, 2024a, p. 14). Politically, it is separated into 23 administrative districts, called Bezirke (see Figure 1). Out of the total city area 53% are covered by either water bodies or green spaces including 1.607,2 ha blue spaces and 20.405,9 ha of green spaces (MA 23, 2024a, p. 15). Of the total city population 64,6% have the Austrian citizenship and 710.419 are foreign citizens. Out of the latter, 295.597 persons (41,6%) are citizens of EU countries (MA 23, 2024a, pp. 63–67).

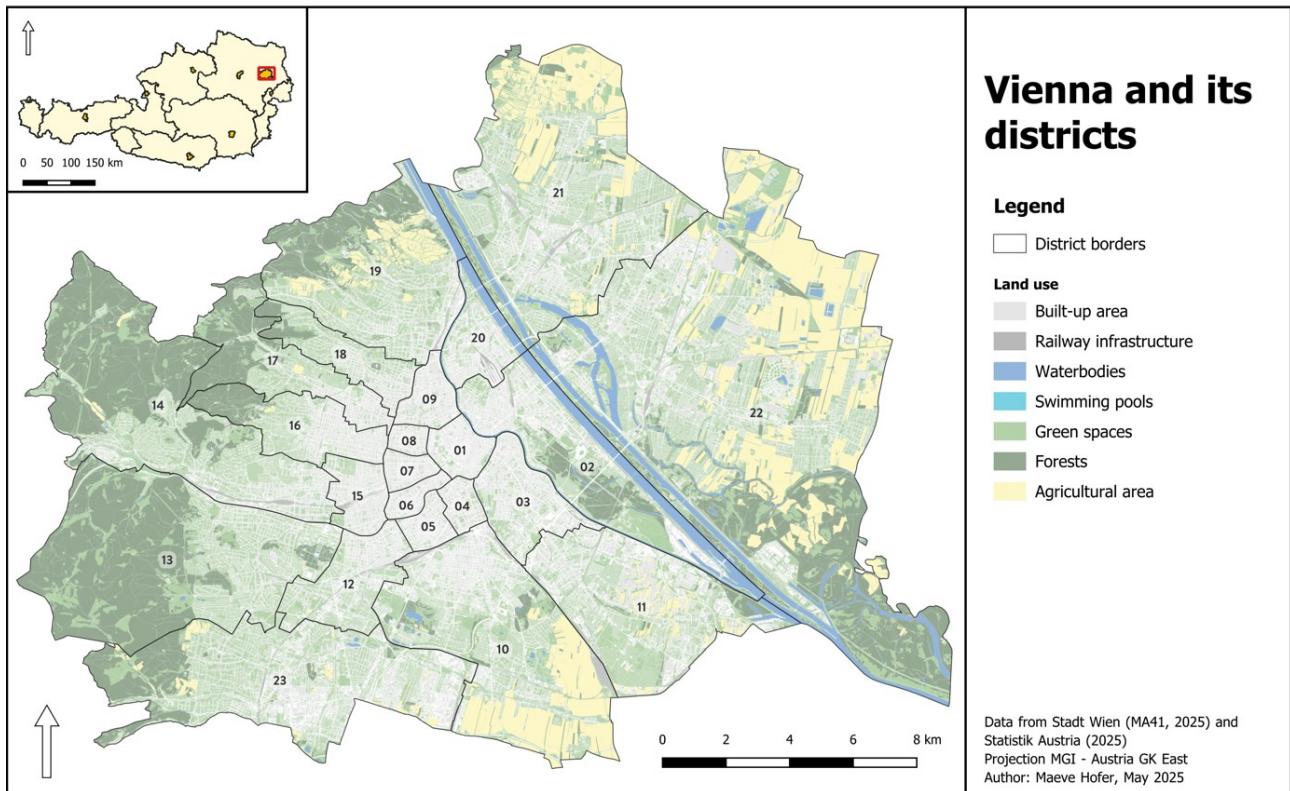


Figure 1: Map of Vienna, including land use and district borders. Data from the City of Vienna (MA 41, 2025) and the Federal Statistical Office (Statistik Austria, 2025).

The region east of the alps, which has its last foothills in the west of Vienna, is characterized by a Pannonian and Illyrian climate (Lichtenberger, 2002). It is where the climate shifts from Central European transition climate to the dryer Continental Steppe climate. This results in cold, windy winters, short spring periods followed by hot summers and generally warm and dry falls. Rain is rare compared to other Austrian regions and mostly falls in early summer (Lichtenberger, 2002, pp. 113–114). Heat days have increased in the last years, with 32 days that showed maximum temperatures of 30 °C or hotter in 2023 (MA 22, 2024; MA 23, 2024a).

4.2 Planning context

In Austria, the federal states and municipalities have substantial competences in the areas of social infrastructures like primary schools and hospitals as well as spatial planning (Lichtenberger, 2002). Vienna is both a federal state and municipality. Since 1945 Vienna has been ruled by the social democratic party (SPÖ – Sozialdemokratische Partei Österreichs). After the elections in 2010 the SPÖ was in a coalition with the green party (Die Grünen), and since 2020 is in coalition with the new liberal party (NEOS) (Wien Geschichte Wiki, 2024). In 2025, the national government is constituted by a coalition between the conservative party (ÖVP – Österreichische Volkspartei), the social democratic party (SPÖ) and the liberal party (NEOS). Until 2024 the ÖVP was in coalition with the green party.

Austria is characterized by a comprehensive integrated planning system and a relatively pronounced multi-level structure with mainly vertical coordination and cooperation (Farinós Dasí et al., 2007). Being a legally defined as cross-sectional task, different public authorities at different governance levels make up spatial planning in Austria. Fassmann (2018, p. 2311) described this as a “two-and-a-half-level system” (own translation). Most spatial planning competencies are distributed to both the municipalities and the federal states (Bundesländer). The federal government mostly has a coordinative role in spatial planning matters; yet, it can enact important influence through sectoral policies like infrastructure planning, water management and forestry (Gruber et al., 2018). The Austrian Conference on Spatial Planning (in German called ÖROK – Österreichische Raumordnungskonferenz) is the federal government’s organization for coordinating spatial planning in Austria. Members include the federal chancellor, federal ministers, the heads of the federal states, representatives of the Austrian Association of Cities and Towns and of the Austrian Association of Municipalities. Their main tasks are firstly, the preparation and publication of the Austrian Spatial Development Concept (ÖREK, Österreichisches Raumentwicklungskonzept) and secondly, the systematic monitoring of spatial development (ÖROK Atlas) in Austria (Fassmann, 2018; Geschäftsstelle der Österreichischen Raumordnungskonferenz, 2024).

The federal states (Bundesländer) enact the spatial planning laws for the areas under their geographical responsibility. The laws set overarching objectives for spatial development and define instruments for local and regional spatial planning (Fassmann, 2018). The Bundesländer, furthermore, can resolve spatial planning or spatial development programs for the whole or parts of the federal territory in which framework conditions for further structural development are spatially defined (Gruber et al., 2018). In Vienna, the spatial planning law is called „Bauordnung für Wien“ (full title: Wiener Stadtentwicklungs-, Stadtplanungs- und Baugesetzbuch). It defines principles and goals of spatial planning striving for “orderly and sustainable design and development of the urban area” (Bauordnung Für Wien, 2025a § 1 (1), own translation). This includes aims to conserve and create environmental conditions that ensure healthy livelihoods, to use natural resources both economically efficient and ecologically effective to, among others, mitigate climate change, to preserve and make provisions for urban blue and green spaces, which serve recreation purposes and improve local climate conditions, and to maintain and expand the amount of blue and green infrastructure in public spaces that improve quality of stay, the microclimate and ecological diversity (Bauordnung Für Wien, 2025 § 1 (2) Z 4, 6, 6a). Additionally, the spatial planning law regulates the content of zoning plans (Flächenwidmungspläne) and land development plans (Bebauungspläne), delineates formal planning procedures and instruments, lays out how the municipality can enter into private law contracts, sets ownership restrictions, for example conditions under which expropriations of land are permitted, and defines formal requirements and processes for construction projects. In some federal states the regional level engages in spatial planning through developing regional concepts and plans (Fassmann, 2018), for Vienna, however, this is not applicable.

Municipalities (Gemeinden) are responsible for spatial planning within their geographical area, in other words they determine the local land use. Therefore, they are a central planning organ in the Austrian planning structure (Fassmann, 2018; Gruber et al., 2018). Usually, municipalities define long-term spatial development priorities within local development concepts (Örtliche Entwicklungskonzepte) (Fassmann, 2018). In Vienna these local development concepts are called STEP (Stadtentwicklungsplan) and are developed approximately every 10 years. The most recent STEP, the so-called “Wien-Plan” (Vienna plan) was adopted by the municipal council in April 2025 (MA 18, 2025). Based on the local development concept, the zoning plan (Flächenwidmungsplan) specifies the land use of each plot of land. In Vienna categories include green land (Grünland), building land (Bauland), traffic areas (Verkehrsbänder), and special zones (Sondergebiete). Green land contains rural areas, recreational areas like parks, public pools, sport fields and allotment gardens, protected areas such as nature reserves and green belts, and cemeteries (Bauordnung Für Wien, 2025a § 4). The third main instrument of municipalities for land use planning are land development plans (Bebauungspläne), which regulate how and how dense the land plots are built, e.g., defining the type of construction, building height, and street alignment (Fassmann, 2018). In Vienna, the zoning plan is combined with the land development plan.

In Vienna, several units are responsible for spatial planning. The Vienna city administration is organized in administrative groups that are each chaired by an executive city councilor who sits in the city senate (Stadt Wien, 2025b). Currently, there are seven administrative groups of which two are of interest to the endeavor of this thesis. The first is the ‘Administrative Group Urban Development, Mobility and Vienna Public Utilities’² (Geschäftsgruppe Stadtentwicklung, Mobilität und Wiener Stadtwerke), which includes municipal departments (MA / Magistratsabteilungen) responsible for strategic planning considerations like, for example, organizing and coordinating the process for the local development concept (MA 18 ‘Urban Development and Planning’, Stadtentwicklung und Stadtplanung), the municipal department ‘District Planning and Land Use’ (MA 21 Stadtteilplanung und Flächenwidmung), and ‘Architecture and Urban Design’ for planning and designing public spaces (MA 19 Architektur und Stadtgestaltung). Also, the municipal department ‘Road Management and Construction’ (MA 28 Straßenverwaltung und Straßenbau) as well as the department responsible for urban blue spaces (MA 45 ‘Water Management’, Wiener Gewässer) are allocated to this administrative group, which is headed by Ulli Sima (SPÖ) as the executive city councilor (Stadt Wien, 2025c). The second relevant administrative group is the ‘Administrative Group Climate, Environment, Democracy and Personnel’, which includes the municipal departments ‘Environmental Protection’ (MA 22 Umweltschutz), ‘Vienna Water’ for the drinking water provision (MA 31 Wiener Wasser), ‘Parks and Gardens’ responsible for green public spaces (MA 42 Wiener Stadtgärten) and ‘Municipal Swimming Pools’ (MA 44 Wiener Bäder). This administrative group is led by the executive city councilor Jürgen Czernohorszky (SPÖ) (Stadt Wien, 2025c). Desk research only offered little clarity on how these different municipal departments are involved in the planning of urban water features, which thus is one task of this master’s thesis. But

² For the translations to English the bilingual glossary on the organization of the Vienna city administration was consulted (MD BT, n.d.).

before describing the conceptual framework and methodological approach of this investigation a quick overview is given to the distribution and physical structure of water features in the city area of Vienna.

4.3 Viennese water features

Water features in the sense of small water infrastructures like fountains are not visible in Vienna's zoning plan. Water bodies like the Danube or Danube channel are zoned as traffic area, the Alte Donau and Liesing are zoned as recreational area. The Wienerberg, a natural area that includes a small lake, and the Lobau, a nature preserve area with water bodies, are zoned as protected area. The Neue Donau is zoned as special zone (Stadt Wien, 2025a). Water features like drinking fountains or misting systems are mostly found in areas zoned as traffic areas, like streets and pedestrian ways, and recreational or protected areas, e.g., different public parks, as their location is not decided by the zoning plan but rather at the level of street and park surface design.

The City of Vienna has mapped 2.289 urban water features in a spatial data set they provide open access, and which can be seen in Figure 2. The water features, displayed as blue points, include different types of drinking water fountains, misting systems, water play elements, and decorative fountains (MA 31, 2025).

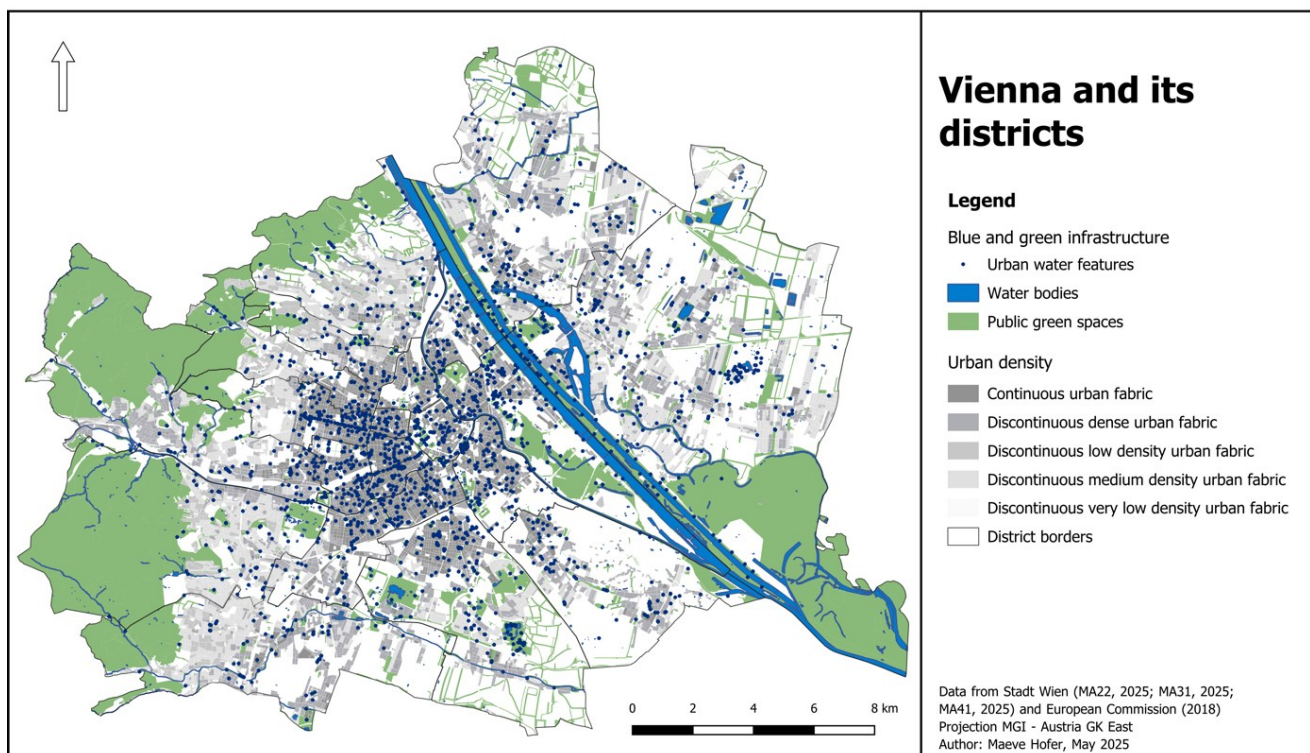


Figure 2: Map of Vienna, blue and green infrastructure and urban density. Data from City of Vienna (MA 22, 2025; MA 31, 2025; MA 41, 2025) and Urban Atlas (European Commission, 2018).

Urban water features are found across all districts, however with varying concentration. The unequal spatial distribution can be partly explained by urban density. In areas that offer a higher

degree of urban density more water features seem to be located compared to low-density zones. Still, some densely built-up areas, for example, in the south appear to have less water features than other dense areas in the inner city and the inner-western areas. In the latter, some individual streets can even be identified, for example the Thaliastraße in the west of Vienna (16th district) that recently has been redeveloped and now shows one of the greatest densities of water features (almost appearing as a blue, horizontal line in Figure 2). Consequently, there seem to be spatial discrepancies in the distribution of urban water features in the City of Vienna.

Concerning the physical structure of Viennese water features this thesis distinguishes between six types that are commonly planned and realized. The first type consists of drinking water fountains, which can be found in various designs in the City of Vienna (see Figure 3). Some of these also provide water for dogs and other animals in installed bowls (e.g., 3rd picture in Figure 3). Most people used them for drinking water or washing their hands, some also for refreshing and cooling themselves on hot summer days or for providing water to their dogs.



top:
drinking fountains

Figure 3: Drinking water fountains in and by the City of Vienna. Photos: Maeve Hofer.

The second type of Viennese water features are misting or water spray systems, which generate water mists that locally cool both air and humans who interact with it through evaporation. Passersby frequently chose a path that took them through the water mist, or paused for a moment in the water spray during heat exposure. The third type describes water play features in public spaces and parks including pavement fountains and built water surfaces that allow for direct interaction with it (for both see Figure 4). Oftentimes children were found to play with these water elements, but also dogs were observed, for instance, trying to catch the water from the jets of the pavement fountains.



Figure 4: Misting systems and water play features in and by the City of Vienna. Photos: Maeve Hofer.

The fourth type of urban water features in Vienna are ornamental fountains for mostly decorative purposes. Fifthly, ponds in public parks are understood as another type of water features in Vienna. Lastly, public baths make up the sixth type of water features in Vienna (for all three types see Figure 5). Public baths are usually not discussed under the framing of urban water feature nor urban blue infrastructure. Yet, in Vienna so-called family baths (Familienbäder) are publicly provided by the City of Vienna and free for children up to 14 years old. Vienna has eleven such family baths in addition to 27 other baths (MA 44, 2020). In all baths operated by the City of Vienna the entry prices are set by the municipal council. Thus, in the understanding of this thesis they are part of the public provision of urban water features in Vienna.



