An aerial architectural rendering of a city. A large canal flows through the center, bordered by a green park area with trees and a building complex. A dashed orange line traces the path of the canal and the park. The surrounding city is represented by white 3D block models of buildings.

Exploring the potential of the Grand Canal as a backbone for adaptive and resilient urban development in Tongzhou

# REDEFINE THE BORDER OF WATER

**Linyu Qu**  
2020 Flowscape  
MSc, Delft University of Technology

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Exploring the potential of the Grand Canal as a backbone for adaptive and resilient urban development in Tongzhou

Flowscape (Individual project)

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STICHTING **N·H·BOS**  
ter bevordering van de landschapsarchitectuur



  
**Urbanism**





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The project is mostly fascinated by the author's own experience. The author comes from Beijing, an inland city in China. In the process of living and travelling, the author has been to various cities, almost all of them have a river similar to the lifeline of the city. Nowadays, rivers are no longer used as road systems for urban transportation or as transportation facilities, but instead has the trend of been transferred as carriers for diverse landscape environments and providing multiple urban recreational functions. Nevertheless, in some developing countries, watercourses are abandoned or covered after they have lost their historical significance, and the spaces on the riverside are also occupied by urban infrastructures or architecture. Water is one of the most important elements of the urban landscape, rivers or other forms of watercourses also have significant meaning to the city. Therefore, it is worth to consider that instead of being passage for the city, how can water transform to another kind of lifeline that complements the city? The focus of this research article will be on how to transform infrastructure into landscape infrastructure, the principles that need to be followed and the available toolkit when integrating water and urban development.

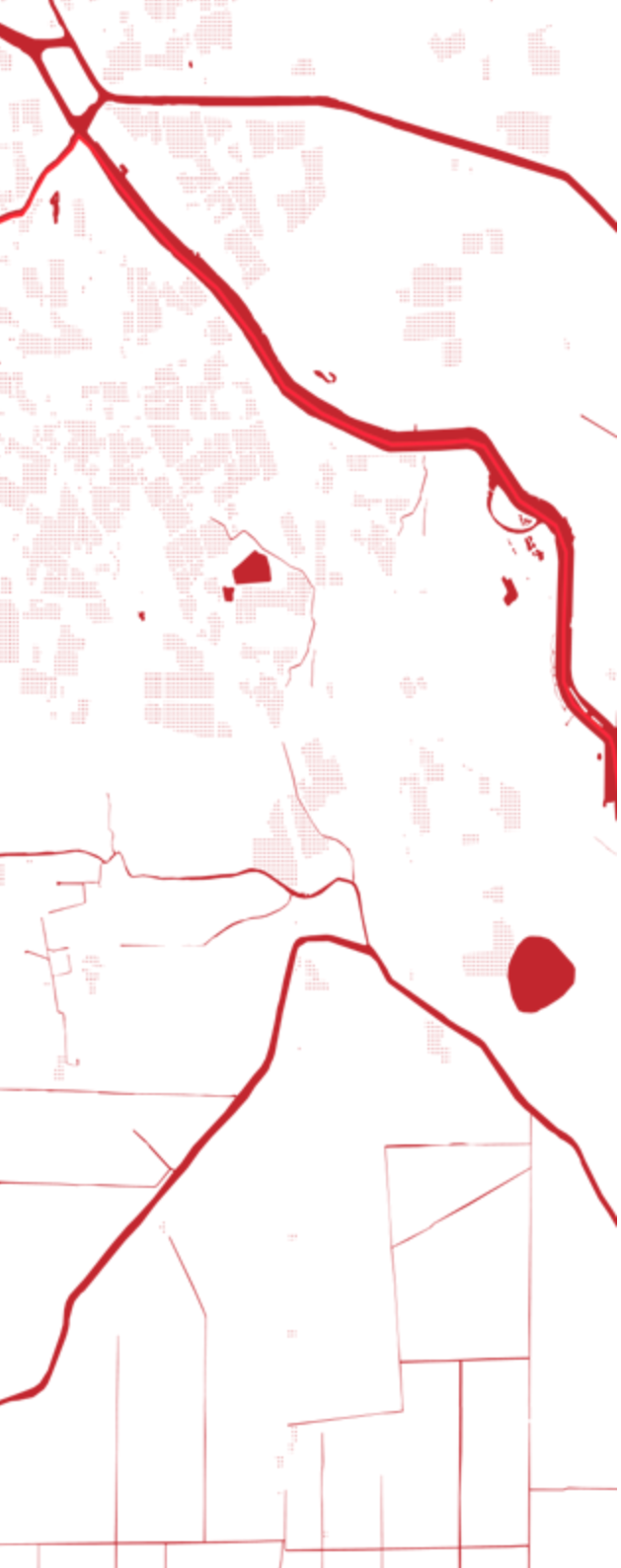
This research will test the principles and toolkits which obtained from the research in Beijing. As known by all, Beijing is an extremely water-scarce city, but there is also a canal that used to be the lifeline of the ancient imperial city. The Beijing-Hangzhou Grand Canal flows pass Beijing, running through the north and south of China. The Beijing section of the Grand Canal located in Tongzhou District, the southeast corner of Beijing. This canal once led to the development of commerce and trade in Tongzhou District and the shaping of the urban river landscape. Although the Tongzhou section of the canal has already been designed and reflected on the riverside landscape, it lacks the overall consideration of the relationship between the city and the canal at different scales, as well as cohesion and riparian behaviour that can happen to the surrounding environment and people. As a future urban sub-centre, Tongzhou has great potential for population growth, so there is a

