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# Chapter 12

## Historical Canals as Urban Landscape Infrastructure in Guangzhou: Reactivating Public Life Through Water



Yu Zheng, Steffen Nijhuis, and Gregory Bracken

**Abstract** In the heart of the Pearl River Delta, the city of Guangzhou is fast-growing and prone to flooding. In history, people constructed canals based on natural waterways to deal with water problems. The canal system not only served as an important infrastructure but was also as the backbone of urban life. But with the development of the road network in recent decades, the urban canals in the historical inner city have been neglected and are disappearing, losing their identity, and becoming the forgotten side of the city. What can be learned from the historical situation to reactivate the urban canals as carriers of socially and ecologically inclusive urban space? This chapter aims to identify design principles for (historical) urban canal design and examine their potential through design exploration, with Donghao Chong as a typical example. The results showcase how, through the meaningful application of historical knowledge, urban canals can become a water landscape infrastructure that effectively integrates public space by combining design, heritage, water management, and ecology.

**Keywords** Historical urban canals · Heritage design · Public space design · Blue space · Urban landscape infrastructure · Canal restoration

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## 12.1 Introduction

### 12.1.1 The Forgotten Urban Canals

Located in the Pearl River Delta, Guangzhou is one of the biggest cities in China. Its geographic characteristics determine that its urban development is inseparable from water. The historical districts of Guangzhou not only have the characteristics of traditional Chinese urban culture, but also have the distinctive characteristics of a water town. The urban water system is an important driving force for the development of Guangzhou; it is also the lifeline of the city. With the rapid development of the Pearl River Delta, and the continuous expansion of Guangzhou’s urban area, historical canals have been disappearing, with those that remain mainly used for industrial waste and sewage, which has led to water pollution and waterlogging problems (Meng et al. 2019). The poor condition of the canals makes them the forgotten side of the city, isolated in the urban tissue where they used to be the hotspots of the city: the centre of urban life for Guangzhou’s inhabitants in the past. In short, the historical canals used to be a well-functioning water landscape infrastructure but now are single-use drainage canals (Fig. 12.1). There were two canal restoration projects undertaken in Guangzhou in the last 10 years. However, these projects delivered public space that barely functions because the designers did not think of the canals as part of the surrounding areas. Some interventions even increase the risk of flooding, and the cost of maintenance is also very high.

To summarise, with city development, the potential of the historical canal system in Guangzhou as an urban landscape infrastructure has been ignored, leading to water pollution in the canals and the decline of the water infrastructure and a greater risk of flooding in the canal areas (Fig. 12.2).