Figure 5: Ornamental fountains, ponds, and public baths in and by the City of Vienna. Photos: Maeve Hofer.

5 CONCEPTUAL FRAMEWORK: New institutionalism meets environmental justice

The planning of water features in the City of Vienna is analyzed through an institutionalist and environmental justice perspective. How I understand, apply, and operationalize these two theoretical frameworks is described in this chapter. As the concepts have already been discussed in previous sections (see chapter 3.2 for new institutionalism, 3.3.4 for environmental justice, and 3.3.6 for human health and well-being), the following only briefly summarizes the main premises before going on to explain how the theory informs the analysis in this investigation.

The key ideas of new institutionalism are that institutions and structures influence planning and that planning in turn influences these institutions but also actively creates new ones (Gailing & Hamedinger, 2019; Sorensen, 2017). Institutions can be understood as both formal and informal rules and shared understandings that provide a certain scope of action (Sorensen, 2017). Building on the previously reviewed literature, formal institutions in this thesis are defined as legal foundations like laws, regulations, contracts, organizational structures such as the Vienna city administration, and strategic planning documents. The latter usually are legally not binding, however still present a general orientation of where and how planning should act by including specific aims to be pursued. At the same time strategic planning documents are also an outcome of planning (Alexander, 2005; Sorensen, 2017). Referring more to historical and sociological institutionalism than rational choice institutionalism, the importance of informal institutions are acknowledged (Hall & Taylor, 1996; Healey, 2007). In this thesis informal institutions are understood as values, frames of meaning, attitudes, and practices. An important characteristic of informal institutions is that even though they are not as legally or politically enforceable as formal institutions, their violation is still sanctioned in some way, e.g., socially. Nevertheless, they can still be fuzzy and difficult to trace in practice (Healey, 2007). Therefore, no comprehensive evaluation of informal institutions and their effect can be assured in this thesis.

Analytically, I aim to identify the formal and informal institutions, which are involved in the planning of urban water features in Vienna. In addition, the analysis strives to understand how they shape and influence the planning process, and which results can be traced back to institutional arrangements. Out of this, five analytical categories for guiding the empirical analysis arise: first, regulations and laws; second, aims and the strategic context; third, administrative structures; fourth, planning processes; and fifth, informal institutions and how they are respectively relevant in water feature planning.

The perspective of new institutionalism is a descriptive one that primarily strives to describe and explain planning processes and outcomes. It provides a thorough analysis of the particular circumstances in which Viennese water feature planning operates and contributes to improving our

understanding of planning practice, which is one major aim of planning theory (Gunder et al., 2017; Wiechmann, 2019c). The second main task of planning theory is to provide instructions of how to plan, which is an explicitly normative endeavor (Gunder et al., 2017; Wiechmann, 2019c). For Fainstein and Campbell (2012, p. 5) this should happen with a clear prescriptive aim to “pursue the good city”. Thus, in order to assess the planning of urban water features in Vienna against normative guidelines, new institutionalism is combined with an environmental justice perspective. Moreover, adding an equality perspective to this thesis’ conceptual framework positions this research in a feminist geography tradition that is committed to the experiences of those that are marginalized (Couper, 2015).

Justice can be analyzed through many lenses. For the purpose of studying the planning of blue infrastructure an environmental justice approach seems most appropriate as the theory is space-sensitive and also considers procedural as well as recognitional aspects while being concerned with environmental goods in the everyday environments of people (Kuehn, 2000; Schlosberg & Collins, 2014). This thesis aims to understand how environmental justice is considered in the planning of urban water features in Vienna. For this the three commonly discussed environmental justice dimensions, namely distributive, procedural, and recognitional justice, are operationalized (Kuehn, 2000; Newell et al., 2021; Schlosberg & Collins, 2014).

Distributive justice refers to fairly distributed outcomes striving towards geographical equity. For this thesis, the equal “distribution of the benefits of environmental programs and policies, such as parks and beaches, public transportation, safe drinking water, and sewerage and drainage” (Kuehn, 2000, p. 10684) is relevant. Procedural justice thematizes the procedures that lead to the outcome and its fairness and inclusiveness. Access to information should be provided and participation should happen with equal concern, respect and free from discrimination at every level of decision making (Kuehn, 2000). In addition, the process should be transparent, accountable, and enabling meaningful participation (Newell et al., 2021). In that sense, a procedural just planning process opposes “the predominant, expertise-oriented, interest-group model of environmental decisionmaking [that] favors those with resources and political power over people of color and low-income communities” (Kuehn, 2000, p. 10689), offering substantial overlap with ideas of communicative planning (see chapter 3.4.2). Finally, recognition justice emphasizes the need to acknowledge difference in society. All groups but especially those marginalized should have the opportunity to represent their views. “[U]nderstanding difference alongside protecting equal rights for all” is one key premise of this dimension (Newell et al., 2021). The US-American environmental justice literature clearly shows that discrimination happens along lines of race and ethnicity; for the Austrian context this most appropriately can be translated to immigrant status, citizenship, or country of birth (Glatter-Götz et al., 2019). Besides the recognition of different groups in society that use places and should be involved in the planning process, Raymond et al. (2016) point towards activity diversity as another possible operationalization of this dimension of environmental justice. The three environmental justice dimensions (distribution, procedure, recognition) are well aligned with the three principles for planning the just city, namely equity, democracy, and diversity, as defined by Fainstein (2011) and reviewed in chapter 3.3.4.

An unjust distribution and creation of urban water infrastructures has the potential to negatively affect the health of already marginalized groups in society and thereby deepening inequalities (Gatrell & Elliott, 2015; Wolch et al., 2014). Due to the close interlinkages between justice and health outcomes, human health and well-being are understood as an integral part of environmental justice concerns. Therefore, the consideration of health in the planning of urban water features is added to the analysis. Thus, the following four analytical categories arise from the theory and are added to guide the analysis: how distributional, procedural, and recognitional environmental justice aspects as well as human health and well-being considerations are respectively recognized in the planning of urban water features.

The added value of applying the environmental justice framework onto the planning of urban water features in Vienna is its clarity in what is desirable and what is not. For instance, an inclusive planning process in collaboration with residents and local stakeholders would meet one requirement of an environmentally just process, as well as places planned to recognize different interests, needs, and ways to spend time would meet recognition justice. Thus, the integration of environmental justice considerations into the planning of small-scale blue infrastructure would suggest that the normative ideal of a just and healthy city is pursued.

Bringing new institutionalism and environmental justice together helps to address the research question about how institutions affect the planning of urban water features and the extent to which environmental justice principles are considered (see Figure 6). From this, institutional constraints to justice and human-health- and well-being-supportive water feature planning can be derived.

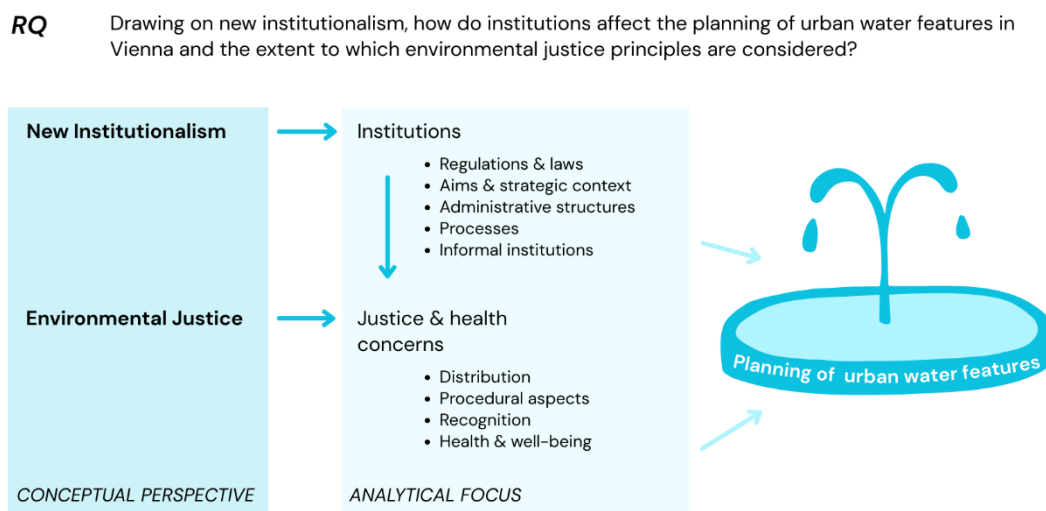


Figure 6: Operationalization of the theory. Own illustration.

6 METHODOLOGY: Qualitative analysis of documents and interviews

This section explains how the research questions were answered through the chosen research approach and the selected methods. First, the methodological approach and research design are presented, followed by a description of the background research, which involved reviewing the literature, desk research, and field visits. Then the empirical data collection methods, specifically the selection of relevant policy documents and the conduct of semi-structured expert interviews, are presented. Finally, an explanation of how the data was analyzed through qualitative content analysis is given.

6.1 Research design

Research strives to increasing both knowledge and understanding and can be characterized by its systematic approach. Planning research distinguishes itself from other research fields through its strong focus on practice with oftentimes comes with action orientation, an explicit and normative focus, the recognition of the political and institutional context, and a considerable interest in spatial relations, and the qualities of places, among others (Silva et al., 2015). Yet, as Silva et al. have pointed out, it is important to recognize, "that any research study is only a partial insight into the complex and dynamic realities in which we live and in which planning work is done" (Silva et al., 2015, p. XXXV).

This thesis employs an exploratory and descriptive case study research design to dive into the topic of urban water features planning in Vienna. Case studies are among the most common research designs in planning studies (du Toit, 2015). A case study design is suitable, as it assists in getting a "full picture of the [phenomenon] in all its complexity" (de Vaus, 2001, p. 220). Vienna is strategically chosen as a spatially defined, single case (Baur & Christmann, 2021) in this research because the city administration has installed water features in great variety and quantity in recent years and thus offers a rich field from which to generate data to answer my research questions. The aim of this case study research is to advance knowledge about small-scale blue infrastructure planning, more specifically planning practice and planning context, in Vienna in its full complexity (Baur & Christmann, 2021; Yin, 2003). Thus, this thesis can be classified as descriptive basic research (as opposed to applied research) (du Toit, 2015). As the topic of urban blue infrastructure planning has not been well understood so far, especially in the case of Vienna, this research integrates exploratory components like a mapping of relevant actors within the city administration and small field visits. This thesis has followed an open and iterative research process as both the literature review and the explorative field visits influenced the development of the research question (Baur & Christmann, 2021).

What is inherent to this study, as it is in many other planning research projects, is the ambition to foster an equitable planning practice that potentially can influence people's lives to the better (Silva et al., 2015). Conducting research always comes with ethical considerations (Scheyvens, 2014) and planning research in particular has been criticized for justifying and sustaining dominant policy discourses and governance arrangements (Thomas & Lo Piccolo, 2015). Therefore, this thesis explicitly tries to maintain a critical perspective in order to avoid reproducing unjust structures and perspectives. It, as a matter of course, follows research ethics guidelines that guarantee integrity and respect for the persons involved in this research, including informed consent, voluntary participation, avoidance of harm for participants as well as integrity, quality, and transparency of the research (Thomas & Lo Piccolo, 2015). The results of the research will be shared with the participants.

An interpretative social science approach that acknowledges the situatedness and social construction of knowledge is the methodological paradigm of this thesis (du Toit, 2015). This is also congruent with a feminist geographical approach, which sees knowledge as always "partial, stated and political" and recognizes inherent power relations (Couper, 2015, p. 129). A qualitative design is regularly chosen from this perspective as the rich, nuanced, and open-ended character of the qualitatively produced data assists in understanding social reality and complex process issues (du Toit, 2015; Graebner et al., 2012, pp. 278–279). It, furthermore, has been argued that qualitative methods are "well-suited to account for social dimensions and egalitarian goals in plan making" (Silverman, 2015, p. 140). Hence, this thesis employs qualitative methods. More precisely, semi-structured interviews were conducted to collect primary data, which was analyzed together with secondary data in the form of policy documents. A further advantage of qualitative data is that it provides texture and authenticity due to its rich character and is more comprehensible in research communication (Silverman, 2015). A literature review, desk research, and observational field visits provide the necessary background for the case study.

The indispensable engagement with the researcher's positionality has been emphasized by multiple authors in the constructivist social sciences (Couper, 2015; Scheyvens, 2014; Sultana, 2007). My positionality as a white, Austrian woman who has the resources to study and the luck to be employed in a research project engaged with urban blue spaces may have eased some difficulties in this thesis, especially being granted access to interviews. My academic background in development studies and human geography sharpened my interest in spatial configurations of inequality. A strong sense of fear facing the climate crisis explains the choice to focus on infrastructures that can help to mitigate and adapt to climate change. The emphasis on planning, its context, and its process is due to faith that spatial planning can act as a leverage point for societal change towards more carbon-neutral, climate-friendly, healthy, and just cities. A research notebook has accompanied me during this thesis project, enabling me to collect observations and thoughts and to continuously reflect upon the content and process of the thesis but also my own position within it, particularly when engaging with the participants and when interpreting the data (Manning, 2018; Scheyvens, 2014).

6.2 Background research

To contextualize the current planning investigation in both the academic discourse and the local, urban context, first, a literature review; second, desk research; and third, exploratory field visits were performed. These methods do not directly contribute to answering the research question (and thus are not the research methods) but rather, through a comprehensive engagement with both the literature and the local Viennese context, build the background in front of which the research question is answered.

Literature review

For the contextualization of water features in the academic discourse a systematic literature review approach oriented at the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021) was applied. The database of SCOPUS was searched with two search strings ('urban AND "water features"', 'urban AND "water elements"') in February 2025. The results (232 and 77 entries respectively) and their bibliographic information were downloaded as xlsx-file. The title, abstracts and keywords were reviewed to, firstly, sort out irrelevant articles, and to secondly, identify main themes according to which the review could be structured. The relevance and type of water feature were coded, and categories assigned inductively according to the main themes discussed in each paper. This included the categories 'architecture', 'design', 'ecology', 'engineering', 'equal access', 'ecosystem services', 'health', 'hygiene', 'heat mitigation', 'nature-based solutions', 'physical activity', 'planning', 'play', 'property value', 'public spaces', 'sound', 'stormwater management', 'urban green and blue spaces' and 'water quality'. Duplicates were removed and several relevant papers from each category chosen. The relevance was determined by the reviewer through evaluating the suitability of the topic in the light of this thesis, the paper's understanding of urban water features, the actuality, the journal, and the number of citations. This led to the full-text review of 56 articles and the inclusion of 28 articles (see Appendix, chapter 13.1). With the addition of further relevant literature this resulted in chapter 2. In September 2025 the search was repeated and six additional research papers reviewed out of which four were added.

The literature review of the planning literature was less systematic but more in-depth in return. The main starting points were firstly, handbooks on planning theory like the ones edited by Gunder et al. (2017), Wiechmann (2019a, 2019b) and Fainstein and Campbell (2012), and secondly, article provided by lecturers during and outside of university classes on specific topics like new institutionalism, planning culture, or strategic planning. The literature was snowballed by looking at the reference lists of relevant articles and adding numerous individual searches about specific topics. These included, among others, communicative planning, planning systems, specific city concepts, justice and planning, and the planning of urban blue-green infrastructures. The searches were performed in the databases of SCOPUS, Web of Science and u:search (the literature search tool of the University of Vienna). The ARL – Academy for Territorial Development of the Leibniz Association (Akademie für Raumentwicklung in der Leibniz-Gemeinschaft) also proved to be a

valuable resource for writings about planning in the German-speaking regions (Blotevogel et al., 2019). The selected literature was carefully read, excerpted, and synthesized into chapter 3.

Desk research

The aim of the desk research was to both get an overview of the Viennese case and to identify relevant stakeholders and documents that are involved in the planning of urban water features. The desk research involved a screening of websites mostly by different departments of the city administration and a review of the division of responsibilities for the Municipality of the City of Vienna (Geschäftseinteilung für den Magistrat der Stadt Wien), which resulted in the mapping of the following potentially relevant actors (see Figure 7):

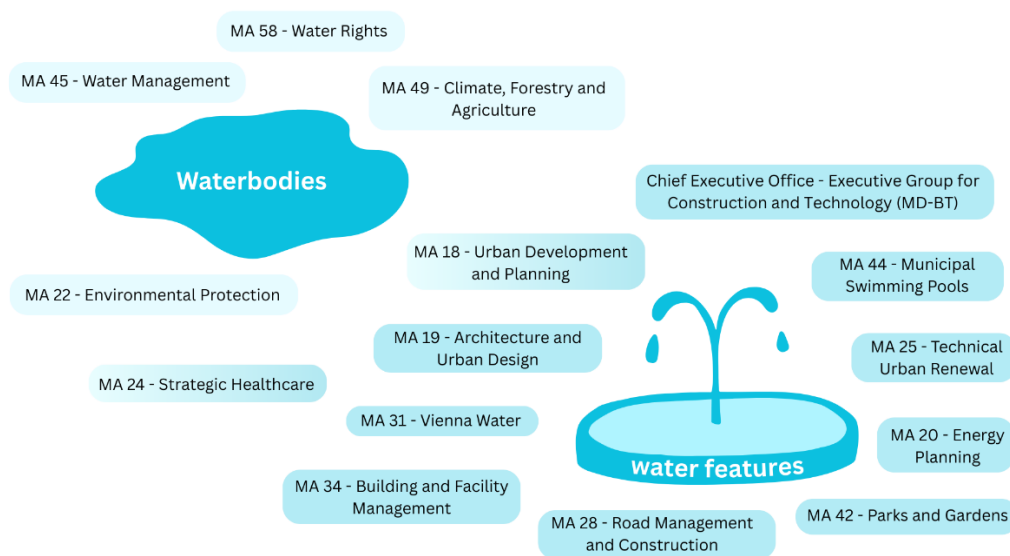


Figure 7: Mapping of municipal departments potentially involved in urban blue infrastructure planning in Vienna. Own illustration.