demand for a well-designed urban ecosystem and urban recreational space. At the same time, this area has serious uneven rainfall, freezing and water shortage issue in winter, and occasional heavy rainfall in summer. Therefore, the storage of rainfall in the rainy season to supply water shortage season is also an urgent problem to be solved. In summary, this project will test the principals obtained from the research and conduct social-ecological integrated design from different scales. At the same time, the canal and other landscape facilities can flexibly collect and reuse rainwater to solve the water issue in the city. Hence, to make the city more a resilient and adaptive urban landscape that can cope with unpredictable changes in the future.

Through the research method of research by design, we understand the project and the landscape approach from different perspectives and contexts. The field trip helped the designer to understand the site and has a spatial impact of the area. In the design stage, the author worked from different scale in parallel to timely test the collected principles and toolkits. This project aims to intervene in urban space and elements through landscape techniques, not only to create a better living environment and enhance the contemporary value and significance of historical remaining but also to promote the ecological development of the city and let the city be more flexible to deal with future unpredictable changes through the intervention of landscape methods.



# INTRODUCTION



This chapter introduces the fascination of this project, clarified the key notions of the problem and put forward the research questions.

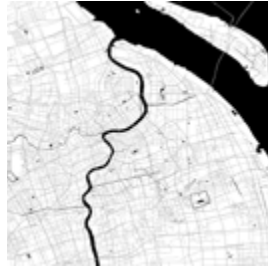
The inspiration of working with urban water is the author's personal experience that there is a huge difference in how the watercourses being used in different cities. Moreover, from the ancient drawings and the author's own observation to the Africa landscape during the fly to Morocco, she gets to understand the important role water plays in the past and still. Water is a lifeline to the city and it brings people and other life forms. Most of the watercourses in the marine time were no longer worked as how they were. However, can they still benefit the city and the people?



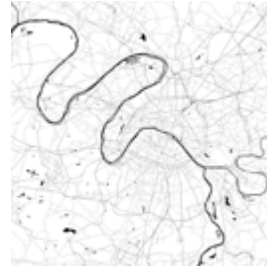
*New York*



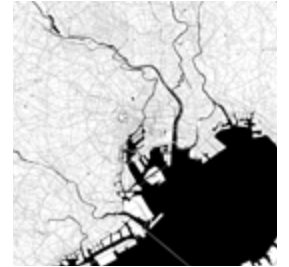
*London*



*Shanghai*



*Paris*



*Tokyo*

If you look at all the megacities in the world, almost each of them has a waterway going through the city. Those waterways or water structures such as canals, etc. were important as a lifeline for a city instead of being a facility only for water. However, globally, cities are turning their back to the water. Despite their potential for urban development, many canals or watercourses are losing their identity in urban areas. In the meanwhile, lots of urban cities are facing extreme stress. For example, the influx of population, natural disaster and the insufficient capacity of urban infrastructure. In China, because of the rapid expansion of urbanism, most of the historical and cultural interventions are demolished or rebuild.