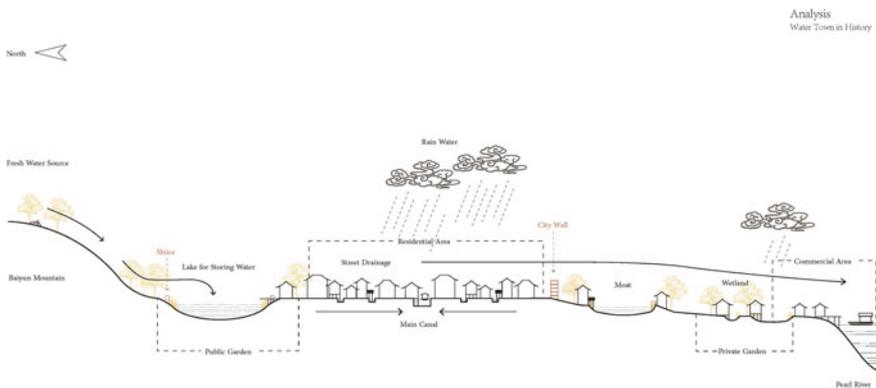


Fig. 12.1 Analysis of water town in history. Image Yu Zheng

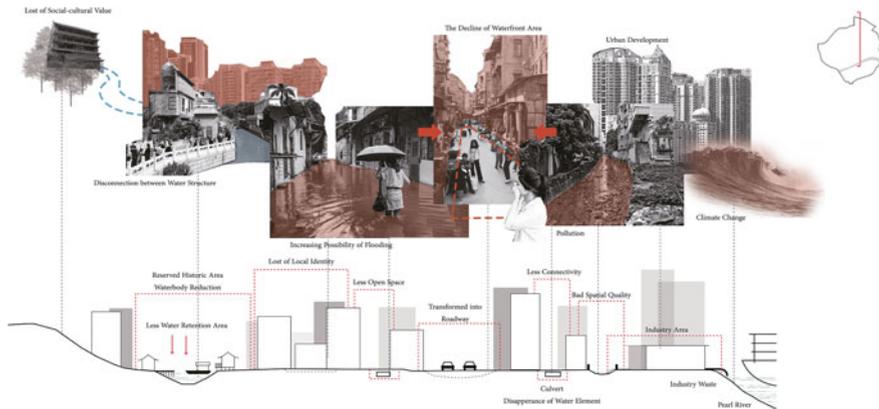


Fig. 12.2 Challenges facing the historical urban canals of Guangzhou. Image Yu Zheng

### 12.1.2 Objective

To understand the dilemma facing historical canals in Guangzhou, we need to consider them as an urban landscape infrastructure interacting with the different layers of the city: from the natural base to the urban system itself.

Guangzhou is located at the heart of the Pearl River Delta, which is the centre of a dense river network. This natural condition determines that Guangzhou needs a water drainage network. Therefore, historically, the people who lived in Guangzhou developed a canal system that expanded along with the city. Apart from their drainage function, the canals also played an important role in improving spatial quality, residents' urban life and transportation. On the one hand, past inhabitants constructed the canal system based on the natural river network, and this water system, with different hierarchies, has worked well in draining water in the rainy season and storing it in the dry season. On the other hand, the canals shaped the built environment and facilitated different social and ecological interactions, for instance, the freshwater lake acted as a public garden for the whole city, there was also a royal garden that combined a water purification system. Throughout history, people have worked well with the water; and the canal system in Guangzhou was not only an important water infrastructure but also the centre of urban life.

However, in the last 50 years, because of the rapid growth of population and limited land, the built-up area has quickly expanded in the historical inner city. Because of the rapid increase of the number of impervious surfaces, less rainwater can filter into the land directly, leading to a greater risk of flooding. The expansion of the built-up area also means a decrease in volume of the water body. The places where drainage canals used to be now have problems with waterlogging (Zhang et al. 2018). The water issues of the historical canals have greatly affected the spatial quality of their surrounding areas, which are losing their local identity as historical waterfront areas and have gradually become separated from the water. Therefore, for the safe and

sustainable future development of Guangzhou, we need to ask how people can better live with water and what role it can play in their daily lives?

This brings us to our research objective: How to redefine the role of the historical canal system in Guangzhou as a water landscape infrastructure and adapt it to future urban development? And how can the historical canals work with this? What can we learn from the historical use and function of the canals in the city? And how can we use the knowledge of the past for today?

### ***12.1.3 Relevance***

This chapter aims to identify design principles for reactivating urban canals based on historical urban canal design and examines their potential for future use through design exploration. In the current situation, the function of the canal system as an important public space, and its potential for shaping the urban environment, have been abandoned. The quality of the canal system, in its social and ecological aspects, has greatly decreased; they no longer meet their needs as water infrastructure, particularly in the face of possible extreme climate events and further urban expansion. This chapter is intended to help readers understand the importance of the historical canal system in Guangzhou, and its social-cultural influence on surrounding areas, and to outline what this understanding can do to mitigate the adverse effects of climate change. In the part that deals with design exploration, the social-cultural and ecological values of water infrastructure are reinstated, and their influence on the surrounding built environment explored.

Guangzhou is not the only city whose canals and water-based life have deteriorated in recent decades, but the importance of canals to local life has also faded in many places due to modern urban development. Neither is Guangzhou the only city to suffer from water problems like flooding. Its geographical conditions and city development are mirrored in many places throughout the world. This chapter provides a new perspective for solving some of these problem by looking back at history to explore the potential that historical waterways have in their social-cultural values and what these can contribute to the spatial qualities of the city. The resultant design could then provide a template for resilient and adaptive coastal- or canal-city development, as well as give guidelines for other similar projects.