Secondly, a descriptive spatial analysis of water features in Vienna was conducted. For this open access geodata from the City of Vienna (MA 22, 2025; MA 31, 2025; MA 41, 2025) was displayed and visually analyzed in QGIS. Furthermore, the data on water features was combined with data about urban density (European Commission, 2018) in an attempt to explain heterogenous distribution. The results are processed in the case study description in chapter 4.

Field visits

In addition to reviewing documents and descriptively analyzing spatial data about water features in Vienna, exploratory field visits were conducted mostly in summer 2024 (observations on urban water features in public spaces, however, have taken place throughout the thesis process). The goal of these on-site field visits was to see what water features there are and how they look like, understand how they operate in their urban spaces and how people interact with it. The field visits were not a systematically applied method but rather exploratory, providing context, and assisting the research question development (Tabačková, 2021). Field notes about observed facts and events

as well as reflections were written down in the research notebook and pictures of the water features were taken (Silverman, 2015). Among the visited places were the Volkertplatz, in the 2nd district, for the opening of a “cool zone”, the Neubaugasse (7th district) with its misting systems, the water playground at the water tower in the 10th district and at the Donauinsel (22nd district), ornamental fountains in the 1st and 10th district, Karlsplatz, Kardinal-Rauscher-Platz and Meidlinger Markt with their water features (1st, 15th and 12th district respectively), the Esterhazy park and its misting systems (6th district) and drinking water fountains at St.-Elisabeth-Platz (4th district), Rotenturmstraße (1st district), Mariahilferstraße (6th district) and Yppenplatz (16th district). The time spent at the places varied between 15 minutes and 1,5 hours. The observations are integrated in the case study area description in chapter 4.

6.3 Qualitative data collection: policy documents and expert interviews

The main empirical contribution of this thesis builds on data that was collected during six semi-structured interviews with eight representatives from different municipal departments involved in the planning of blue infrastructure in Vienna. In addition, ten relevant policy documents were analyzed. These research methods are described in the following.

Policy documents

Official policy documents issued by the City of Vienna about urban planning, specifically regarding urban blue infrastructure and public space were reviewed and selected for analysis. This assisted in gaining first, a good overview and second, a comprehensive insight of how urban water features are discussed in Viennese city planning. The specificity about working with documents is that they are not created for the purpose of the research (Bryman, 2016). This is an advantage on the one hand, because it excludes any influence of my research on the data; on the other hand, they were created for another purpose, probably with a specific agenda. Thus, the context of document creation needs to be evaluated and reflected (Bryman, 2016).

The chosen documents (see Figure 8) were selected firstly, because of their strategic relevance for urban planning, such as the urban development plans, and secondly, because of their implications for urban blue infrastructure planning, like the technical concept on public spaces (Fachkonzept Öffentlicher Raum) or the cooling guide (Cooling-Fibel). During the thesis process the latest urban development plan was published. However, most empirical data had been collected while the old urban development plan (STEP 2025) was still in place. Therefore, both plans were included in the analysis and compared regarding their approach towards climate change adaptation, urban blue infrastructure, and urban water features. A full list of all analyzed documents is given in Table 1, an extended version that includes information about the content, context, and justification for inclusion can be found in Appendix 13.2 (Table 5).

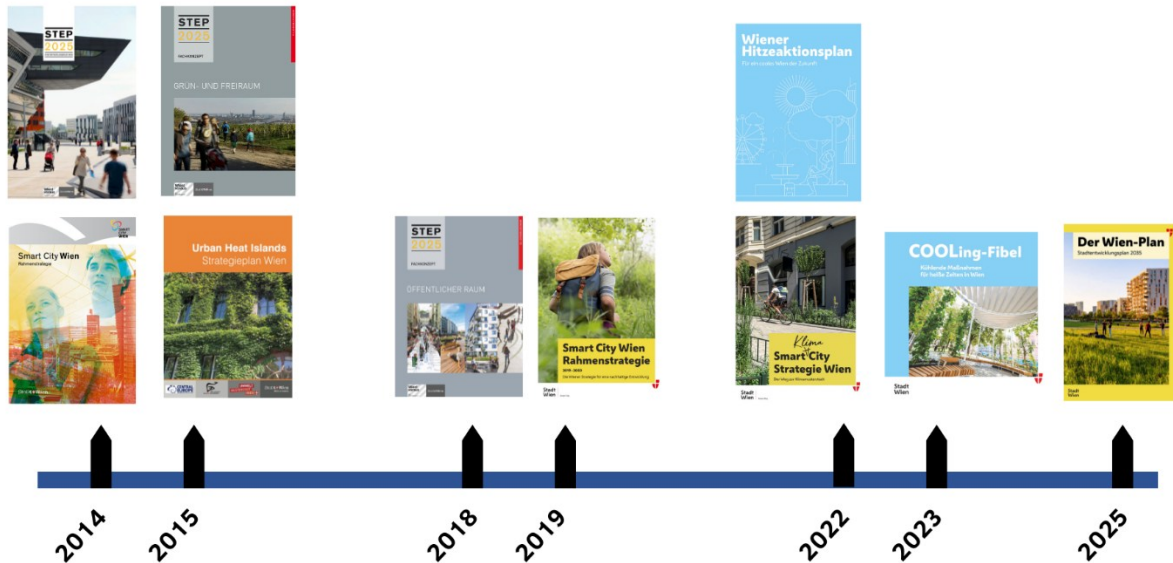


Figure 8: Selected policy documents, sorted by year of publication. Own illustration. Covers reproduced with the permission of the respective publishing units (see Table 1).

Table 1: List of policy documents for analysis. An extended version is available in the Appendix.

Type of policy document	Title, year of publication, publishing unit	Document pages
<i>Strategic urban development plans and associated concepts</i>	„STEP 2025“, 2014, MA 18 ³	143
	„STEP 2025, Fachkonzept Grün- und Freiräume“, 2015, MA 18	94
	„STEP 2025, Fachkonzept Öffentlicher Raum“, 2018, MA 18	103
	„Der Wien-Plan, Stadtentwicklungsplan 2035“, 2025, MA 18	163
<i>Other strategic plans</i>	„Smart City Wien Rahmenstrategie“, 2014, Magistrat der Stadt Wien ⁴	109
	„Smart City Wien Rahmenstrategie, 2019-2050, Die Wiener Strategie für eine nachhaltige Entwicklung“, 2019, Magistrat der Stadt Wien	163
	„Smart Klima City Strategie Wien, Der Weg zur Klimamusterstadt“, 2022, Magistrat der Stadt Wien	131
<i>Other relevant policy documents/plans</i>	„Urban Heat Islands Strategieplan Wien (UHI-STRAT)“, 2015, MA 22 ⁵	112
	„Wiener Hitzeaktionsplan“, 2022, Magistrat der Stadt Wien	61
	„COOLing-Fibel, Kühlende Maßnahmen für heiße Zeiten in Wien“, 2023, MA 42 ⁶	90

³ MA 18 is the municipal department ‘Urban Development and Planning’.

⁴ ‘Magistrat der Stadt Wien’ refers to the city administration of Vienna.

⁵ MA 22 is the municipal department ‘Environmental Protection’.

⁶ MA 42 is the municipal department ‘Parks and Gardens’.

Semi-structured interviews

Interviews are conversations that strive to produce usable knowledge (Brinkmann, 2013). This method is well-established in both social sciences and planning research (Silverman, 2015; Thierbach, 2021). Interviews are suitable for collecting detailed and focused information about a particular topic of interest (Silverman, 2015), which in the case of this thesis is how urban water features are planned by the city administration of Vienna. Therefore, planning experts were chosen as the target group of the qualitative data collection. Conducting interviews fulfills the principles of qualitative social research concerning openness, communication, focus on processes, and reflexivity (Thierbach, 2021).

A semi-structured interview approach was chosen to be able to define the themes of the conversation while still being open to the respondents and giving them the opportunity to communicate what seems important to them (Silverman, 2015; Thierbach, 2021). To structure the conversation about specific issues that are of relevance for the research an interview guide consisting of seven broad, open questions was developed based on the literature review, desk research and preliminary document analysis. Questions about the following themes were asked: the topics of water in everyday planning work, the planning of urban water features specifically including competences, aims, processes and decision-making, planning strategies for urban water features, cooperation with other municipal departments, citizen participation in water feature planning as well as challenges and potentials in urban water feature and blue infrastructure planning (see Appendix 13.3). The interview guide was tested and slightly adapted to the everyday language of planners after internal feedback from both my supervisor and another senior researcher.

The interview partners were purposively sampled (Brinkmann, 2013); the prior identified municipal departments potentially involved in the planning of urban water features (see chapter 6.2) were contacted for interviews through sending out advance letters via e-mail. In these the aim of the research was explained, and an interview requested. Out of the contacted departments, six returned positive answers and dates for the interview were agreed (see Table 2). The interview guide was sent to the interviewees in advance of the conversation.

The semi-structured interviews took place at the municipal departments and mostly at the offices of the interview partners. They lasted between 53 minutes and 1,5 hours (average 66 minutes) and were all conducted in person. In two instances two experts from the same municipal department but with varying fields of expertise were involved in the conversation. The interviews took place in German language. The interview partners were informed about the topic and purpose of the investigation and signed an informed consent sheet that clarified that they could withdraw from the research (see Appendix 0). With the permission of the interview partners the conversations were recorded. In addition, notes were taken during the interview, which included information about the date, place, atmosphere, and occurrences (Thierbach, 2021). In the aftermath the recordings were transcribed with the help of MaxQDA and a Word Online speech-to-text plug-in following an easy transcription approach focused on content. All spoken words, including

repetitions, were transcribed and dialect translated to standard German; breaks in speech, however, were not recorded. The transcripts were manually reviewed and corrected. The data was stored safely.

One limitation of the interview method is that only the perspective of the interview partner, or potentially the employing institution, is represented (Thierbach, 2021). Other planners in the same departments might offer different perspectives on the planning of urban blue infrastructures; however, as the institutional structures and formal planning practices are the focus of this thesis, this shortcoming can be regarded as not substantially influencing the results of this research. In addition, conducting multiple interviews and analyzing them together with the documents serves as data triangulation (Yin, 2003). Another risk of conducting interviews are suggestive questions through which the researcher can influence the answer that is given (Thierbach, 2021). I tried to overcome this issue through carefully reviewing the formulation of the questions alone and together with other researchers and by being sensitive to this risk during the interview situation. Generating own data with planning experts that directly answers to the research problem was of utmost value in answering to the research questions.

Table 2: List of interview partners.

Municipal department	Interview length in minutes
MA 25 - Technical Urban Renewal	58
MA 28 - Road Construction and Management	65
MA 31 - Vienna Water	53
MA 42 - Parks and Gardens	93
MA 44 - Municipal Swimming Pools	64
MD-BT - Chief Executive Office, Executive Group for Construction and Technology	62

6.4 Data analysis

The empirically collected qualitative data was analyzed through qualitative content analysis following Mayring (2022). Qualitative content analysis, which is also referred to as category-based text analysis, is a method to systematically analyze the material through categorization (Mayring, 2022; Stamann et al., 2011). It is rules-based and theory-led as the data is approached through questions derived from the research questions against the background of theory (Mayring, 2019, 2022). Qualitative content analysis is a suitable method for open, explorative, and descriptive research like the presented case study due to its capacity to systematize manifest and latent communication content and its flexibility to reasonably adapt the analysis procedure to the object of research (Mayring, 2022; Stamann et al., 2011).

The material for analysis consisted of the transcripts of the interviews and notes taken during and after the interviews as well as the selected policy documents. While the former were produced for the purpose of this thesis, the latter were not; this contextual information is important to consider in qualitative text analysis (Mayring, 2022). In addition, e-mail exchanges with persons from municipal departments, particularly MA 19 Architecture and Urban Design, MA 24 Strategic Health Care, and MA 34 Building and Facility Management, were consulted to complement the analysis. The aim of this qualitative content analysis is to draw conclusion about the planning of urban water features, the influence of institutions, and consideration of environmental justice principles in Viennese city planning, answering to the posed research question.

The main elements of analysis are categories, which are constructed systematically. In this work the categories describe the content of the material (other options are formal or scaling categories) (Stamann et al., 2011). There are multiple possible procedures to build categories, this thesis adopts a deductive-inductive approach (Mayring, 2022). While deductive refers to theory-led, inductive describes being directly developed from the material without involvement of theory (Mayring, 2022). For the analysis that was carried out this means that first, the research questions were operationalized and differentiated into sub-questions in order to guide the analysis. Second, relevant categories were derived from the sub-research-questions and definitions determined respectively (see Table 3). Third, a part of the material was evaluated through these categories to test their suitability and find appropriate examples for each category. The deductively developed categories were held rather broad on purpose in order to, fourthly, fill them inductively with codes identified from the collected data material. For each code a text had to provide a unit of meaning, i.e. be more than just one word. Occasionally text segments were assigned to more than one code and category. For some categories the inductive codes were summarized, e.g., when analyzing the aims and strategic context, the inductively created codes were summarized according to city concepts. Observations were noted as memos. Fifth, the categories and codes were analyzed and interpreted in the context of the conceptual framework and theory.

In the language of the qualitative data analysis this thesis deployed a blended approach of structuration (which is deductive category-building) and inductive category-building, like it is suggested under the term of 'thematic analysis' (Mayring, 2022). In some instances, this was complemented by elicitation as a strategy of qualitative content analysis (Mayring, 2022). Especially related to the regulations and laws, the respective legal documents were additionally analyzed to more fully understand what impact they have on the planning of urban water features. The MaxQDA software was used for the qualitative analysis (version 2022). The data segments that are quoted are all translated by the author. The online translator Linguee (DeepL SE, 2025b) assisted the translation process of e.g., direct quotes from the interviews. Occasionally, translations were improved with the help of the artificial-intelligence-augmented platform DeepL (DeepL SE, 2025a). The artificial intelligence tool QuillBot was sporadically used to check the grammar of certain sentences, principally concerning punctuation (Learneo, 2025). The data was anonymized before using any of the third-party online tools on it and no sensitive data was shared.

Table 3: Coding guide, including definitions of the applied analytical categories.

Category	Definition
A1 regulations & laws	Formal and legally defined institutions like the constitution, laws, ordinances, regulations and contracts that are relevant for the planning of urban water features.
A2 aims & strategic context	Both the objectives and long-term goals mentioned in relation to planning urban water features. The city concept they are oriented at.
A3 administrative structures	Information about how urban water feature planning is formally organized, how responsibilities and competences are distributed, and how decision-making takes place.
A4 planning processes	The different steps in the process of planning and implementing urban water features and the involved actors.
A5 informal institutions	Voiced values, frames of meaning, attitudes, and practices related to the planning of urban water features.
B1 distributive justice	The physical distribution and spatial aspects of urban water features planning such as placement, accessibility, and socio-economic context.
B2 procedural justice	Procedural aspects of planning urban water features like fairness, inclusiveness, access to information, transparency, accountability, and level of meaningful participation in planning processes.
B3 recognitional justice	Recognitional aspects of planning urban water features such as acknowledgement of difference in society, inclusion of marginalized views, involvement of immigrant groups, and recognition of varied user preferences.
B4 human health and well-being	The consideration of potential both positive and negative health impacts in the planning of urban water features.

7 RESULTS: Effects of institutions on urban water feature planning and environmental justice

The empirical analysis shows that a great variety of actors of different municipal departments are involved in the planning of water features in the City of Vienna. Depending on the land zoning different actors are responsible and realize various urban water features, partly with diverse aims and following different regulations and processes. This chapter describes the conducted analysis and the results that arise from the data in the light of the research question.

First, the identified institutions to urban water feature planning are evaluated, namely relevant regulations and laws, aims and the strategic context, administrative structures, planning processes, and informal institutions. Second, the consideration of distributive, procedural, and recognitional environment justice principles as well as potential human health and well-being impacts in this are analyzed. The subsequent chapter 8 discusses the results and brings them together to answer the research question of how institutions affect the planning of urban water features in Vienna and the extent to which environmental justice principles are considered.

7.1 Regulations and laws

The urban water features under investigation are primarily located on public streets, and places as well as parks. As these areas are mostly public lands, liability regulations have been described in both the documents and interviews as crucial factors for planning water features (Fachkonzept Öffentlicher Raum, p. 65; Interview MA25, MD-BT). The technical concept on public spaces explains the influence of liability questions in planning:

When dealing with public space as a public good, the issue of personal liability (e.g., road maintenance liability) of individual employees is fundamental. To protect against this, decisions are often made that have adverse consequences for the design and thus for the quality of stay in public spaces. (Fachkonzept Öffentlicher Raum, p. 65)⁷

Likewise, the interview partners mentioned liability regulations as restricting design freedom and conflicting with some strategic aims, like, for example, the water-sensitive city (Interview MA25, MD-BT).

In areas that are zoned as traffic areas, road traffic regulations are relevant laws for the placement of water features, like drinking fountains and misting systems (Fachkonzept Öffentlicher Raum, pp. 65-66; Interview MD-BT). The road traffic regulation strives to maximizing safety, ease, and fluidity of traffic and regulates the use of streets for non-traffic purposes, e.g., § 88 defines to what extent

⁷ All direct quotes, both of documents and interviews, are translations by the authors.

play is allowed (StVO 1960, 2025)⁸. Other features like the width of the sidewalk and necessities for barrier-free access are regulated in norms like the 'Guidelines and Regulations for Road Construction'. These regulations influence potential sites for and designs of urban water features (Interview MA 28). In addition, the building regulations of the City of Vienna (Bauordnung Für Wien, 2025) regulate issues such as access roads for the fire department or access to garages, which excludes some areas for the installation of water features (Fachkonzept Öffentlicher Raum, pp. 66-67).