As a landscape architecture student, the willing is to explore how water influenced people's lives and find out what we can learn from past experience. The potential of turning the canal or watercourses back to a lifeline for the city by landscape methods.

This project is going to look for the power of landscape architecture to reinventing the impact of the historical substructure and turn it into part of the adaptive and resilient urban infrastructure.

Globally, cities are turning their back to the water. Despite their potential for urban development, many canals or watercourses are losing their identity in urban areas. Through landscape methods, there are potential to turn the role of water in cities more positive and let it influence life in the urban area.

The Grand Canal [1] (known to the Chinese as the Jing–Hang Grand Canal) in China, start from Hangzhou to Beijing, was a backbone for urban life and played an important role in social, culture, ecology and economy in the marine time. Tongzhou, located in a low-lying area in the southeast corner of Beijing, was in history a linchpin along the Grand Canal that connected Beijing city centre and southern China. Now, the Grand Canal in Beijing part is no longer used for transportation because of the lack of water.

The site located in Tongzhou district, as a suburb right next to central Beijing. Space along the canal was planned as Central Business District zone, luxury community and commercial centre, city park and forest park. However, those spaces were not planned as a whole but separate system that disconnected with nearby communities, also the water was inaccessible for the public.

There are always roads or a stretch of green in parallel to the canal, several public area or waterfront dock located along the canal in the longitudinal dimension. The stretch of green was mostly planned as part of a park or public area. Space was only expanded in parallel to the canal almost in all types of waterfront. Longitudinally, the existing green area next to the canal is a separate system from the city. The opening of the green areas is always facing a wide road without any form of connection to the communities. The accessibility to the public area can be improved in the lateral dimension. Vertically, there is always a boundary in the border of water, it is hard for people to touch the water,





[1]

The Grand Canal in China, from Beijing to Hangzhou, a UNESCO World Heritage Site, passes through 6 provinces. It is 1794km long, links the Yellow River and Yangtze River. (Wikipedia).

**It was built as an infrastructure for defence and to transfer goods to the capital city and also act as a lifeline in the urbanism in history.**

which is considered dangerous being close to the water. To transform the Grand Canal as a landscape infrastructure, we need to make use of the expansion area and create a connection between city and water, people and water. Hence, space is going to be considered as a zone instead of a line around the canal and from the upland trail to instream. Moreover, the Grand Canal as one of the most important water source carrier is in charge of keeping water and keep the quality of water. There are moves of water retention and purification to be made in the design process. In conclusion, most of the space along the canal only expanded longitudinally but lack of consideration on the lateral and vertical dimension.

This project explores the potentials of the Grand Canal as a backbone for urban development. It is considered to be an urban landscape infrastructure that exploits the longitudinal(amount of water and water connection), lateral(the connection between water and city, ecology connection) and vertical(connection between water and people, water and ecology) dimensions and creates conditions for the development of a social-ecological inclusive urban landscape and sustainable water management.



[2]  
 The "Boundary Marker" of Grand Canal in Tongzhou  
 Source: <https://zh.wikipedia.org/wiki/%E4%BA%AC%E6%9D%AD%E5%A4%A7%E8%BF%90%E6%B2%B3>



[3]  
 The Grand Canal in Zhangjiawan, Tongzhou district  
 Photo taken by author

### III /Research objective +Questions

Nowadays, rivers became increasingly alienated from the economic and social life. This project is focusing on “redefining the border of water”, **exploring the potential of the Grand Canal as a backbone for adaptive and resilient urban development in Tongzhou district.**

Even though the Grand Canal doesn't benefit Beijing as in the past anymore, it is still a strong urban element for creating public space and potential backbone for urban development in Tongzhou district. The Grand Canal can serve as a landscape infrastructure in Tongzhou district, creating spatial conditions for social-ecological inclusive urban development. In the meanwhile, deal with the waterlogging and flooding issue in rain season.