### ***12.1.4 Structure of the Chapter***

The next section elaborates the theoretical and methodological background of the study. This is followed by an introduction of the historical canals of Guangzhou and the research problem. Next, the design principles for historical urban canal design are identified via an in-depth study of the development and structure of Guangzhou's canals throughout history. This is followed by a design exploration that shows the

potential for using historical design principles in the future. The chapter closes with a discussion of its findings and the potential use of its design processes in a wider context.

## 12.2 Theoretical Background

### 12.2.1 *Urban Landscape Infrastructure*

The main object of this research is the canal system of Guangzhou, an important infrastructure for the urban system. In flowscape theory, infrastructure is considered a type of landscape and landscape a type of infrastructure, summarised as urban landscape infrastructure (Nijhuis and Jauslin 2015). The hybridisation of the two concepts seeks to redefine infrastructure beyond its strictly utilitarian definition, while allowing spatial design to gain operative force in territorial transformation processes (Nijhuis and Jauslin 2015).

The potential these infrastructure systems have for performing the additional function of shaping architectural and urban form is largely unrealised. They can be designed with a formal clarity that expresses their importance to society, at the same time creating new layers of urban landmarks, spaces and connections (Strang 1996). By exploring this theory, the potential and possibility of the historical canal system working as landscape and infrastructure, and how it affects its surrounding environment, physically and social-culturally, have been explored. Urban canals can work as an operative force in territorial transformation processes, in which the structure of the built environment and the river-course keep affecting each other. During this process, it facilitates dynamic social and ecological interactions, such as local identity as water town.

### 12.2.2 *Resilient Landscape*

In popular terms, resilience means the capacity to persist in the face of change: to continue to develop within an ever-changing environment. Resilience thinking is about how periods of gradual change interact with those of abrupt changes, and the capacity of people, communities, societies and cultures to adapt or even transform into new development pathways in the face of dynamic change.

A resilient landscape is one that has the capacity to adapt in the face of constant change. This concept has allowed the development of an approach to understanding complex adaptive systems and serves as a platform for interdisciplinary and transdisciplinary research with an emphasis on social-ecological systems (Folke 2016).

In this research, a resilient landscape is one that focuses on improving its ability to adapt to future urban development and climate change. The historical canals could (and should) be part of this and could (and should) develop and grow with the city. In this process, interdisciplinary and transdisciplinary research can also help lead to a better understanding of the social-cultural aspects of these developments.

### ***12.2.3 Learning from the Past***

Landscape architecture is one of the few disciplines in which the history of the future can be created. Pillaging an ‘endless bank of history’, landscape architects play the role of ‘critical historians’. That being said, these artists of the built environment should ‘always study history. If they are good, they can then invent their own (Hunt 2014). Looking back into history does not mean just copy-pasting what is found there. As an old Chinese saying has it: ‘History could be a mirror to today’s questions’. History can help us better understand the nature of today’s problems by comparing situations now and then. As a result, it helps us have better understanding and possibly even become better decision-makers if we are open to the lessons of the past.

In this research, we could not begin to investigate Guangzhou’s historical canal system without taking its development into account. Learning from history means identifying core problems in this historical landscape infrastructure that can be relevant to current situations, and identifying design principles that have potential use today.

### ***12.2.4 Design Research***

The relationship between research and design should be dynamic because they affect each other. Design can be the orientation of research. The goal of design sets the framework for research, making its process more targeted and efficient, and its results more effective. On the other hand, research works as a major input for design: it provides background knowledge, can help establish parameters and informs design decisions. In this research’s design exploration, the research created the basis for the design (Laurel 2003).

### ***12.2.5 Research Through Design***

This project is not only about project design. Here design is also employed as a research strategy, often referred to as research through design (Nijhuis and De Vries 2020). Research through design is used to explore the possibilities of the design

principles learned from history and studies how they are relevant to modern challenges and specific site conditions. This is also an important process for transforming research knowledge into practical design. In this case, the design principles learned from history are not enough for a design, they also need to be tested and transformed under specific conditions (Nijhuis and Bobbink 2012). In the design exploration part, different design principles are combined and tested via several design explorations. This process enriched the design principles, showing how they not only worked in Guangzhou, but could also have the potential to work in similar situations elsewhere.