Both liability and general regulations are less strict for areas that are zoned as recreational or protected areas. This different legal context offers planning departments more freedom in the placement and design of water features, for example in urban parks (Interview MA25, MD-BT). Thus, the zoning plan is a significant institution in the planning of urban water features, as the legal regulations partly change depending on the land zoning.

Depending on the type of urban water features, additional regulations are applicable. For ornamental and historic fountains preservation laws are important (Interview MA31), in public parks the green space ordinance applies (Interview MA42). For public baths, hygiene and safety regulations are essential (Interview MA44). These are equally a central topic for the MA31 Vienna Water (Interview MA31).

On a more strategic level various federal and state laws and regulations were mentioned, like the Vienna Climate Law, the Vienna Nature Protection Law and the Water Rights Act. The Vienna Climate Law (Wiener Klimagesetz, 2025) emphasizes climate protection, climate adaptation, and circular economy with aims including the climate neutrality of the city until 2040 and increasing urban resilience (Wien-Plan, p. 139). It highlights the necessity of climate mitigation and adaptation and therefore can be understood to support measures like urban water features. Building on an EU directive, the Vienna Nature Protection Law (Wiener Naturschutzgesetz, 2025) regulates the care and protection of nature and specifies different categories of nature protection areas, which come with individual requirements regarding technical interventions and human interferences (Fachkonzept Grün- und Freiräume, p. 87). For urban water features this limits the potential locations for realization. The federal Water Rights Act (WRG 1959, 2025) provides regulations for the utilization and protection of water bodies as well as the protection against water as hazard. Regarding urban blue infrastructure the guidelines on ground water and what types of water can be allowed to seep away are of relevance (Interview MD-BT). Yet, this is more important for rainwater management than small-scale urban water features. On an international level, the latest urban development plan refers to the Paris Agreement, a legally binding treaty about limiting climate change induced temperature increases and reducing greenhouse gas emissions towards climate neutrality (Wien-Plan, p. 156). These laws and regulations constitute the legal policy context in which Viennese urban planning takes place. Especially the Vienna Climate Law and the Paris Agreement are used as an imperative argument for climate adaptation measures in the city, which

⁸ For all referenced laws the most actual version was consulted for this analysis. Thus, the year given indicates when the law was retrieved. For information about the year the law was passed (in case it is not indicated in the title of the law), the reader is referred to the bibliography.

include the installation of urban water features, however, without providing any specific regulations on their planning.

7.2 Aims and strategic context

Local urban strategic documents like urban development plans and the city's smart climate city strategy provide regulations that are not legally binding but are nevertheless binding in terms of content. The strategic planning documents and their objectives were frequently mentioned during the interviews (Interviews MA28, MA42, MD-BT). Their approaches towards urban water features and blue infrastructure are presented in the following.

Goals of planning water features

On the strategic planning level urban water features are mostly discussed in connection with the quality of stay in urban public spaces and heat mitigation. Even though the analyzed strategic policy documents were created and published across more than a decade, the goals attached to planning urban water features have remained the same. The city development plan from 2014, for example, mentions water features in conjunction with the quality of open spaces regarding recreation and active mobility (STEP 2025, p. 120). At another instance water features like drinking fountains and misting systems are referred to when highlighting infrastructural measures for heat mitigation (STEP 2025, p. 142). While the technical concept about green and open spaces does not mention water features at all (Fachkonzept Grün- und Freiräume), the one on public space integrates them in its content and visual presentation (e.g., picture of a fountain with water jets on page 11, Fachkonzept Öffentlicher Raum). In the latter, aims towards an increase of drinking water supplies, ornamental fountains, and water surfaces are defined (Fachkonzept Öffentlicher Raum, pp. 19-20). The main intentions of integrating water features (together with measures like planting new trees and increasing seating options) are improving both the quality of use and stay and the micro-climate (Fachkonzept Öffentlicher Raum, pp. 19-20). The technical concept on public spaces reads,

Water features, ornamental fountains, or drinking fountains, whose water drains above ground have a cooling effect in addition to their positive impact on design and use [of public spaces]. Flowing water (and its evaporation) in particular contributes to cooling.
(Fachkonzept Öffentlicher Raum, p. 43).

The same document also mentions water features in connection with increasing the possibilities of play, for example water play tables accompanying streets or ground-level fountains with water jets in public places (Fachkonzept Öffentlicher Raum, pp. 45-46). It is written that *"In almost all its forms, water is a fascinating attraction for children and adults alike during the warm season."* (Fachkonzept Öffentlicher Raum, p. 46). In the smart climate city strategy, urban water features are discussed in the context of climate change adaptation of public places and heat mitigation (Smart Klima City Strategie, pp. 85, 87). Furthermore, the recent city development strategy mentions water features in connection with improving the micro-climate: *"In urban open spaces smaller water surfaces, water plays, spray showers, misting systems and alike water features improve the micro-*

climate and provide local cooling” (Wien-Plan, p. 29). Furthermore, the plan strives to upgrade the quality of public spaces through the installation of water features. Open water surfaces as well as small channels and retention areas should increasingly be realized in the design of public spaces (Wien-Plan, p. 90).

The strategic considerations for quality of stay and heat mitigation are well reflected in the perspectives of the interview partners and their respective municipal departments. Asked for their goals when implementing urban water features, all interviewees list both improving the quality of stay for citizens and providing cooling (Interviews MA25, MA28, MA31, MA42, MD-BT). The expert of the department for road management and construction stated that they design in a way *“so that the quality of stay is enriched, as well as for climate change adaptation and for rainwater management”* (Interview MA28). For them the quality of stay likewise includes barrier-free design and the assurance of street safety (Interview MA28). The MA31 Vienna Water, which maintain both drinking water fountains and ornamental fountains, stress the importance to take care of these objects so that they remain in a good condition and serve the public (Interview MA31). In addition, the planning of urban water features *“is also about adapting the existing city to climate change”* (Interview MA25), for example, through the program InKa, which is an acronym for infrastructural climate change adaptation (Interview MD-BT). In fact, the *“avoidance of urban heat island”* (Interview MD-BT) is explicitly stated as a goal in connection with urban water features, which are, among other, appreciated for their cooling evaporation (Interview MD-BT). Another interview partner explains, *“this is comparable to the effect, well, I mean, it’s just a replicated effect of course, like in the mountains when standing in the spray from a waterfall. It does help to cool you down a little, of course.”* (Interview MA31).

Beyond quality of stay and heat mitigation, the various departments show different emphasis on other functions provided by urban water features, for example, improving life quality, drinking water provision, opportunities for play, and hygiene. The MA25 Technical Urban Renewal, for instance, highlights the improvement of life quality in residential surroundings:

[T]he main aim is actually to increase the living comfort in public, meaning in regard to public spaces [...] to simply improve the quality of life in public space, to enhance the quality of stay so that more people both want to and can spend time in public spaces.
(Interview MA25)

Drinking water provision is a crucial objective of the MA31 Vienna Water in regard to urban water features. They say, *“the primary purpose of our Brunnhilden [a type of drinking water fountain, see chapter 4.3, Figure 3, 1st picture] is and remains drinking fountains, yes, they are suitable for water withdrawal”* (Interview MA31). The municipal department responsible for public parks and gardens similarly emphasizes the provision of drinking water as well as offering opportunity for playing:

On the one hand it is drinking water for drinking, as a basic provision so to speak, when you are out and about. And the other is the more playful character and the ambient cooling [...] but not in the wider sense rather on a small scale. (Interview MA42)

The main aims of MA44 Municipal Swimming Pools include the provision of opportunities for swimming, especially where the city is growing, and that citizens learn how to swim. They see themselves as a health facility that promotes exercise, as an educational facility, as a leisure facility, and as a hygiene facility that, moreover, facilitates integration. The public baths also function as places for individual heat mitigation in summer months and the green spaces in outdoor swimming pools contribute to rainwater retention, biodiversity, and cooling (Interview MA44).

Strategic context of blue infrastructure planning

Regarding urban blue infrastructure more generally, regulating and cultural ecosystem services are highlighted. Most attention is given to the potential of water areas for climate and rainwater regulation. The Wien-Plan states, *„The waterways are of great importance as blue infrastructure for the city, due in part to their positive microclimatic effects.”* (Wien-Plan, p. 86). Regarding the improvement of water management, the recent urban development plan remarks that *„[d]epending on local conditions, forms of rainwater management, such as “sponge city modules”, are being given greater consideration in planning, and the natural water cycle in the city is being made more visible [...]”* (Wien-Plan, p. 148). Additionally, the smart (climate) city strategies from 2019 and 2022 put an emphasis on rainwater management (Smart City Wien Rahmenstrategie, pp. 39-40, 94-95; Smart Klima City Strategie Wien, pp. 82-87). This is also reflected in the interviews with the Road Management and Construction department as well as with the Executive Group for Construction and Technology. The latter explains that:

There is the topic of how can we manage to pursue this goal of a water-sensitive city? It is clear, it is about decoupling areas from the canal. Of course, it is about allowing water to evaporate or seep away as locally as possible, these are the goals. (Interview MD-BT)

However, the department responsible for road management and construction highlights challenges with this aim:

A very essential point is that we would very much like to allow much more water to seep away, but that's nothing where we as a department must discuss. We are simply aware of the fact that road runoff with a certain dirt load or contamination cannot simply be brought to seep away. In Vienna, we have salt spreading [in the winter] and this water is very harmful to the trees and the groundwater, which are both protected, and therefore we just cannot simply allow it to seep away. (Interview MA28)

The climate and especially the rainwater regulation function of urban blue and green infrastructure have gained more prominence in recent years (Interviews MA28, MD-BT; Wien-Plan 2025). Recreational functions of urban blue spaces have been and still are appreciated. The STEP 2025, for instance, strives toward both the creation of recreational opportunities close to home and an attractive network of green spaces that *“[provide] access to and enjoyment of waterways such as the Danube, the Danube Canal, the Wien River, and the Liesingbach.”* (STEP 2025, p. 120). The technical concept on green and open spaces wrote about the Danube, *„Today, the unifying effect of the recreational area, which is of city-wide importance, is moving to the forefront.”* (Fachkonzept Grün- und Freiräume, p. 39). Furthermore, aims towards the renaturation of water bodies and their

shores as well as the daylighting of channeled water streams are formulated in order to make them more accessible and experienceable (Wien-Plan, p. 86). Provisioning ecosystem services, like the importance of water areas as habitat for biodiversity, are mentioned in the technical concept about green and open spaces (Fachkonzept Grün- und Freiräume, p. 91). One interview partner mentioned recreational functions not only in regards to urban blue spaces, but also with urban water features like misting systems:

[Y]es, I think water has a huge recreational effect and a very high recreational value for residents. Yes, so that could be a spray mist system, a water play. Yes, and ideally a river, one can look at. I think that water has something very calming when looking at it. And it's interesting, there is always something happening, and it has a high attraction effect. For example, the Danube channel, people just sit at its edge and watch the water. It's simply, I think it probably is pleasant for people that it draws them there. I would think that if the Danube channel were a highway, people probably wouldn't hang out at its edge and watch the cars. (Interview MA25)

7.3 Administrative structures

How tasks are organized within the Viennese city administration is determined by both the Rules of Procedure (Geschäftsordnung) and the Allocation of Competencies (Geschäftseinteilung), which are approved by the city council and decreed by the mayor (Interview MD-BT, MA42). The Allocation of Competencies defines the 57 municipal departments with their respective responsibilities out of which at least 23 are directly involved in the planning and management of public open spaces (Fachkonzept Öffentlicher Raum, pp. 56-57). Additionally, the district councils play an important role in the realization of interventions within their local jurisdiction (Fachkonzept Öffentlicher Raum, p. 55; Interviews MA25, MA28, MA31, MA42, MD-BT).

Distribution of competencies

A variety of municipal departments are involved in the planning of urban water features with different competencies regarding either the different types of urban water features, different land zones, or different stages in the planning process. One interview partner explains,

if we now look at blue-green infrastructure measures, which are different types of water features, misting systems, they clearly fall within the responsibility of the property management department. As a general rule, these are in public space; the MA42, MA28, and MA19 that do the planning and that look at where which intervention is good, important, and reasonable. (Interview MD-BT)

The specific responsibilities of all identified relevant municipal departments are listed in the subsequent Table 4. However, even though responsibilities are defined in the Allocation of Competencies, in practice it is not always clear in whose area of competencies certain topics fall. One interviewee mentioned spending a lot of time on finding out who is responsible (Interview MD-BT).

Table 4: Competences regarding the planning of urban water features. Own illustration based on the analysis of both the interviews and strategic documents.

Municipal department	Competencies regarding the planning of urban water features (WF)
MA 18 – Urban Development and Planning	Provide the general planning context by developing strategic goals.
MA 19 – Architecture and Urban Design	Plan and design WF as one out of many components in the redesign of public spaces.
MA 25 – Technical Urban Renewal	Coordinate interventions like the realization of WF in program areas in the context of city renewal strategies.
MA 28 – Road Construction and Management	Coordinate and install WF in areas that are zoned as traffic areas.
MA 31 – Vienna Water	Provide safe drinking water for WF, operate some drinking fountains in public areas (type “Brunnhilde”), maintain ornamental fountains, and manage one waterplay ground at the water tower in the 10 th district.
MA 34 – Building and Facility Management	Organize constructional realization of WF and install water connections on behalf of MA 28 and MA 42.
MA 42 – Parks and Gardens	Plan, build, and maintain WF in parks and spaces zoned as recreational areas.
MA 44 – Municipal Swimming Pools	Manage public baths.
MA 45 – Water Management	Plan WF on properties that are managed by the MA 45 (mostly in proximity to bigger water bodies) like the water playground on the Danube Island.
MD-BT – Chief Executive Office, Executive Group for Construction and Technology	Coordinate the work of the municipal departments and promote increased climate adaptation. Audit bigger projects.

In almost all planning processes, a variety of the listed actors are actively involved in joint meetings or at least consulted (Interviews MA25, MA28, MA42, MD-BT). For example, close coordination between the MA31 and the MA42 is required concerning ornamental fountains that are located in parks. Correspondingly, when a park and the adjacent street are redeveloped and water features installed, the MA28, MA31, MA34, MA42 and numerous other departments are responsible for certain aspects of the project. The inter-department cooperation has been described as constructive but also challenging at times. One interview partner stated that *“in most cases the cooperation between the departments works very well [...]”* (Interview MA25). However, especially in bigger projects with a lot of involved actors the cooperation can be lengthy and demanding: *“We have a whole list of departments that are relevant. And they all can say something. And sometimes it happens that you just can’t agree. It then takes a long time to find a compromise that suits everyone.”* (Interview MA42). Yet, another interview partner explains, *“that is something we try, to find solutions among the departments of our level, because that’s our daily business to work*

together” (Interview MA28). If no agreement can be reached the issue is referred to a higher-level authority. For the Executive Group for Construction and Technology collaboration is even more important as they do not have their own budget for implementations:

It can only work in cooperation with the municipal departments, because of course, we plan and coordinate things, but those who implement it are other people. And if those realizing it are not convinced of specific ideas, because of concerns or refusal, then it just doesn't happen [...]. So, and by no means in the quality or the way you want it to be, as it would be effective then. (Interview MD-BT)

Role of the districts

More important even than the collaboration between the different municipal departments seems to be the role of the districts and its cooperation with the municipal departments. The district councils decide, which interventions take place in their districts and define the budget for this. One interview partner explains that *“almost every planning project is initiated by the district. The district commissions the planning in public spaces and also determines the scope of the planning project”* (Interview MA25). Another interview partner says, *“the contracting authority is usually the political sphere, either at the district or city level, which would like to implement a project, but in most cases, it is the district level”* (Interview MA 28). Thus, within the context of the strategic urban planning documents of the City of Vienna, the district councils can mostly decide where they realize interventions like urban water features. One interview partner describes that the different districts act very differently (Interview MA28). Often the impulse for surface redevelopments is necessary road or underground utility infrastructure renovations (like the replacement of water pipes) in the course of which the public spaces are redesigned and urban water features installed (Interview MA28). Still, most district councils are in close and constant contact with the municipal departments through regular meetings, where interventions in public space are coordinated, and where the municipal departments can point out specific development needs or focus areas in line with the urban development strategy (Interview MA28). Nevertheless, the districts can enact their own strategic planning regarding public spaces (called *“Entwicklungsplan Öffentlicher Raum”*). Sometimes this is done in collaboration with adjacent districts. An exception to the rule that the districts commission the planning projects are urban development areas like the Seestadt Aspern, where planning happens at the urban administrative level.

Financing

Usually though, the districts commission the planning, and it is mostly their budget that is spent on planning projects and interventions. The expert from the department Parks and Garden says, *“And of course, the district has to provide the budget”* (Interview MA42). Yet, it has been mentioned that different districts have different financial resources:

Some districts simply don't have as much money [...]. These measures all cost money and if one has spent a lot of money on one measure you have to re-evaluate, then there is not too much money left for innovative measures. (Interview MA28)

However, for specific interventions like climate adaptation measures, there is city-wide internal funding available to which the district councils can apply. An example is the so-called “Livable Climate Model City” (Lebenswerte Klimamusterstadt) subsidy program, which strives to foster climate adaptation across the whole city and supports the creation of water features in public spaces (Interview MA28, MD-BT). Projects in urban development areas that are planned by the city level are funded by the central city budget (Interview MA42). Still, financing has been mentioned as a challenge for the planning of urban water features (Interview MA25, MA28, MA31, MA42).