This project explores the potentials of the Grand Canal as a backbone for urban development. It is considered to be an urban landscape infrastructure that exploits the longitudinal(amount of water and water connection), lateral(the connection between water and city, ecology connection) and vertical(connection between water and people, water and ecology) dimensions and creates conditions for the development of a social-ecological inclusive urban landscape and sustainable water management.



How to use Grand Canal as a **backbone** for **adaptive and resilient urban development** by **social and ecological connectivity** principles in Tongzhou district?

How does the Grand Canal function as **an operative landscape structure**?

How to transform the canal to a **landscape infrastructure** (principles and strategies)?

How to use the **water source** in Tongzhou as **part of the urban infrastructure**?

Is there **room left** for **unexpected**?



[4]  
Social-ecological  
inclusive urban  
landscape cases

- a. Seeuferweg, Zurich
- b. English garden, Munich
- c. Emerald Necklace, Boston
- d. Madrid Rio, Madrid

The Grand Canal has brought great benefit to the canal side cities in history. The blending of culture, the transportation function, the consolidation of central government's rule over the country. Also, it helped with irrigation and reducing extreme floods. Moreover, it helped to strengthen economic construction in the southern region and form a unified Chinese economy. By contrast, the Grand Canal contributes not as much as before to the urban culture and society nowadays. This project is going to switch the role between the canal and city again, to make it adaptive and resilient landscape with the power of landscape architecture.

The goal is to transform the grand canal as an urban green-blue landscape infrastructure in the urban area through scale by learning from past experience and worldwide cases.

Inspired by the Emerald Necklace in Boston, the green and public space along the Grand Canal can be designed as a system instead of separate individuals. By doing this, there will form an ecology corridor along the Grand Canal which would be an adaptive and resilient landscape infrastructure to the urban area. In the meanwhile, the project will pay attention to preventing from flooding issue in summer and deal with the uneven rainfall in summer and winter. Last but not least, while forming the ecology corridor, there would be more space for the public and formulate a complete pedestrian and biking system beside the new green-blue corridor. The historical value of the Grand Canal would be the added value.

Besides, the design of the canal zone will be done in the longitudinal, lateral and vertical dimension. Based on the experience of walking through the English Garden in Munich, the stretch of river Isar cannot be neglect. The design was well considered in the longitudinal dimension.

In addition, the landscape infrastructure is not a separate system with the city. They live with each other and serve each other. The green area and public area should be welcoming for the community. Ultimately, on a neighbourhood scale and lateral dimension, the green-blue system and the city is well connected and achieve the mutual benefit. Last but not least, space is functioned vertically from upland trail, bank to instream. The spatial quality will be from active to passive to serve the community and ecology. Principles for a different dimension and different layers (people, ecology, water flow and accessibility) will be concluded based on the research of literature and case studies to achieve the goal.

Consequently, the design will be shown on a different scale. From masterplan to detail design to zoom in one or several specific zones. By acknowledge from historic experience, literature study and case study, there will be a series of principles in different scale and dimension. The final design will be selected from the scenarios by matching the site with different principles.

The results of the project proposed a social-ecological integrated landscape design method. The purpose is to revise the historical remaining to once again affect the lives of cities and people. For people, watercourses are socially significant landscape element. As well as for cities, it is the carrier to achieve an adaptive and resilient city.

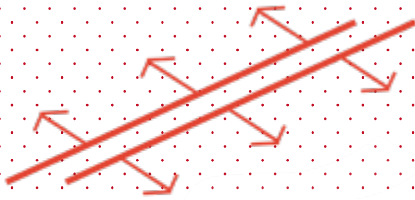
In many cities, the old waterways are abandoned and became a water container or infrastructure unrelated to the city. However, in the perspective of landscape architects, these water containers have great potential to involve in urban development. With landscape implied, you can take action or plan for current or expected impacts to help cities better adapt to water issues, such as waterlogging or flooding. Through integrated design, watercourses can provide the city with flexibility and the ability to recover from the effects of climate change.