## 12.3 Learning from the Past

### 12.3.1 *Development of the Canal System*

The canal system was developed into an urban landscape infrastructure through the efforts of generations of people, even if they did not realise it. It was first constructed to drain fresh water from the mountains, and combined with a great royal garden, the system had social and ecological functions. Gradually, with the expansion of the city, the canals connected more and more, and became closely intertwined with people's daily lives.

A city cannot develop without water. Therefore, having a sufficient water source is one of the important prerequisites for a city's location. The water system of Guangzhou runs through the history of its urban development, with a bearing on various aspects and needs, including urban space, ecology, the military, transportation, culture, etc., presenting the social, natural, economic, and other values of the whole city in a holistic way. This can be seen in the comprehensive review of the evolutionary history and related governance processes of the water system in the main urban areas of Guangzhou that follows.

### 12.3.2 *Types of Waterfronts*

To deal with the flooding threats and the lack of fresh water, there was a clear hierarchy in the canal system: street drainage collected rainwater into the six main canals in the city centre, rainwater then ran into the moat through sluices in the city walls before flowing into the Pearl River and, eventually, the South China Sea. The canal system was constructed based on the natural water system, connecting the lake and wetlands around the city, which were a buffer zone for flooding and had ecological functions that greatly improved capacity for water storage.

This systematically arranged water system worked as the backbone of the urban public space. The relationship between landscape composition, urban areas, and



### 12.3.2.2 Waterfront Residential Zones

Compared to the commercial areas, the waterfront residential zones had a more intense street pattern and use of public space. The canals were the backbone of these areas, acting as a transportation network connecting the different layers of these public spaces. The narrow canals also made the relationship between people, the built environment, and the water more intense.

The built environment, together with the canals, were the backdrop for various lively activities. The waterfront residential zones in the ancient city of Guangzhou were initially concentrated in the inner harbour and wharf at the centre of the urban canal network. Various types of buildings, such as inns, temples, businesses, and community centres were formed along the waterways. The canals were the backbone of the urban public space structure. Roadways stretched into the blocks and connected the different layers of public space to the canals. Because the canal water was connected to the Pearl River it was brackish, so people built wells and retention ponds to store fresh water.

Compared with the historical waterfront residential zones, public space in the canal restoration projects does not work well because it does not involve residents in the design decisions, nor does it consider water an important part of their daily lives. The waterfront residential areas used to be more abundant and livelier. Not only were there many buildings standing next to the water, but there were also public spaces, especially at the bridgeheads, such as small piers, performance stages, old trees, temples, making these zones the social and cultural centre of the old city.

### 12.3.2.3 Waterfront Gardens

Waterfront gardens include public, private, and royal gardens. There used to be harmony between the built environment and nature in ancient Guangzhou. People could enjoy panoramic views as well as store or drain water in the dynamic waterscape. Waterfront gardens were the most abundant water landscape in ancient times and were mostly distributed around the waterways. The urban canal system of the ancient city in Guangzhou, based on its different topography and water sources, formed different regional water forms, each with its own natural characteristics based on the water system, and which have diachronic and sustainable ecological characteristics (Fig. 12.4).

There were dense river networks in the suburbs of the ancient city of Guangzhou, so the owners often used the original water resources to excavate ponds and build gardens. Ancient gardens in Guangzhou were mostly a combination of living and courtyard spaces. Therefore, the setting of the waterfront garden can adapt to the needs of Guangzhou's subtropical regional climate, with local species of flowers and trees planted around them. The waterfront yard connected to the urban water system, which not only prevented the water from drying up, but also played a role in reducing temperature and preventing drought during intense heat, and, more importantly, it could drain flood water quickly during the rainy season. The inclusion of trees and



**Fig. 12.4** The waterfront gardens of Guangzhou as recorded by the English architect Thomas Allom around 1850 (private collection Steffen Nijhuis)

plants were also beneficial to the microclimate of the garden, and simple adjustments could enhance the practicability and convenience of the water court (Cai 2018). The waterfront garden was the centre of the green structure of ancient Guangzhou (Fig. 12.5).