Politics

The influence of politics, be it city or district councils, in initiating projects has already been evident in the quotes above. One interview partner summed it up by saying, *“political representatives use the municipal departments to implement their ideas. They just don’t have the capacities to draw the plan and build the streets themselves”* (Interview MA28). This was evaluated positively by the interviewed expert who added: *“that’s the good thing, because we are not elected, the political parties are elected and if the citizens like it, then they’ll vote a bit more in favor at the next election. After all I’m not being elected”* (Interview MA28). Another interview partner adds more critically that:

Of course it’s always a question of preference. So, what is prioritized? In public space it is the motorized or space for motorized individual transport, or is it space for green and blue infrastructure? In the end it’s always very much a political question. Public space is just very strongly influenced by politics. (Interview MA25)

7.4 Planning processes

Planning processes vary for the different types of urban water features in Vienna and depend on the zoning area, which they are located in. Typically, the planning object are existing streets and parks that are redesigned on behalf of the district, as was described above. After the commission of the project to the leading municipal department (usually the MA28 for planning interventions located on streets or MA42 for those located in parks and gardens) the first step are internal consultations with all relevant municipal departments and the district council. Based on these agreements, a preliminary draft is developed, which outlines the possibilities within the budget and checks what is technically feasible. One expert explains, *“We have to look at what is technically feasible in the preliminary draft. We look at the budget that is available, what the district gives us, as it is the contractor, so to speak. Then we make cuts.”* (Interview MA42). Subsequently, the preliminary draft is reconciled, firstly internally with the various involved municipal departments and secondly externally, perhaps with citizens. Citizen participation depends on the size and content of the project as well as the budget (see chapter 7.7). After adapting the preliminary draft to the comments and objections the detailed planning takes place, including different kinds of technical plans, details, or the planting plan (Interview MA28, MA42). Then it is either given to the MA 34 Building and Facility Management for the operational planning, or a call for tender is issued

and the plan implemented by a construction company (e-mail exchange MA34, Interview MA42). After realization, the project is taken over into maintenance by the leading municipal department during a site visit (Interviews MA28, MA42).

In these planning processes water features are just some out of multiple infrastructures that are integrated in the redesign of public streets and parks (Interview MA28, MA42). This is also reflected in the information from the MA19 Architecture and Urban Design who declined the invitation for the interview, as water features are just seen as one of many potential building blocks for redesigns in public spaces (e-mail exchange MA19). If and how urban water features are integrated depends on factors like financing, technical feasibility, questions of safety, space availability, usage of the space, design, and political aims (e-mail exchange MA19). The drinking water fountains and misting systems of the MA31 Vienna Water are mounted onto existing fire hydrants, taking into consideration space requirements and heat hotspots. There the planning is mostly coordinated between the municipal department and the districts (Interview MA31). In case water features are planned in a program area of the city renewal strategies, then the planning of water features can be coordinated by the MA25 Technical Urban Renewal (Interview MA25).

The role of planners in the planning of urban water features was described as mostly coordinative (Interview MA25, MA28). The planners in the MA28 and MA42 additionally develop and draw plans for street and park redevelopment respectively. The interview partner from the MA28 explains:

Of course, as a planner, we coordinate, and as the one who coordinates, you naturally have a role to play. So, if you yourself as a planner are very convinced of the benefits of planting lots of trees and implementing design measures, then you can of course include more of these measures in the plans, and they may then be reduced because they are too expensive or because they result in a significant loss of parking spaces. (Interview MA28)

The planning of park redevelopments is partly performed by the MA42 and partly given to external planning offices. Asked for their agency in the planning process, the expert from the MA42 describes:

So, when we plan ourselves, which happens quite often, we naturally have creative freedom. We are all landscape planners anyway, most of us, or simply experienced. Within the park guideline, of course, with the specifications we have. Yes, but there is still enough freedom for design. And when it comes to external contracting, the planning office has the freedom for design, and we just check whether it corresponds to the park guideline, whether it is technically feasible, and whether it complies with the requirements of the maintenance unit. (Interview MA42)

Other interview partners complained about restrictive tendencies and traditional planning understandings in connection with the agency of planners that does not sufficiently recognize the role of urban blue and green (Interview MA25, MD-BT). One expert states: “*And if these [blue and green] infrastructures are given greater value, I hope that there will simply be more of them, or that more space will be allocated [to them]. Yes. But ultimately, it's a question of the planners, the implementing planners.*” (Interview MA25).

7.5 Informal institutions

Informal institutions like values, frames of meaning, attitudes, and practices regarding the planning of urban water features were analyzed through looking at the discourse about these infrastructures. The collected data shows that the discussion on urban water features has increased over time. Parallels can be drawn to the debate on climate change and particularly heat adaptation, which has also intensified. While older strategic documents only to a limited extent refer to small-scale water infrastructures and climate change adaptation, these topics are more frequently mentioned and discussed more in-depth in the recent planning documents (see Figure 9).

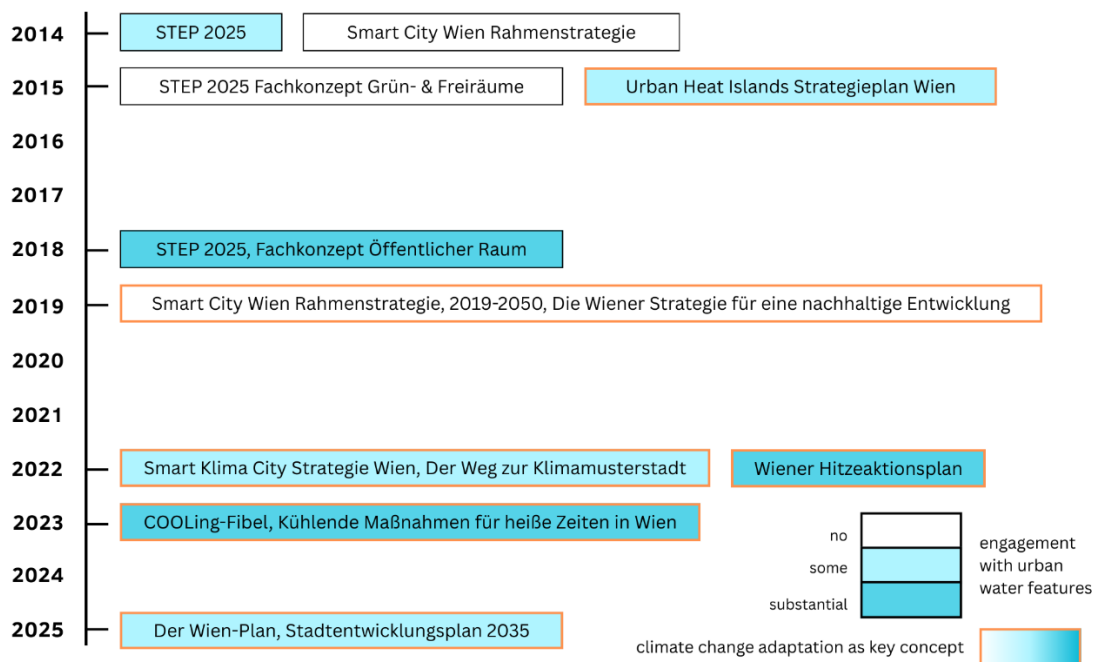


Figure 9: Engagement of analyzed policy documents with urban water features and climate change adaptation. Own illustration.

The STEP, published in 2014, refers twice to urban water features. Firstly, this is in the context of recreational opportunities close to home and an attractive network of footpaths, and secondly, as infrastructural measures for heat mitigation (STEP 2025, pp. 118, 140). Climate change adaptation was only mentioned in three instances as an increasingly important function of open and green spaces in addition to their recreational value (STEP 2025, pp. 115-119).

In the urban heat island strategy plan from 2015, which was developed as part of a cooperation between Central European cities, concrete measures concerning urban water features were presented for the first time. Thereby, the goal of increasing in the share of water in the city is pursued. It is stated that *“water is not only essential for the living environment and therefore also the human organism, water in public spaces also contributes to human well-being and, depending on its size, has a cooling effect on the environment when temperatures are high.”* (UHI-STRAT, p. 66). Among the proposed measures are the installation of more water features like misting systems and fountains, the enabling of above ground run-off followed by ground infiltration instead of direct drainage to the canal, the increased provision of drinking water through public fountains, and the

creation of more water surfaces, for example in parks (UHI-STRAT, pp. 69-71). Climate change adaptation was used as a key framing for discussing urban heat islands and cooling measures. The municipal department for environmental protection coordinated and issued this plan.

In 2018 the technical concept of public spaces for the STEP was published by the urban development and planning department. There urban water features are described as integral component of public spaces. Building on the urban heat island strategy, aims include the increase of the opportunities for drinking water and the number of fountains and water surfaces in public spaces (Fachkonzept Öffentlicher Raum, pp. 19-20). One group of measures engages with climate change adaptation of urban public spaces, yet primarily through the realization of green infrastructure. Blue infrastructure is not explicitly mentioned in this context, even though water is described as contributing to temperature reduction at another instance (Fachkonzept Öffentlicher Raum, pp. 33-34, 44).

With the newly elected city council the smart city strategy was revised and republished under the new title Smart Climate City Strategy in 2022. Climate change adaptation explicitly frames the whole policy document. This strategic document, moreover, names the installation of drinking fountains and water features like misting systems and water play elements for the design of cool public spaces as heat mitigation measures (Smart Klima City Strategie, p. 85). These water features are seen as *“addition to the most significant measures such as parks, green spaces, and trees to create a supplementary cooling effect”* (Smart Klima City Strategie, p. 87).

In the same year a heat action plan was developed, outlining primarily acute and short-term measures for mitigating urban heat. Regarding urban water features, these include the creation of additional fountains and misting systems, cool spots, which are defined as *“cool oases with a high quality of stay and cooling-optimized planning. Cooling elements include shading, misting systems, etc.”* (Hitzeaktionsplan, p. 34), and the expansion of drinking fountains (Hitzeaktionsplan, pp. 33-35). Water features are very present in this policy document, both in text and image. Like in the urban heat island strategy plan, climate change adaptation is central to the document’s conceptual framing.

In 2023, shortly after the heat action plan, a handbook for cooling was published by the MA42 Parks and Gardens. Here, urban water features are mentioned throughout the document and presented into detail. Besides the already mentioned drinking water fountains and different types of misting systems a special emphasis is put on water play elements in public space. It writes, *“[w]here water flows, is collected, stands, sprays, or mists, people quickly start experimenting, laughing, splashing, and observing. It makes you want to play. It’s tempting for young and old alike!”* (COOLing-Fibel, p. 41). Small, engageable streams, playground equipment with water elements, water tables, water playgrounds, and pavement water fountains are suggested as measures to counter urban heat and increase the quality of stay. The handbook evaluates their costs, water consumption, cooling factor, and play factor (COOLing-Fibel, pp. 41-64). Climate change adaptation is discussed continuously.

The Wien-Plan, as the most recent strategic urban development plan, has taken up much content of the previous policy documents regarding urban water features, however, not as in-depth and

specific. It applies the term green-blue infrastructure and highlights both the microclimatic cooling function of urban water features and the improvement of quality of stay, yet without specifying the measures (Wien-Plan, pp. 29, 91). Interestingly, the technical concept of public spaces from 2018 engages much more with urban water features as design elements than the respective section in the Wien-Plan. Compared to the STEP the climate change adaptation framing is more prominent in the Wien-Plan. It says, “[a] central theme of this plan is global climate change and its impact on Vienna. Unlike any other urban development plan before it, the Wien-Plan focuses on climate protection, climate adaptation, and the circular economy.” (Wien-Plan, p. 3).

The document analysis shows that both the frequency of mention and depth of engagement regarding urban water features has increased over the years. Especially, the number of additional policy documents, besides the urban development plans, is notable. Among them are the three versions of the smart (climate) city strategy, in which climate change adaptation has become a key topic, and the three plans that specifically engage with urban heat and cooling (Urban Heat Island Strategieplan Wien, Wiener Hitzeaktionsplan, and COOLing-Fibel).

The interview partners likewise highlight that the discourse on urban water features and climate change adaption has increased in recent years (Interview MA28, MD-BT). The expert from the municipal department Road Management and Construction explains:

And what is also very essential is that, in the past, or let's put it this way, the issue of climate change and climate change adaptation has only been a topic of public discussion for 10 years, I would say, if at all, for 10 years. And back then, it was always just about the heat, but we know that storms are becoming more frequent, and above all, heavy rainfall events are becoming more frequent, and that's where we need to focus [...] with rainwater management or water in the city. [...] If you really think about it, 10-15 years ago, parking spaces were still very important. We optimized parking spaces then. Gradually, surface material designs have become more and more important. And now that we have been realizing how important climate change adaptation is, we are doing a lot more unsealing, i.e., creating green infrastructure, planting lots of trees, and integrating blue infrastructure. And the City of Vienna is providing massive subsidies for this. (Interview MA28)

Based on the urban heat island strategy plan from 2015 the already mentioned program about infrastructural adaption to climate change (InKA) was launched by the Chief Executive Office in 2018. The aim of the program is to develop knowledge about countermeasure against the effect of climate change through interdisciplinary and inter-departmental projects. Projects focus on encouraging climate-resilient urban planning, adaptation measures for the existing city, interventions for the improvement of urban open and green spaces, the creation of sustainable public places, and fostering the natural water cycle in the city. Much of the work is “talking about challenges, discussing and creating synergies” (Interview MD-BT). The interview partner from the responsible department evaluates it as an “important, important platform in order to address issues of climate change adaptation.” (Interview MD-BT).

Concerning attitudes and practices in the planning of urban water features no unambiguous observation about existing informal institutions could be made. For the interview partners and their respective departments water features were one out of many potential interventions in the redevelopment of public spaces and no expert seemed to have a particularly strong opinion about it. Still, their existence and their effect in cooling and increasing the quality of stay appeared to be appreciated and realized when possible. Yet, attitudes towards how citizen knowledge could be integrated in the planning of urban water features differed (see chapter 7.7). Regarding climate change adaptation, the interview partners were highly aware and actively working towards mitigating the negative effects of climate change (Interviews MA25, MA28, MA31, MA42, MA44, MD-BT). Nevertheless, some comments point towards the circumstance that climate resilient planning by no means has been mainstreamed through all municipal departments and planners. One interview partner said about the Road Management and Construction department that *“the name simply reflects the fact that this is about asphalt surfaces and not so much about green space planning”* (Interview MA25). The municipal department in question, indeed, explained:

Yes, I have to tell you, quite frankly, that the easiest thing for us would be to pave everything and have no trees, no nothing, no benches, nothing. Every measure we take, which we are happy to do, actually makes our work more difficult, because a tree is a weak spot in the asphalt. Every bench gets in the way when you're renovating. But we have a clear mandate and we're of course glad to do it, otherwise public spaces wouldn't look the way they do. And it's really a matter of course for us to take these things into account.
(Interview MA28)

7.6 Distributive justice aspects

Strategic urban planning documents like the Wien-Plan highlight planning towards the geographically just city by, for example, safeguarding socially diverse neighborhoods and the provision of social, health-related, and cultural infrastructures close to people's homes (Wien-Plan, p. 58), thereby counteracting segregation. Furthermore, priority areas for the transformation of public spaces are defined; they are characterized by above-average heat during summer, below-average socio-economic status of residents, high use-pressure on public spaces, a low availability of open and green spaces, and high building density (Wien-Plan, pp. 92-93). The previous urban development plan stated, *“Vienna is a city in which social status cannot be inferred from the residential address. This is good and should remain like this.”* (STEP 2025, p. 133). The accompanying technical concept repeatedly mentions green space equity. Yet, no references are made to urban blue spaces nor urban water features in relation with distributional justice consideration.

In the conversations with the interview partners the heterogeneous distribution of urban water features across the city area (cf. chapter 4) is explained by several factors. Firstly, urban density and the type of land development was mentioned as reasons for why some areas have less urban water features: *“For example, I'm thinking of the 23rd district now, they probably partly have residential areas made up out of single-family homes with gardens. There, perhaps the focus in the street space should not be on such elements then”* (Interview MA28). Secondly, recent larger-scale street

redevelopment projects that took place in the 1st district were used as an explanation for the high density of water features there. This was in a way justified by another interview partner who said that:

For example, as far as I know, the most frequently visited drinking fountain is located on Graben [a public place right next to the Stefansplatz] [...] it's very popular with visitors to the city. And it is significant of course on Graben. It's certainly a place where we represent the City of Vienna with its water quality. (Interview MA31)

A third given reason for the heterogenous spatial distribution of urban water features is politically defined priority areas where many interventions have been coordinated in the past (Interview MA25). Examples include an area in the 2nd district close to the Praterstern, or the Thaliastraße in the 16th district. In city development areas these water features had already been considered in the planning stage and accordingly realized in public spaces (Interview MA42). Fourthly, the varying district budgets that are spent on these types of interventions were stressed (Interview MA28).

7.7 Procedural justice aspects

The importance of participation in urban development is repeatedly stressed in the strategic plans, in the planning of water features, however, it is applied only partially. The 2014 urban development plan states that *"citizen participation and elements of direct democracy add value to urban development"* (STEP 2025, p. 10). The STEP 2025 furthermore explains:

The STEP understands participation as a self-evident element of cooperative urban development: participation does more than just create acceptance. When used early and targeted, participation contributes to better and more durable results: citizens and stakeholders in urban development have undisputed expertise in all matters that affect their living and working environments. [...] For planning processes this implies both a new understanding and a novel management: it is no longer simply about the transparent communication of plans and decisions, but about involvement from the very beginning, open discussions on development goals (rather than just on measures) and openness towards unforeseeable proposed solutions. (STEP 2025, p. 30)

Similarly, the Wien-Plan emphasizes that *"citizens are invited to contribute to a livable environment at all levels and in all fields"* (Wien-Plan, p. 6) and that democracy is a lived-practice in Vienna. Furthermore, reference values for the number of residential units when citizens need to be engaged in urban development projects are defined. *"Participation processes enable residents to influence the design of their own living environment according to their needs"* (Wien-Plan, p. 137). In one of the technical concepts, functional and social space analyses combined with advocacy planning are mentioned as tool to include the interests and needs of those people that for different reasons can or do not participate in public planning processes (Fachkonzept Öffentlicher Raum, p. 50). Thus, a clear strategic commitment towards public participation in city development is evident from the analyzed documents in Vienna.