**Fig. 12.5** The system waterfront gardens in Guangzhou. Image Yu Zheng

### 12.3.3 Design Principles

What can be learned from the historical situation to reactivate the urban canals as carriers of socially and ecologically inclusive urban space? Design principles learned from history are divided into two separate but interconnected aspects: landscape and water management.

The connectivity between public space and water is a key aspect of Guangzhou's landscape. The analysis of the city's management of its water network throughout history provides the base for the design principles outlined in the following section (Figs. 12.6 and 12.7). The analysis of waterfront commercial area shows the diverse interface brought variety to water as public space. The analysis of waterfront residential area shows how the systematic water network worked with natural water purification system and artificial retention pond. These offer a template for sustainable water management in the city in the future. Both aspects, landscape and water management, should work *with* the natural environment to play their role in improving the spatial quality of the city and increase its capacity to resist flood and drought (Fig. 12.8).

In conclusion, this study of the city's history shows how canals have shaped the built environment, and these design principles, based on the canals that worked so well in managing Guangzhou's water system in the past, should also ensure the creation of good quality space, with both space and water playing important roles in people everyday lives.

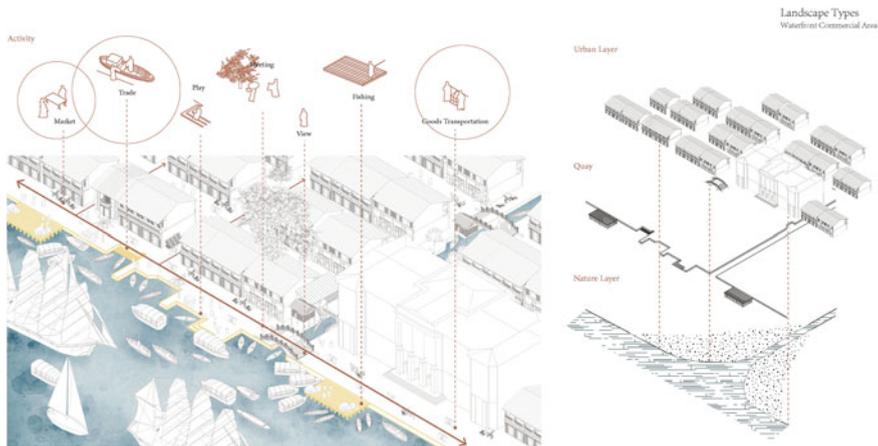


Fig. 12.6 Design principles in waterfront commercial area. Image Yu Zheng

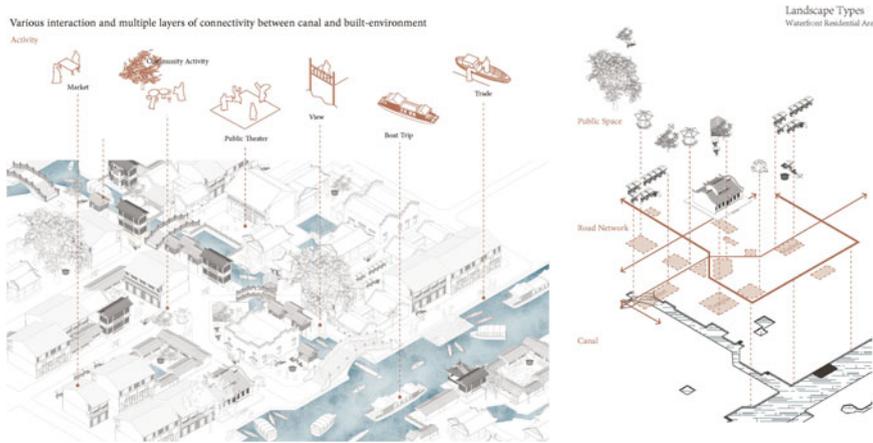


Fig. 12.7 Design principles in waterfront residential area. Image Yu Zheng

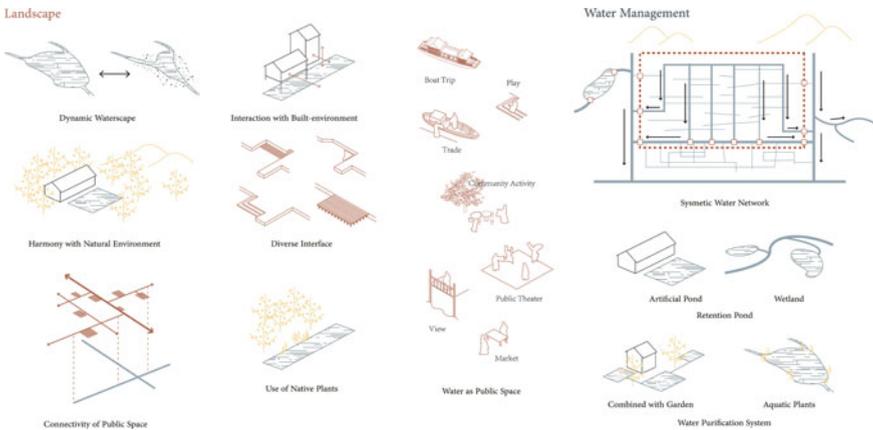


Fig. 12.8 Design principles learned from historical analysis. Image Yu Zheng

## 12.4 Design Exploration

### 12.4.1 The Application of Design Principles

The toolkit of the design principles learning from the past keeps growing in the process of design exploration. It has three steps: first, select suitable design principles from history; second, adapt them to specific sites; and third, explore the possibilities of those sites and the possibilities of the design principles in different situations. In this iterative process, the design principles can be further developed, providing a more effective toolkit for today’s situation in Guangzhou and even beyond.

### 12.4.2 Donghao Chong as a Typical Example

Donghao Chong is a typical example of what has happened to historical canals in Guangzhou. Isolated by hard interfaces, the canal is now the forgotten side of the neighbourhood. Interface conditions differ according to the surrounding elements. This research has identified a number of different types of interface, including apartment complexes, a community park, office buildings and open squares. Different elements, like the parking lot, or temporary housing (that is in poor condition), as well as the heavily trafficked roads, create hard boundaries along the waterfronts. To address these different interface conditions, different design principles learned from history are tested in design models to visualise the possibilities of the site so that it can be improved by these principles. Design models include a wetland park, a water-adapted neighbourhood, and a traditional water town. It is also important to remember to transform historical design principles so as to adapt them appropriately for current situations.

The results show that through the meaningful application of historical knowledge, urban canals can become a water landscape infrastructure that effectively integrates public space, design, heritage, water management, and ecology (Fig. 12.9).

For example, in Donghao Chong's residential areas, the wetland park provides the possibility for diverse waterscapes and water-based activities while also purifying and storing water. This new neighbourhood is connected to the city's canals via a green structure of public space, and also via the water system itself. The retention pond with reeds can purify water, while socially the new water system also enlivens the environment. In this new urban system, new social and ecological interactions are facilitated and new processes shape the built environment into a better place. In the site's nodal points there are layers for different transportation types and other