In the planning practice of urban water features, though, the integration of public participation is less clear. For some interviewed planning practitioners water features and especially drinking water fountains and rainwater management solutions are perceived as technical interventions, which do not need participation (Interview MA31, MD-BT). One interview partner says, „[b]ut in my specific work, I don't think it would be, I'm skeptical if that [participation] would be effective. The issues we deal with are comparably specific, they're very specialized [...] and usually complex" (Interview MD-BT). The municipal department responsible for some drinking water fountains and the ornamental fountains mainly engages with citizens indirectly through complaint management (Interview MA31). Other planners evaluated citizen participation more positively. The interview partner from the Road Management and Construction department stated:

It [citizen participation] makes perfect sense. Of course, it prolongs the planning process, but then hopefully we don't end up planning something that doesn't meet the needs of those using it. We're not planning it for ourselves, and our goal isn't to get it done as quickly as possible. Instead, the planning is meant to last for several decades, so that people can feel comfortable in this space for many years to come. (Interview MA28)

In the municipal department for Parks and Gardens, one planner explains, “for us citizen participation is actually required, and it makes sense, of course” (Interview MA42). How exactly the participation is organized depends on the project size and complexity, sometimes neighbors are only informed with direct mailings and can respond through letters or postcards, in other cases participation events are organized in the public parks and sometimes, with large and complex projects, the participation process is commissioned (Interview MA42). The interview partner further stated, “[we] try to make the most of the tasks we have been given for the benefit of the population; we are not doing this for ourselves. And for that, we need the support of the population” (Interview MA42).

Yet, the districts too have an influential role on citizen participation in the planning of urban water features. As they define a project's budget they directly influence how and how much participation is possible. One expert described that “it's also always a question of political acceptance of citizen participation I would say [...] or rather, how much participation is allowed. And that differs between the district chairpersons. So, it really varies from district to district” (Interview MA25).

7.8 Recognitional justice aspects

The acknowledgement of difference in society regarding user preferences of and activities with urban water features can be identified on the strategic urban planning level, while its consideration in the operational planning is mostly absent. The Smart City Vienna Framework Strategy highlights social inclusion and states, “Vienna is only smart, if the needs of many different groups in society can be met. Smart City Vienna means recognizing this diversity” and, “Vienna is only smart, if a high quality of living is possible even on a lower income” (Smart City Wien Rahmenstrategie, 2014, p. 15). The most recent urban development plan reads:

Citizens are invited to participate in planning projects at the district and project level. This improves the quality of solutions and avoids conflicts. Different realities and phases of life are taken into account in urban planning, regardless of gender, age, educational background, and origin. (Wien-Plan, 2025, p. 6)

Similarly, marginalized views including those of immigrant groups are mentioned in the strategies, however not in relation to urban water features. In the urban development plan, it reads that public spaces should be accessible to all residents of Vienna and that particular attention should be paid to socially marginalized groups among other (Wien-Plan, 2025, p. 32). The STEP emphasizes:

Today, the city is more diverse than ever before, with people from around 200 nations living in Vienna, a third of the population born abroad, and almost 50 percent with family migration histories [...]. Different lifestyles, value systems, and views, changing gender roles, and diverse economic, linguistic, religious, and cultural backgrounds shape how people live, work, and spend their free time. (STEP, 2014, p. 16)

In the semi-structured interviews with planners, aspects of recognitional justice were hardly mentioned. In the conversation with the municipal department for public parks and gardens the interview partner mentioned that some groups in society are more dependent on public spaces and that the participatory processes aim to include all residents (Interview MA42). Additionally, diverse user preferences concerning public spaces (Interview MA25), use conflicts (Interview MA28), and the multiple use of spaces (Interview MD-BT) were mentioned, however neither specifically talking about urban water features nor explicitly mentioning immigrant groups. The only particular group whose needs and preferences are explicitly recognized are children and their play behaviors (Interview MA31, MA42, MA44, MD-BT). Concerning municipal baths, the interview partners explained that the municipal council sets the entry ticket prices, ensuring its affordability, and that they, as public organization, are not allowed to exclude specific groups or discriminate (Interview MA44). Observations about the design of Viennese urban water features showed that apparently animals like dogs are also thought of, as some types of drinking water features have a bowl installed in the bottom, from which animals can feed water. Beyond that, recognitional justice is barely present in the operational planning regarding urban water features in Vienna.

7.9 Human health and well-being

Human health and well-being benefits of urban water features are partly acknowledged but not explicitly framed as such. Most engagement with human health is related to the avoidance of negative health effects. Measures include regularly flushing the public drinking fountains to ensure a high water quality that is free of germs and bacteria (Interview MA28, 31, 42, MD-BT) and safeguarding a good drainage of water play elements to avoid standing water that could become breeding grounds for mosquitos and other insects (Interview MA42, MD-BT). Due to hygiene regulations, rainwater is only used for drip irrigation in Vienna to avoid health threats, for example to children playing with fountains or sprinklers (Interview MA42). The municipal department for

Viennese Water has an own unit for water quality (Interview MA31) but other municipal departments engage with it as well. One interview partner explains:

Especially misting systems, for example, need more intensive testing when they're put into service in spring. So, there are water tests, and they need to be flushed before they spray, so that there are no germs. So, our focus is really on not causing any health hazards with these water features, just like you have to make sure there's no tripping hazard on the sidewalk. (Interview MA28)

Regarding health and well-being benefits of urban water features primarily the micro-climatic cooling function is mentioned in the interviews and policy documents, followed by the provision of drinking water. The Smart Climate City Strategy states that “[c]ool spots such as Esterházy park or Schlingermarkt can lower the perceived temperature by up to 6 °C.” (Smart Klima City Strategie, p. 84). The Urban Heat Island Strategy Plan appreciates different types of urban water features for its positive effects on human well-being, among them various fountains (both for drinking water and aesthetic reasons), misting systems, and water surfaces (UHI STRAT, pp. 66, 69-71). In addition, one expert says:

Yes, as stated in the Cooling Handbook, on the one hand, drinking water for drinking, basic provision, so to speak, when you're out and about. And the other is more of a playful character, ambient cooling, if you will, but not in a broad, wider field, but actually on a small spatial scale. (Interview MA42)

The connection between urban water features and their recreational benefits for health and well-being is not as commonly drawn. However, as previous sections have shown, the improvement of the quality of stay in public places is clearly recognized in both the documents and during the interviews, which can positively impact well-being. One interview partner from the Vienna Water department makes this clear:

And drinking water is, of course, healthy—there's no question about that. Whether I personally see great potential for health right now, yes, it's more of an enhancement of public space. It encourages people to spend time outdoors, perhaps—all these things come together there. (Interview MA31)

The municipal department Municipal Swimming Pools most clearly establishes the link with recreation and human health and well-being and even perceives itself as actively promoting physical activity and thereby health: “from this perspective, we are also a health facility” (Interview MA44).

Remarkably, the analysis shows that there are hardly any cooperations between the municipal departments responsible for urban planning and the one dealing with health (e-mail exchange MA24). Even though one strategic document, the technical concept green and open spaces, mentions the connection between the environment and health outcomes (Fachkonzept Grün- und Freiräume, pp. 38, 90) and life quality seems to be a crucial theme in all efforts of the City of Vienna (all reviewed policy documents), the impact of the built environment on health outcomes is under-illuminated. The experts from the MA 24 strategic healthcare explain that health in the Viennese city administration is perceived traditionally very narrow and that there is a long way to go towards

a holistic understanding of health. They criticize that there is no technical concept on health in the strategic urban development plans and the person I was referred to as the most knowledgeable regarding my request said that he has not been involved in any spatial planning processes (e-mail exchange MA24).

The new urban development plan explicitly strives towards greater collaboration between health and urban planning, nonetheless, mostly referring to needs assessments, strategies, and concepts for primary care in the city in urban development areas (Wien-Plan, p. 150), which reflects the traditional understanding of health planning. Nevertheless, two interview partners put health considerations to the core of their work; one said, *“Yes, health, of course. I mean, that's the only aspiration we have”* (Interview MD-BT) and the expert from the municipal department Road Construction and Management explained, *“So, health is not really something we as a department need to worry about, actually, but of course we do care, because, looking at the City of Vienna as a whole, we of course want to have healthy people”* (Interview MA28).

8 DISCUSSION: How institutions matter

The empirical analysis has shown that institutions matter in the planning of urban water features by the city administration of Vienna. How the different formal and informal institutions influence environmental justice and human health and well-being is elaborated in this chapter. The findings are discussed in the context of the theory to answer the research question, which is: *Drawing on new institutionalism, how do institutions affect the planning of urban water features in Vienna and the extent to which environmental justice principles are considered?*

First, the institutional mechanisms of how the three dimensions of environmental justice and health are affected in urban water feature planning are carved out. Second, institutional constraints for urban water feature planning are derived. Third, the findings are reflected against the backdrop of planning theory. Fourth, the limitations of this study are thematized and fifth, avenues for further research proposed.

8.1 The influence of institutions on the environmental justice of urban water features

The analysis of the empirical evidence has demonstrated that institutions structure how urban water features as small-scale blue infrastructures are planned for, which has meaningful implications for distributional, procedural, and recognitional justice, as well as human health and well-being.

The distribution of urban water features in Vienna does not follow a city-wide strategy. Even though their installation is encouraged in strategic policy documents and funding support is provided as incentive, the responsibility for actually integrating them in public space lies with the district councils. Applying a new institutionalism perspective, this means that even though some formal institutions (namely strategic planning documents and funding schemes) promote the uptake of urban water features among other measures to counter urban heat and improve the quality of public spaces, the city administrations' structure and how responsibilities are distributed legally, in other words the "tiers of planning" (Turowski, 2002), decentralizes the main competence for their planning to the districts. The districts, however, have different financial resources, political priorities, and capacities for redeveloping public spaces. This helps explain the spatially unequal distribution of urban water features, where some districts have built many urban water features while others have not (see Figure 2, chapter 4.3). Only through coordinating specific projects in politically defined priority areas can the city administration influence the spatial pattern of urban water features. This, too, is partly reflected in the spatial distribution, e.g., the case of Thaliastraße.

Formal institutions likewise influence the procedural justice of urban water features, especially the extent of citizen participation in the planning process. Depending on the land zoning, different laws

are applicable, liability varies, and different municipal departments are responsible and commissioned by the district councils. While some municipal departments actively integrate aspects of communicative planning in their planning processes, like information and consultation of citizens, other municipal departments apply a more rationalistic approach towards urban water features planning. In the latter, the planner is understood as the expert who has all the necessary information for deciding where urban water features can be built (e.g., know the underground installations, the sidewalk width and other local requirements). This technocratic understanding of planning regarding small-scale blue infrastructure inhibits a procedurally just process. The rationalist approach has been found to be formally and informally institutionalized in some municipal departments: formally in organizational structures and operational processes, and informally in attitudes and practices. In addition, the project scope and budget (which is determined by the district councils) influence the extent of the participation process and can impede participation even where the municipal department would include it following their organizational procedures.

Regarding the recognitional justice of urban water features in Vienna, the analysis shows that these infrastructures are predominantly perceived as technical options to realize when redeveloping streets or public parks. This framing seems to prevent a discussion about the social context in which planning takes place. Thus, differences of various user groups, concerning needs and preferences, are hardly considered. User diversity is mainly recognized through providing opportunities for the play of children and water for non-human animals like dogs and birds.

Interestingly, a certain trade-off between distributional and procedural environmental justice is visible in the context of Viennese water feature planning. While the institutional configuration that most decision-making power lies with the district councils might hinder distributive justice through creating an uneven spatial distribution, it does make the process more democratic. As the decisions are made on the district level, which is the most local tier of planning in the City of Vienna, the district councils are more accountable to their voters. This can contribute to procedural justice and the just city (Fainstein, 2011; Großmann, 2018; Kuehn, 2000; Newell et al., 2021). A challenge to this argumentation, however, is that a substantial share of marginalized people, specifically of those with migration histories, are not allowed to vote. Potential discrepancies between distributional and procedural justice have also been thematized in the literature. Fainstein (2011), for example, has argued for prioritizing distributional outcomes over just processes in such a case.

In Vienna formal and informal institutions create a planning context, which both enables and constrains the just production of urban water features. Strategic planning documents and some legal regulations (e.g., the Vienna Climate Law) foster the realization of urban water features, with the former in particular considering environmental justice concerns comprehensively but abstractly. Nevertheless, there remains potential to more thoroughly translate the justice perspectives to the actual installation of urban water features, where other formal and informal institutions (distribution of competences, organizational procedures and attitudes towards citizen participation, planning practices) impede some of the efforts for a just production of urban water features. This may have severe negative implications for the health and well-being of some groups

in society, especially those already marginalized, thereby reproducing and potentially deepening inequalities (Anguelovski et al., 2018; Haase et al., 2017; Nieuwenhuijsen, 2024). The organizational structure of strictly separating the departments on planning and health, in addition to a lack of cooperation and a traditional understanding of health in the latter, might contribute to an undervaluation of health and well-being aspects in spatial planning in the City of Vienna. This is in line with what Bond et al. (2013) identified in the strategic planning in the UK, where the health perspective was not commonly applied and where collaboration between planning and health was scarce, which inhibited active planning for human health and well-being.

Moreover, the health benefits that are considered in formal institutions like strategic planning documents regarding urban water features predominantly focus on the pathway mitigation (White et al., 2020), specifically of heat. The two other pathways linking blue infrastructure with health, namely restoration (referring to regeneration and stress reduction) and instoration (i.e. building health capacities through the promotion of social interaction or physical activity) appear to be underrecognized in the planning of urban water features in Vienna. That water features contribute to the quality of stay of public spaces is primarily understood to foster life quality. The connection to social health benefits through providing attractive places for social communication is not commonly made in the city administration. Instead, the safeguarding of a high quality of drinking water is institutionalized both in a separate unit within the administrative department responsible for drinking water and in operational processes of other planning departments, for instance when putting water features into operation in spring. Potential harms from using rainwater-fed water elements (De Man et al., 2014) are institutionally constrained through strict hygiene regulations in Vienna that only allow rainwater to be used for drip-irrigation. Similarly, mitigating heat through urban water features is institutionalized in the strategic policy documents. Thus, the institutions in the Viennese planning of urban water features were found to primarily facilitate the reduction of harm through heat and pollution. While mitigation is one important pathway to human health and well-being, other pathways like restoration and instoration likewise hold great potential to be pursued for fostering health. Approaches that promote the consideration of health, e.g., Health in All Policies (HiAP), have been proposed in the literature as solutions to systematically integrate health concerns and thereby limit negative while stimulating positive human health and well-being effects (Nieuwenhuijsen, 2024).

Overall, this thesis' findings support the argument of Kronenberg et al. (2021), who reasoned that institutions play a complex role in the planning of urban blue and green infrastructure and matter for environmental justice concerns and equitable health outcomes. In Vienna the growing formalization of the discourse on climate change adaptation and urban heat in strategic planning documents gives more imperative and legitimacy to implementing urban water features. Nevertheless, other institutions, like safety regulations, the distribution of competencies, operational processes, and planners' attitudes towards citizen participation continue to restrict an environmentally just and human-health- and well-being-supportive urban water feature planning. Striving for a (re)politicization of the discourse on urban water features, like Anguelovski, Connolly, and Brand (2018) have proposed in the context of urban greening projects, might help to bring

justice and health concerns into the discourse. This is to emphasize that urban water features are not just neutral, technical interventions but that they provide a variety of functions and can have substantial meaning in the everyday lives of urban dwellers.

8.2 Institutional constraints to urban water feature planning

Besides hindrances to environmental justice, human health, and well-being, several more general planning constraints arise from the institutional context for urban water feature planning. Although some formal and informal institutions foster the planning and realization of urban water features, other institutions in the form of regulations and laws restrict it. Examples of water feature planning supportive institutions are strategic planning documents, city-wide funding mechanisms, and the increased institutionalization of the discourse on climate change adaptation and urban heat, which creates a planning context that recognizes small-scale blue infrastructures for their cooling potential and supports their installation. Yet, urban water feature planning is not embedded in or framed as blue infrastructure planning in the Viennese planning discourse.

Institutions that constrain the planning of urban water features include many of the relevant laws and regulations that focus on ease of traffic, safety, hygiene, or nature protection. Thereby, these formal institutions limit potential planning areas and possible types of water features to be installed. Another important institution impeding the planning of urban water features is the issue of liability, especially where water features are installed in the road space. There, small-scale infrastructures such as water features, but also greening-elements or benches for example, are seen as a fault location, which can both be an object of potential injury and come with higher maintenance requirements. That a rather large variety of actors and administrative departments are involved in the planning of urban water elements in Vienna makes it a quite complex planning process and sometimes leads to uncertain responsibilities among planners.

In both formal (laws, regulations, liability) and informal (values, attitudes, practices) institutions, prevailing aspects of the modern, car-centric city concept can be detected. For instance, a focus on the fluidity of traffic, conflicts regarding parking spaces, and described difficulties in mainstreaming the consideration of the natural water cycle in urban planning point towards institutional structures that prioritize space for motorized individual transport. Even though key notions of other city concepts like the sustainable city, the green city, the water-sensitive city, and the resilient city (e.g., less sealing, more space for blue and green infrastructure, climate adaptation) are partly institutionalized in the strategic planning documents, these ideas have not yet permeated the planning culture, i.e., neither the planning environment and planning artefacts, of the Vienna city administration, nor the societal environment, according to the results of this thesis. This does not mean that the newer city concepts are not guiding planning, the analysis clearly shows that they do; however, it demonstrates that the previous city concepts and its ideas still prevail and continue to influence planning efforts.

Some of the identified institutional constraints in this thesis overlap with the findings of Deely et al. (2020), who, based on a systematic literature review, identified institutional barriers towards urban blue-green infrastructure planning. On the city level, unclear roles and governance responsibilities, inhibiting legislation and regulation, a lack of clear leadership, and the absence of long-term vision are applicable to the planning of urban water features in Vienna. For the district level, the data point towards a lack of political will and competing priorities for some districts.

In addition to institutional constraints, the analysis of the empirical data shows that both resources and political agendas are seen as an important restriction for urban water feature planning. Limited financial resources were discussed, but also the availability and consumption of fresh water thematized. Political factors, like which parties sit in district councils, how great the acceptance of reducing car parking space is, or how dire the issue of climate change adaptation is perceived, influence the uptake of urban water features. Thus, political factors (e.g., elected politicians and their agendas) as well as resource and funding questions can have impeding implications for the planning of urban water features.

8.3 Theoretical reflection

The findings from this thesis regarding how urban water features are planned in practice might explain the scarce engagement with it in the literature. In the Viennese planning practice, urban water features are not considered as objects for which a whole process is designed but rather as one out of many potential infrastructures to be incrementally realized in the redevelopment of public space. As such, they have not received a great amount of attention in both planning practice and academic engagement from a geographical perspective. This investigation of the planning context and process of urban water features as well as the consideration of environmental justice principles, may help fill the gap in the literature about the planning of small-scale blue infrastructure and its local institutional context in Vienna.

New institutionalism has proven to be an insightful and productive perspective for analyzing and understanding the planning of urban water features. Particularly, the combination of the analytic and descriptive theory of new institutionalism with the normative concept of environmental justice enabled a targeted discussion about how institutions and structure can influence human-health- and well-being-supportive as well as just outcomes. The finding that institutions matter is very much in line with the work of other authors that highlight the important influence of institutions for planning (see for example Gailing & Hamedinger, 2019; Hall & Taylor, 1996; Healey, 2007; Sorensen, 2017).

The analysis of Viennese water feature planning also confirms the characteristics of the comprehensive integrated planning system that was assigned to Austria by Farinós Dasí et al. (2007). These include a mature and stable multi-level planning structure, a large variety of relevant regulations and instruments, as well as some inflexibility. In line with Diller's (2018) observation about a tendency towards informal planning instruments in the German-speaking countries, the

case of Vienna shows an increase in informal planning documents like the smart (climate) city strategies, the heat action plan, or the cooling handbook. Even though these are not legally binding (and, thus, called informal planning documents), they still define the direction of urban development and structure the scope of action for the city and district administrations (and, thus, are understood as formal institutions). Regarding the agency of planners in the planning of water features in Vienna, it was found that they have a certain degree of freedom in the design of plans. In addition, some planners seemed very passionate about adapting the city to climate change and improving overall life quality. Still, the formal institutions were frequently referred to as guiding the planning work and important decisions beyond that are made politically, based on the formally defined distribution of competences. This confirms the significance of institutions in structuring the agency of planners in comprehensive integrated planning systems (Purkarthofer, 2022).

Institutions are not only important to consider because of their current influence on planning, but also because of their stability over time and the path-dependencies they possibly create. Commonly, the set-up costs, the functional role and legitimacy, self-reinforcing feedback loops, and power relations work to preserve the status-quo of the institutional context (Mäntysalo & Bäcklund, 2017; North, 1990; Sorensen, 2017). Institutional change can either happen incrementally, like is observable in the growing discourse on climate change and climate change adaptation in Vienna, or at critical moments, for example after severe natural disasters. The former type is slow, the latter rare; therefore, the institutional context usually remains stable. The steadiness of institutions is also evident in the results of this thesis investigation (e.g., laws and regulations, organizational structures, the car-centric city concept) and makes it even more important to firstly, identify and analyze the institutions that support and hinder equitable planning processes and outcomes, and to secondly, re-politicize the discourse on urban water feature planning.

8.4 Limitations

As for any other scientific investigation, certain limitations arise out of the chosen research design, the applied methods, and the decisions that were made in the preparation of this thesis. Due to the single case study research design, the results are context-specific and only allow for a limited generalization of the observed circumstances. The aim of this study was rather to get a deep and holistic insight into the Viennese planning system and its institutional context to firstly, further local efforts for justice and health-supportive planning and to secondly, empirically contribute to the literature on small-scale urban blue infrastructure planning. Nevertheless, the fact that the findings are in line with those of other authors allows for inferring that institutions may also matter for urban water features planning and the consideration of environmental justice principles in other cases. A limitation that arises from conducting semi-structured expert interviews is the reliance on the information from and perspective of the interview partners. All interview partners were employees of the city administration, which only provides an internal perspective on local urban planning. This was reasonable as the focus was on planning done by the city administration and the influence of other actors, like planning offices, politicians, non-governmental organizations, or

citizens, was not explicitly investigated. In addition, the sample was rather small, which might have resulted in missing out on certain issues regarding the planning of urban water features, especially as two relevant departments, one for coordinating planning in public spaces and the other responsible for the strategic urban planning approach, were not available for an interview. However, the e-mail exchange with the former municipal department and the analysis of many strategic documents, substituting the latter, has helped to complement the data and partly overcome this limitation through triangulation. Finally, it needs to be recognized that the analysis of informal institutions in the planning of urban water features in Vienna was only partial. Informal institutions are difficult to study due to their fuzzy social nature (Healey, 2007) and the methodological choice of expert interviews and policy documents as data sources limited the investigation of values, frames of meanings, norms, attitudes, and practices.

8.5 Avenues for further research

In the course of this research several directions and topics for interesting additional research came up. Firstly, and tying in with the last-mentioned limitation, in-depth interviews, focus group discussions, observatory and participatory methods would be well suitable for a thorough and supplementary analysis of informal institutions in the planning of small-scale blue infrastructure or nature-based solutions more generally. Secondly, the district level emerged as an important arena for planning urban public spaces in Vienna. An investigation into the institutional context and constraints in district planning could offer further fruitful insights to foster just and health-supportive climate adaptation measures. This could take the form of a survey among district planners combined with expert interviews or focus groups. Thirdly, the political context and how institutions influence decision-making processes could be focused on. Fourthly, recent redevelopment projects could be analyzed to see if and how the uptake of urban water features has increased and how environmentally just the specific processes as well as the place-specific outcomes are. Fifthly, geospatial analysis could be productively employed to shed light on the spatial distribution of urban water features or blue infrastructure more generally in Vienna. Identifying relationships with socio-demographic or socioeconomic variables, like average income or share of residents with foreign citizenship, would be very much in the tradition of the environmental justice literature. Sixthly, an analysis of the actual health impacts of small-scale blue infrastructure would greatly contribute to this field of literature. A survey could be combined with interviews and participant observation to illuminate the different health-supportive pathways of urban water features. Seventhly, the case of Vienna could be compared with another city case. The theory on planning culture could be particularly useful to examine differences in social and planning environments as well as planning artefacts. Lastly (but not least), more research about the specific configurations of urban blue infrastructure, their planning and management, as well as their implications for human health and well-being would contribute to developing a discrete field of research beyond urban green infrastructure.

9 CONCLUSION: Viennese urban water features planning from an institutionalist and environmental justice perspective

In the context of the unfolding climate crisis, urban areas and particularly their adoption of nature-based solutions are increasingly recognized as leverage points for climate adaptation and mitigation. Urban planning, thus, has the important task to integrate blue and green infrastructure in a manner that fosters human health and well-being as well as equity. Specifically, justice concerns have been overlooked in the past, which has contributed to a deepening of health inequalities through inconsiderate climate change adaptation. Therefore, it is crucial to consider justice aspects when evaluating health and well-being implications of urban blue and green infrastructure.

One type of blue infrastructure are urban water features, which include drinking and ornamental fountains, misting systems, water play features, and water surfaces like ponds. These small-scale blue infrastructures are more agile to plan with and easier to realize, compared to for example urban rivers, streams, or lakes. Moreover, they can offer important functions for both climate change adaptation and human health and well-being. This makes them a versatile and valuable intervention in urban planning practice and a highly interesting and current research object.

Hence, this thesis has analyzed the planning of urban water features and the extent to which environmental justice principles are considered in Vienna. The City of Vienna was chosen as a single case study because of its active planning of urban water features. Building on a literature review on urban water features, blue infrastructure, planning theory, especially new institutionalism, and environmental justice theory, a qualitative methodology was applied. Empirical data was collected during six semi-structured expert interviews, which were qualitatively analyzed together with ten strategic planning documents of the City of Vienna. Through this, both the actors and the institutions of planning in Vienna were investigated. Particular analytical attention has been directed to the institutional context of planning, in other words the structures that influence both planners' agency and the planning outcome. The empirical data collection was contextualized by desk research and field visits to ensure a holistic engagement with Viennese planning.

This research has shown that urban water features are recognized and framed as important infrastructures for micro-climatic heat mitigation and for improving the quality of stay in public spaces in the strategic Viennese planning discourse. Their realization, however, is both enabled and constrained by formal and informal institutions. While strategic planning documents and funding instruments promote the development of urban water features for improving climate adaptation and residents' life quality, formal regulations, for example concerned with street safety and liability issues, impede the planning process. Relevant laws and liability differ between the various land zoning categories; the greatest institutional constraints for the installation of urban water features are in place on urban streets. Additionally, a great variety of involved actors and the lack of an

integrative, city-wide, and long-term vision concerning urban water features might hinder their installation. Thus, according to the findings of this thesis, formal and informal institutions, like laws and regulations, administrative structures, operational procedures, strategic planning documents, attitudes, and practices, provide a particular context, both enabling and constraining, in which planning takes place.

Institutions not only structure how urban water features are planned but also influence how environmental justice and health and well-being aspects are considered in the case of Vienna. On the level of strategic planning, all three dimensions of environmental justice (i.e., distribution, procedure, and recognition) are acknowledged and emphasized. In the specific planning of urban water features, however, some formal and informal institutions restrict the environmental justice of the outcome. Distributional justice is impacted by the allocation of competences across the different levels of the city administration. As the design of public spaces lies mainly in the districts' legal responsibility and urban water features planning is not steered in a city-wide strategy, the capacities, priorities, and resources that are spent on the planning of small-scale blue infrastructures differ between the Viennese districts, explaining and potentially reproducing spatial inequalities. On the institutionally supportive side, a city-wide subsidy program for climate adaptation measures encourages the installation of urban water features and might ease out financial differences between the districts. Procedural justice is influenced by the land zoning of where the water features are to be installed. Depending on the land zoning category, different municipal departments are responsible for planning the urban water features on behalf of the districts. How inclusive the planning process is, is subject to the municipal department. While some show quite a collaborative approach towards urban planning, consult various actors, and integrate citizen participation, other municipal departments have a rather rationalistic and technocratic style of planning. Recognitional justice is affected by the understanding of urban water features as some out of many amenities to be integrated in the redevelopments of public spaces and the respective operational procedures. Technical and apolitical aspects in the approach towards small-scale blue infrastructures might inhibit a reflection on the social context in which planning takes place and the potential preferences and needs of different user groups, apart from playing children and thirsty dogs. Human health and well-being benefits of urban water features are typically not recognized as such, and harm mitigation is emphasized. This leaves some untapped potential to thematize health restoration and instoration benefits of urban water features in the Viennese planning discourse. From an institutional perspective, it was additionally found that health departments are not directly involved in spatial planning in the City of Vienna. This suggests that there is an opportunity for more collaboration on the influence of the urban environment on human health and well-being in Vienna's planning structures.

Even though following environmental justice principles in blue infrastructure planning does not automatically lead to equal outcomes, it nevertheless can foster the equity, democracy, and diversity of climate adaptation measures, as well as potential co-benefits for justice and human health and well-being. Combining the descriptive and analytic planning theory of new

institutionalism with the normative environmental justice framework has enabled both an objective analysis of relevant institutions and a normative evaluation of their effect on environmental justice.

The findings underline that a consideration of the local planning context, in which nature-based solutions are to be implemented, is crucial. Acknowledging that institutions influence planning and its outcomes as well as understanding which institutions have an impact in what way is an essential step to further foster the development of just, health- and well-being-supportive, small-scale blue infrastructures for climate change adaptation.

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11 List of figures

Figure 1: Map of Vienna, including land use and district borders. Data from the City of Vienna (MA 41, 2025) and the Federal Statistical Office (Statistik Austria, 2025).	43
Figure 2: Map of Vienna, blue and green infrastructure and urban density. Data from City of Vienna (MA 22, 2025; MA 31, 2025; MA 41, 2025) and Urban Atlas (European Commission, 2018).....	46
Figure 3: Drinking water fountains in and by the City of Vienna. Photos: Maeve Hofer.	47
Figure 4: Misting systems and water play features in and by the City of Vienna. Photos: Maeve Hofer.	48
Figure 5: Ornamental fountains, ponds, and public baths in and by the City of Vienna. Photos: Maeve Hofer.	48
Figure 6: Operationalization of the theory. Own illustration.	51
Figure 7: Mapping of municipal departments potentially involved in urban blue infrastructure planning in Vienna. Own illustration.	55
Figure 8: Selected policy documents, sorted by year of publication. Own illustration. Covers reproduced with the permission of the respective publishing units (see Table 1).	57
Figure 9: Engagement of analyzed policy documents with urban water features and climate change adaptation. Own illustration.....	72
Figure 10: List of reviewed articles about urban water features, February 2025, 1/2.....	109
Figure 11: List of reviewed articles about urban water features, February 2025, 2/2.....	110
Figure 12: List of additionally reviewed articles about urban water features, September 2025...	111
Figure 13: Informed consent sheet.....	115

12 List of tables

Table 1: List of policy documents for analysis. An extended version is available in the Appendix. .	57
Table 2: List of interview partners.	59
Table 3: Coding guide, including definitions of the applied analytical categories.	61
Table 4: Competences regarding the planning of urban water features. Own illustration based on the analysis of both the interviews and strategic documents.....	68
Table 5: List of policy documents for analysis, including content, context, and justification for inclusion.	112

13 Appendix

13.1 List of reviewed articles for contextualizing urban water features

Search strings: ‘urban AND “water features”’ & ‘urban AND “water elements”’, February 2025 + September 2025 (the latter limited to year of publication 2025), Database: Scopus

Records identified and screened: 309 + 44, Records excluded: 253 + 38, Articles reviewed: 56 + 6, Articles included: 28 + 4 (see following Figure 10)

Authors	Title	Year	Source title	DOI	Incl
Albdour M.S.; Baranyai B.	Water body effect on microclimate in summertime: A case study from PÉCS	2019	Pollack Periodica	10.1556/606.2019.14.3.13	
Apollonio F.I.; Gaiani M.; Foschi R.	New water for the neptune fountain in bologna: simulation of the design of the multi-jet system; [Una nuova acqua per la Fontana del Nettuno di Bologna: La simulazione di progetto del sistema	2016	Disegnare Idee Immagini		
Avino P.; Capannesi G.; Diaco L.; Rosada A.	Multivariate analysis applied to trace and ultra-trace elements in Italian potable waters determined by INAA	2010	Current Analytical Chemistry	10.2174/157341110790069646	
Axarli K.; Chatzidimitriou A.	Redesigning urban open spaces based on bioclimatic criteria: Two squares in thessaloniki, Greece	2012	Proceedings - 28th International PLEA Conference on Sustainable Architecture + Urban Design: Opportunities, Limits and Needs - Towards an Environmentally Responsible Architecture, PLEA 2012		
Axelsson Ö.; Nilsson M.E.; Hellström B.; Lundén P.	A field experiment on the impact of sounds from a jet-and-basin fountain on soundscape quality in an urban park	2014	Landscape and Urban Planning	10.1016/j.landurbplan.2013.12.005	1
Backhaus A.; Fryd O.	The aesthetic performance of urban landscape-based stormwater management systems: A review of twenty projects in Northern	2013	Journal of Landscape Architecture	10.1080/18626033.2013.864130	
Balai Kerishnan P.; Maruthaveeran S.	Factors contributing to the usage of pocket parks—A review of the evidence	2021	Urban Forestry and Urban Greening	10.1016/j.ufug.2021.126985	1
Baran P.K.; Smith W.R.; Moore R.C.; Floyd M.F.; Bocarro J.N.; Cosco N.G.; Danninger T.M.	Park Use Among Youth and Adults: Examination of Individual, Social, and Urban Form Factors	2014	Environment and Behavior	10.1177/0013916512470134	1
Barnes M.R.; Donahue M.L.; Keeler B.L.; Shorb C.M.; Mohtadi T.Z.	Characterizing nature and participant experience in studies of nature exposure for positive mental health: An integrative review	2019	Frontiers in Psychology	10.3389/fpsyg.2018.02617	
Beier M.; Gerstendörfer J.; Mendzigall K.; Pavlik D.; Trute P.; Bozkurt M.	Climate Impact and Model Approaches of Blue-Green Infrastructure Measures for Neighborhood Planning	2022	Sustainability (Switzerland)	10.3390/su14116861	
Bozkurt M.	Triangulation study of water play in urban open spaces in sheffield: Children’s experiences, parental and professional understanding and control	2019	A/Z ITU Journal of the Faculty of Architecture	10.5505/ituja.2019.24654	
Bozkurt M.; Woolley H.	Let’s splash: Children’s active and passive water play in constructed and natural water features in urban green spaces in	2020	Urban Forestry and Urban Greening	10.1016/j.ufug.2020.126696	1
Bozkurt M.; Woolley H.; Dempsey N.	Children’s interactions with water in city centres: a case study from Sheffield, UK	2019	Landscape Research	10.1080/01426397.2018.1518518	
Caymaz G.F.Y.; Şimşek E.	Investigating the Relationship Between Water Element Designs and User Preferences	2022	Street Art and Urban Creativity		1
Crouse D.L.; Balram A.; Hystad P.; Pinault L.; van den Bosch M.; Chen H.; Rainham D.; Thomson E.M.; Close C.H.; van Donkelaar A.; Martin R.V.; Ménard R.	Associations between living near water and risk of mortality among urban Canadians	2018	Environmental Health Perspectives	10.1289/EHP3397	
Fahed J.; Kinab E.; Ginestet S.; Adolphe L.	Impact of urban heat island mitigation measures on microclimate and pedestrian comfort in a dense urban district of Lebanon	2020	Sustainable Cities and Society	10.1016/j.scs.2020.102375	1
Fancello G.; Vallée J.; Sœur C.; van Lenthe F.J.; Kestens Y.; Montanari A.; Chaix B.	Micro urban spaces and mental well-being: Measuring the exposure to urban landscapes along daily mobility paths and their effects on momentary depressive symptomatology among older	2023	Environment International	10.1016/j.envint.2023.108095	
Faridatul M.I.; Islam M.; Joy M.J.H.; Wakil M.A.; Rahman M.M.; Gómez F.; Cueva A.P.; Valcuende M.; Matzarakis A.	Impact of greenery and waterbody on the cooling of city’s environment: a case of Rajshahi City	2024	Geology, Ecology, and Landscapes	10.1080/24749508.2024.2373489	1
	Research on ecological design to enhance comfort in open spaces of a city (Valencia, Spain). Utility of the physiological equivalent temperature (PET)	2013	Ecological Engineering	10.1016/j.ecoleng.2013.04.034	1
Haefner M.; Jackson-Smith D.; Buchert M.; Risley J.	“Blue” space accessibility and interactions: Socio-economic status, race, and urban waterways in Northern Utah	2017	Landscape and Urban Planning	10.1016/j.landurbplan.2017.06.008	1
Hekle M.; Drdla J.	Talking to the young generation: perception of nature-based solutions’ attractiveness by children from Generation Z	2024	Local Environment	10.1080/13549839.2024.2407608	
Hensey P.	Construction detailing for landscape and garden design: Urban water features	2019	Construction Detailing for Landscape and Garden Design: Urban Water Features	10.4324/9781315642802	