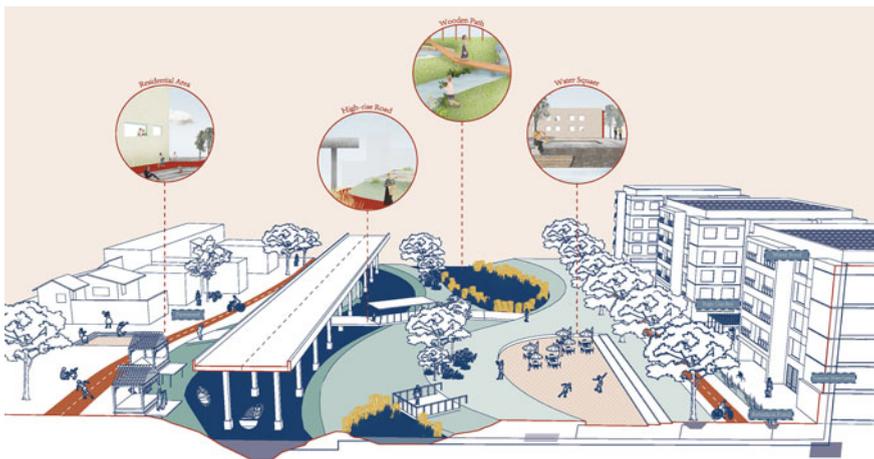


Fig. 12.9 Design exploration to reconnect Guangzhou to its canals. Image Yu Zheng

activities that create a complete and continuous experience for pedestrians, cyclists and boat users. The dysfunctional public space at the edge of the site can be replaced by a green area in harmony with nature allowing more space for water. This can also be connected to the surrounding area via an underground walkway offering space for an exhibition showcasing the history of the Donghao Chong area.

### ***12.4.3 Reconnecting the Urban Canal System***

The revived historical canal system could provide a new green–blue infrastructure for the whole city. It could flow through every corner of the city, making travel, and communication between its neighbourhoods better. It could also create more space for water and open up to new river channels. In the rainy season, the river system can quickly drain water from the historical city to the Pearl River, while during the dry season it has more space to store water.

As urban landscape infrastructure, the canal system is an integral part of the urban ecology, landscape environment, and spatial patterns at a material level (Fig. 12.10). As a part of urban life on the social level, it serves the local community and the wider city. As the starting point of the Maritime Silk Road, Guangzhou's historical development has always been closely related to water. Each urban canal has its unique significance. Through the improvement of the urban canal system in the city centre of Guangzhou, and the comprehensive and effective management of the environment, the relationship between the city, its urban canals, and the people who use them could be restored. People would be able to revive the memory of Lingnan Watertown, and the water culture, urban culture, and humanistic culture that were so much a part of these places' way of life, and which have been missing in recent years—they could be revived to create a new and vibrant waterfront city in Guangzhou.

## **12.5 Discussion and Conclusion**

Canals as urban landscape infrastructure activate public life and become important public space structures for the whole city while also reorienting the urban tissue to the water. At the same time, they can play a critical role in sustainable water management and the ecological development of the city as a whole. To redefine the role of the historical canal system in Guangzhou as water landscape infrastructure adapting to future urban development, the historical canals and their surrounding areas need to be understood as a whole system. Since the canals have a long history and deep relationship with the city, to understand the system, looking back into history is necessary. By comparing historical and current situations, the nature of the challenges the city now faces can be better understood. Looking back at history does not mean trying to recreate scenes from it; it means learning established design principles and applying them to current situations. These days, people tend to seek



**Fig. 12.10** Overview of plans to revive Guangzhou's historical canal system. *Image* Yu Zheng

solutions in modern technology. However, the nature of current problems is very often like historical ones, with answers to questions already there, for those prepared to look. To understand the challenges Guangzhou is facing, this research conducted a layer analysis. The urban landscape is a complex system, consisting of a natural layer and urban layers, and they affect each other. To investigate the challenges of the urban areas, basic natural conditions are an essential element to consider because this natural layer is the basis on which all later city development is built. Mapping these layers was the diagnosis part of the research. Analysis begins with the natural base, and then moves on to city development and the condition of the public spaces. Finally, how the revival of this historical canal system could work as a new urban landscape infrastructure is shown. Landscape infrastructure is an important driving force for the processes that shape the built environment and contemporary space. The revitalised historical canal system could be the driving force for the development of surrounding areas, creating a new green–blue infrastructure that reorients the city back towards the canals as newly activated waterfront areas created through this revival.

Furthermore, this chapter also shows the potential of urban canals as landscape infrastructure and provides a new perspective on their spatial development, not only in Guangzhou but also, potentially, for other canal cities around the world. The design explorations in this study provide the possibility for the sustainable urban development of cities in delta areas as well as guidance for similar canal restoration projects worldwide.

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