Figure 10: List of reviewed articles about urban water features, February 2025, 1/2

Authors	Title	Year	Source title	DOI	Incl
Jandaghian Z.; Colombo A.	The Role of Water Bodies in Climate Regulation: Insights from Recent Studies on Urban Heat Island Mitigation	2024	Buildings	10.3390/buildings14092945	1
Jarvis I.; KoeHoorn M.; Gergel S.E.; van den Bosch M.	Different types of urban natural environments influence various dimensions of self-reported health	2020	Environmental Research	10.1016/j.envres.2020.109614	
Jo H.I.; Jeon J.Y.	Overall environmental assessment in urban parks: Modelling audio-visual interaction with a structural equation model based on soundscape and landscape indices	2021	Building and Environment	10.1016/j.buildenv.2021.108166	1
Khirfan L.; Peck M.L.	Deliberative Q-method: A combined method for understanding the ecological value of urban ecosystem services and disservices	2021	MethodsX	10.1016/j.mex.2021.101547	
Langie K.; Rybak-Niedziółka K.; Hubačíková V.	Principles of Designing Water Elements in Urban Public Spaces	2022	Sustainability (Switzerland)	10.3390/su14116877	1
Leblanc T.; Candau N.; Leblanc M.	Water as a social catalyst: The impact of water features on urban life	2019	International Journal of Architectonic, Spatial, and Environmental Design	10.18848/2325-1662/CGP/v13i02/1-16	
Li H.; Dong W.; Wang Z.; Chen N.; Wu J.; Wang G.; Jiang T.	Effect of a virtual reality-based restorative environment on the emotional and cognitive recovery of individuals with mild-to-moderate anxiety and depression	2021	International Journal of Environmental Research and Public Health	10.3390/ijerph18179053	
Li J.; Trivic Z.	Impact of "blue-green diet" on human health and wellbeing: A systematic review of potential determinants in shaping the effectiveness of blue-green infrastructure (BGI) in urban settings	2024	Science of the Total Environment	10.1016/j.scitotenv.2024.171397	
Lim Y.-S.; Zoh H.D.; Kim T.H.; Kwon T.K.	Analyzing the Cooling Effects of Water Facilities in Urban Park: The Case of Sangju Namsan Park, South Korea	2024	Atmosphere	10.3390/atmos15121456	1
Lin I.-H.; Wu C.; De Sousa C.	Examining the economic impact of park facilities on neighboring residential property values	2013	Applied Geography	10.1016/j.apgeog.2013.10.003	1
Mahfooz Y.; Yasar A.; Sohail M.T.; Tabinda A.B.; Rasheed R.; Irshad S.; Yousaf B.	Investigating the drinking and surface water quality and associated health risks in a semi-arid multi-industrial metropolis (Faisalabad), Pakistan	2019	Environmental Science and Pollution Research	10.1007/s11356-019-05367-9	1
McNabb T.; Charters F.J.; Challies E.; Dionisio R.	Unlocking urban blue-green infrastructure: an interdisciplinary literature review analysing co-benefits and synergies between bio-physical and socio-cultural outcomes	2024	Blue-Green Systems	10.2166/bgs.2024.007	1
Mitra S.; Mondal M.; Biswas M.; Datta S.; Roy A.K.	Managing urban heat islands in Rajarhat-Newtown, India, with the help of greenery and waterscapes	2025	Sustainable Cities and Society	10.1016/j.scs.2024.106033	1
Motomura M.; Koohsari M.J.; Lin C.-Y.; Ishii K.; Shibata A.; Nakaya T.; Kaczynski A.T.; Veitch J.; Oka K.	Associations of public open space attributes with active and sedentary behaviors in dense urban areas: A systematic review of observational studies	2022	Health and Place	10.1016/j.healthplace.2022.102816	1
Nasar J.; Lin Y.-H.	Evaluative responses to five kinds of water features	2003	Landscape Research	10.1080/0142639032000150167	1
Nelson J.R.; Won Y.; Kim J.; Stuhlmacher M.; Kim Y.	Is the grass greener or the water bluer? Drivers of local park visitation patterns in Phoenix, Arizona	2024	Urban Forestry and Urban Greening	10.1016/j.ufug.2024.128325	1
Nordh H.; Østby K.	Pocket parks for people - A study of park design and use	2013	Urban Forestry and Urban Greening	10.1016/j.ufug.2012.11.003	1
Nowacka-Rejzner U.	Water Elements in the Creation of Public Space	2019	IOP Conference Series: Materials Science and Engineering	10.1088/1757-899X/603/2/022087	1
Park S.H.; Lee P.J.; Jung T.; Swenson A.	Effects of the aural and visual experience on psycho-physiological recovery in urban and rural environments	2020	Applied Acoustics	10.1016/j.apacoust.2020.107486	
Peck M.; Khirfan L.	Improving the validity and credibility of the sociocultural valuation of ecosystem services in Amman, Jordan	2021	Ecological Economics	10.1016/j.ecolecon.2021.107111	
Rapuano M.; Ruotolo F.; Ruggiero G.; Masullo M.; Maffei L.; Galderisi A.; Palmieri A.; Iachini T.	Spaces for relaxing, spaces for recharging: How parks affect people's emotions	2022	Journal of Environmental Psychology	10.1016/j.jenvp.2022.101809	
Rising H.H.; Deng L.	The effects of small Water Cool(ing) Islands on body temperature	2024	Journal of Urban Design	10.1080/13574809.2023.2209023	1
Rout A.; Galpern P.	Benches, fountains and trees: Using mixed-methods with questionnaire and smartphone data to design urban green spaces	2022	Urban Forestry and Urban Greening	10.1016/j.ufug.2021.127335	1
Ruiz-Aviles V.; Brazel A.; Davis J.M.; Pijawka D.	Mitigation of Urban Heat Island Effects through "Green Infrastructure": Integrated Design of Constructed Wetlands and Neighborhood Development	2020	Urban Science	10.3390/urbansci4040078	1
Sakici C.	Assessing landscape perceptions of urban waterscapes	2015	Anthropologist	10.1080/09720073.2015.11891807	
Shih W.-Y.	The cooling effect of green infrastructure on surrounding built environments in a sub-tropical climate: a case study in Taipei	2017	Landscape Research	10.1080/01426397.2016.1235684	
Sugiyama T.; Gunn L.D.; Christian H.; Francis J.; Foster S.; Hooper P.; Owen N.; Giles-Corti B.	Quality of public open spaces and recreational walking	2015	American Journal of Public Health	10.2105/AJPH.2015.302890	
Tang Z.; Zhao Y.; Fu M.; Wang Y.; Xue J.	Which factors influence public perceptions of urban attractions? — A comparative study	2023	Ecological Indicators	10.1016/j.ecolind.2023.110541	
Thawaba S.A.	Integration of GIS and perception assessment in the creation of needs-based urban parks in Ramallah, Palestine	2014	Journal of Urbanism	10.1080/17549175.2013.879454	
Torres A.; Galarza-Molina S.; Molina-Prieto L.F.	Bogotá, a city sensitive to the water: Elements for reflection; [Bogotá, cidade sensível à água: Elementos de reflexão]; [Bogotá, una ciudad sensible al agua: Elementos de reflexión]	2019	Cuadernos de Vivienda y Urbanismo	10.11144/laveriana.cvu12-23.bcsa	
Van Renswouw L.; Van Hamersveld Y.; Huibers H.; Vos S.; Lallemand C.	Fontana: Triggering Physical Activity and Social Connectedness through an Interactive Water Installation	2022	Conference on Human Factors in Computing Systems - Proceedings	10.1145/3491101.3519765	1
Völker S.; Matros J.; Claßen T.	Determining urban open spaces for health-related appropriations: a qualitative analysis on the significance of blue space	2016	Environmental Earth Sciences	10.1007/s12665-016-5839-3	1
Wang Y.; Yang Y.; Sun Y.; Lyu S.; Zhang Z.; Liu D.; Wei S.; Liu S.	Public perception and preferences of industrial green infrastructure in Northwest China	2023	Ecological Indicators	10.1016/j.ecolind.2023.111123	
Wendel H.E.W.; Downs J.A.; Mihelcic J.R.	Assessing equitable access to urban green space: The role of engineered water infrastructure	2011	Environmental Science and Technology	10.1021/es103949f	1

Figure 11: List of reviewed articles about urban water features, February 2025, 2/2

Authors	Title	Year	Source title	DOI	Included
Cao, H., Miguez, N. G., Mason, B. M., Callaghan, C. T., & Qiu, J.	Spatial patterns and interactions among multiple cultural ecosystem services across urban greenspaces.	2025	Ecosystem Services	10.1016/j.ecoser.2025.101740	
Ding, Y., Song, Y., & Xu, Z.	Exploring the impact of park features and visitors' socioeconomic status on park visitation: A case study of Austin, Texas	2025	Journal of Outdoor Recreation and Tourism	10.1016/j.jort.2025.100877	
Gao, M., & Fang, C.	Ripples of blue: Unveiling the influence of urban blue spaces on public happiness through social networking sites	2025	Applied Geography	10.1016/j.apgeog.2025.103632	1
Huang, X., Bou-Zeid, E., Vanos, J. K., Middel, A., & Ramamurthy, P.	Urban heat mitigation through misting, and its role in broader blue infrastructure portfolios	2025	Landscape and Urban Planning	10.1016/j.landurbplan.2024.105290	1
Kičić, M., Scheuer, S., Korpilo, S., Vuletić, D., Seletković, A., Haase, D., & Krajter Ostoić, S.	Relationships between urban green space types, cultural ecosystem services and disservices - a Public Participation Geographic Information System study in Zagreb, Croatia	2025	Science of the Total Environment	0.1016/j.scitotenv.2025.179549	1
Xu, Z., Marini, S., Mauro, M., Maietta Latessa, P., Grigoletto, A., & Toselli, S.	Associations Between Urban Green Space Quality and Mental Wellbeing: Systematic Review	2025	Land	10.3390/land14020381	1

Figure 12: List of additionally reviewed articles about urban water features, September 2025

13.2 List of policy documents for analysis

Table 5: List of policy documents for analysis, including content, context, and justification for inclusion.

Title of policy document, year of publication	Content and context	Justification for inclusion	Document pages
<i>Strategic urban development plans incl. associated concepts</i>			
„STEP 2025“, 2014	The politically resolved urban development plan of the city Vienna. Explains key challenges and strategies for urban development and serves as a strategic basis for planning interventions in the following decade. Prepared and issued by the MA 18 Urban Development and Planning.	The urban development plan is the most important strategic document highlighting Vienna's urban development principles and goals. For investigating urban blue infrastructure planning it is inevitable to learn about the general planning context in Vienna. Can itself be understood as a formal institution created by planning. Frequently referred to during the interviews.	143
„STEP 2025, Fachkonzept Grün- und Freiräume“, 2015	Developed on the basis of “STEP 2025”. The focus of this strategic policy document are green and open spaces and their linkages. A typology of different types of urban green and open spaces is developed and development goals and measures defined respectively. Prepared and issued by the MA 18.	Urban water features are part of the urban blue-green infrastructure of a city. The main interest for this policy document is how urban open and green spaces are understood and approached in Viennese city planning and if urban water features are highlighted as part of it.	94
„STEP 2025, Fachkonzept Öffentlicher Raum“, 2018	Developed on the basis of “STEP 2025”. It highlights visions and defines aims and measures for the development of urban public spaces. Issued by the MA 18, prepared by the MA 19 Architecture and Urban Design.	The urban water features that are of interest to this thesis's investigation are mostly located in urban public spaces. Thus, it is of relevance to this analysis to include the strategic document about specifically urban public spaces. Referred to during the interviews.	103
„Der Wien-Plan, Stadtentwicklungsplan 2035“, 2025	The latest, politically resolved urban development plan of the City of Vienna. It explains key challenges and strategies for urban development and serves as a strategic basis for planning interventions in the following decade. Prepared and issued by the MA 18 Urban Development and Planning.	The urban development plan is the most important strategic document highlighting Vienna's urban development principles and goals. For investigating urban blue infrastructure planning it is inevitable to learn about the general planning context and how it has changed in the last 10 years in Vienna. Can itself be understood as a formal institution created by planning.	163

<i>Other strategic plans</i>			
„Smart City Wien Rahmenstrategie“, 2014	This strategic planning document formulates aims towards becoming a smart city with a focus on social aspects. Prepared by the MA 18 Urban Development and Planning and issued by the City of Vienna.	For investigating urban blue infrastructure planning it is inevitable to learn about the general planning context. Can itself be understood as a formal institution created by planning.	109
„Smart City Wien Rahmenstrategie, 2019-2050, Die Wiener Strategie für eine nachhaltige Entwicklung“, 2019	This strategic planning document formulates aims towards becoming a smart city with a focus on sustainable development. Prepared by the MA 18 Urban Development and Planning and issued by the City of Vienna.	For investigating urban blue infrastructure planning it is inevitable to learn about the general planning context and how it has changed. Can itself be understood as a formal institution created by planning.	163
„Smart Klima City Strategie Wien, Der Weg zur Klimamusterstadt“, 2022	This strategic planning document formulates aims towards becoming a smart city with a focus on sustainable development and climate adaptation. Prepared by the MA 18 Urban Development and Planning and issued by the City of Vienna.	For investigating urban blue infrastructure planning it is inevitable to learn about the general planning context and how it has changed. Can itself be understood as a formal institution created by planning. Referred to during the interviews.	131
<i>Other relevant policy documents/plans</i>			
“Urban Heat Islands Strategieplan Wien (UHI-STRAT)“, 2015	Defines strategic measures for mitigating urban heat and improving urban life quality. Developed as part of a cooperation between Central European cities. Prepared and issued by the MA 22 Environmental Protection.	Urban heat is one major framing for the planning of small-scale urban blue infrastructure. Main interest to see how urban water features are discussed.	112
“Wiener Hitzeaktionsplan“, 2022	Strategic policy document that focuses on acute and short-term measures for mitigating urban heat including respective responsibilities. Prepared and issued by the City of Vienna, section for climate affairs.	Urban heat is one major framing for the planning of small-scale urban blue infrastructure. Main interest to see how urban water features are discussed and how the discourse has changed. Referred to during the interviews.	61
“COOLing-Fibel, Kühlende Maßnahmen für heiße Zeiten in Wien“, 2023	A handbook on cooling measures that compares and evaluates the cooling potential, installation and maintenance costs, water consumption, and play value of different interventions. Prepared and issued by the MA 42 Parks and Gardens.	Urban water features are often appreciated for their micro-scale cooling capacity. Main interest to see how urban water features are discussed. Frequently referred to during the interviews.	90

13.3 Interview guide

1. What role does water play in your daily work?
2. How are urban blue infrastructures and urban water features planned by your municipal department?
 - 2.1. What are your goals when planning urban water features?
 - 2.2. What is the legal/formal basis for your work? (political/administrative mandate) What documents/laws do you base your planning on?
 - 2.3. How specific are the guidelines, how much agency do you have in your planning?
 - 2.4. Where does your inspiration come from? What are some best-practice examples, e.g., in terms of design/realization, etc.?
 - 2.5. How do you proceed? Can you explain an exemplary process? What are the procedures? Who is involved? How are decisions made?
 - 2.6. How do you decide where planning interventions take place (e.g., where water features are placed)? What criteria play a role in this?
3. What planning strategies and visions are pursued with small-scale blue infrastructures?
 - 3.1. What ideal city concepts/urban planning concepts are behind this? What does “the good city” look like for your municipal department?
4. Which other departments are also planning urban blue infrastructure/water features in Vienna?
 - 4.1. How do you cooperate between the municipal departments? How do you exchange information? How does your planning work overlap?
 - 4.2. How do opinions differ about the tasks that urban blue infrastructure in Vienna is supposed to fulfill? What are the topics where this occurs particularly often? How is the discussion and how are differences of opinion resolved? How are decisions made?
5. What connections between urban blue spaces and human health and well-being are mainly discussed in your department/in your work?
6. Through an analysis of the distribution of urban water features in the City of Vienna I found that it is spatially quite uneven. What could be reasons for this? How do you assess the spatial distribution of water elements in Vienna?
7. How do you perceive the role of citizen participation in the planning of urban blue infrastructure? Is there citizen participation? How could this be developed in the future?
8. What are potentials and challenges of urban water feature and blue infrastructure planning?
9. Is there anything else you would like to add/mention?

13.4 Informed consent sheet



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Figure 13: Informed consent sheet