According to the policy, water and land are separate systems-oriented by different departments. There is a clear line between water and soil. However, from a landscape perspective, soil and water are both parts of the landscape, they are inseparable components in urban design. Water and soil can be vertical walls with well-defined boundaries, or they can be slopes or steps whose boundaries change with the water level. Changes in water level lead to changes in the boundary between water and soil. For the city, the change of the boundary means the adaptivity of the city towards the changing flow of water, and for people, it will change the range of people's activities. Waterways in cities are usually designed to be straight. However, with the development of the city, the functions of these waterways in the city may be different than before, and the form of waterways also has the potential of being curved or straight accordingly.

The project will work with the research by design method, explore the history and historical

value of the Beijing-Hangzhou Grand Canal and its historical relationship with the city and people. Combining theory and other cases to integrate a toolkit for urban landscape infrastructure and waterfront design. Through cultural and geographical analysis and research, to choose the site which is suitable for the design assignment. At last, the design will process in parallel at different scales, test the toolkit at the selected site and discuss the design which is suitable for the condition.



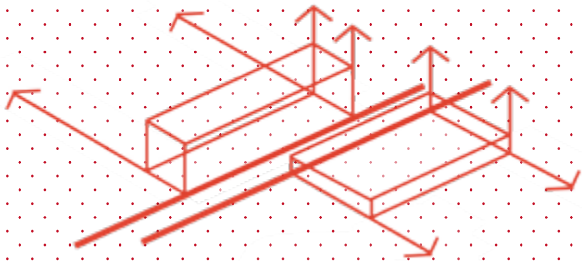


As a research method, the project is based on a literature study, research and comparative research, analysis and history study of landscape architecture and urban planning with the goal of exploring the potential of the Grand Canal as a backbone for adaptive and resilient urban development in Tongzhou district.

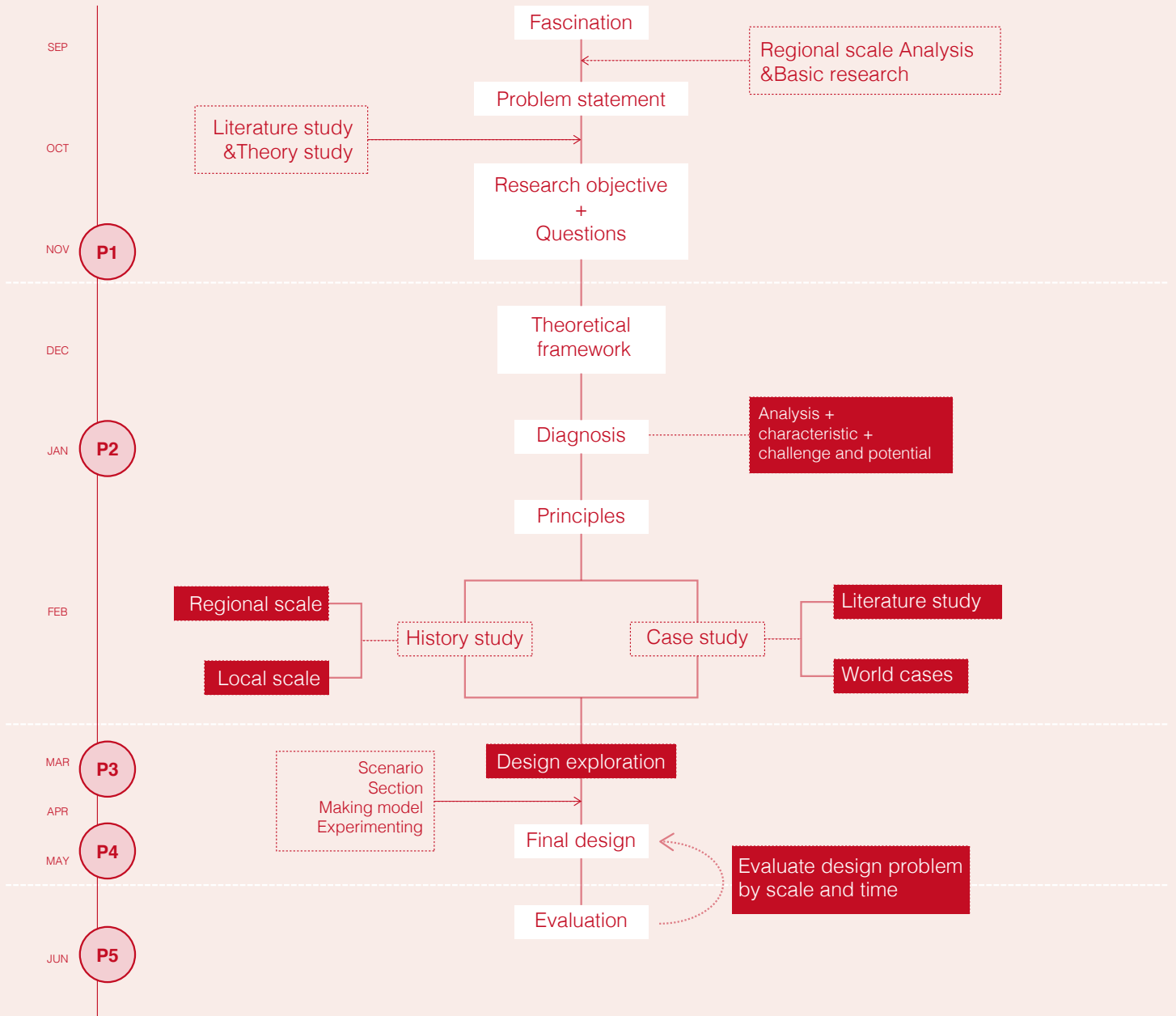
Specifically, the theoretical investigations will be focused on Olmsted (1982) consistently view every park design as part of a comprehensive city plan. Additionally, to discover the opportunities to enhance connectivity of the city with the river, G. Mathias Kondolf (2017) has discovered urban spaces can be improved so as to promote all levels of connectivity:

One single activity, such as running along the riverbank, can require all three levels of connectivity to be present, in the street layout and in the design of the waterfront public spaces: from one's apartment onto the embankment (lateral connectivity), down to the shoreline park (vertical connectivity), and along it (longitudinal connectivity).

As it happens to most of the canals in the world, there is a trend to turn the role of the Grand Canal from infrastructure to landscape infrastructure by enhancing connectivity of the city with the river.



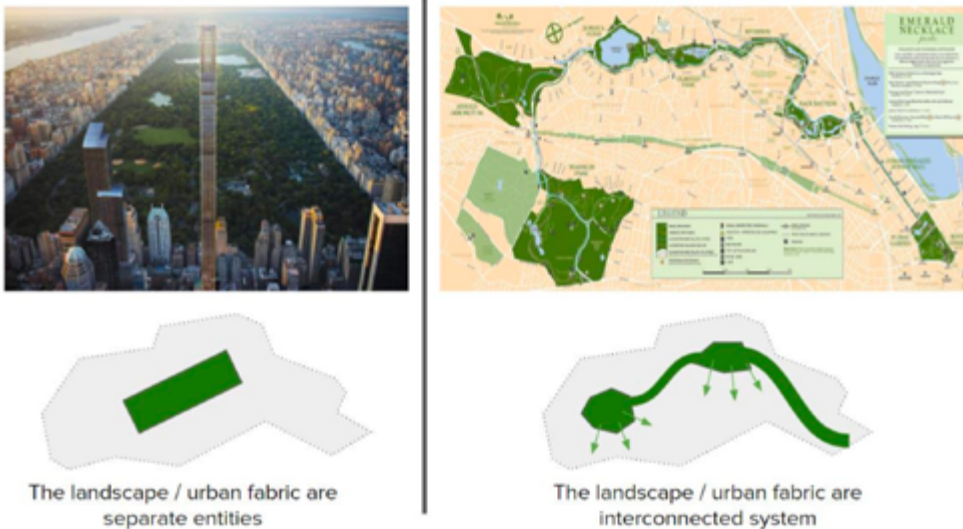
# I /Methodology





## II /Theoretical Framework 21

### i. Landscape urbanism



The Central Park, New York and The Emerald Necklace, Boston

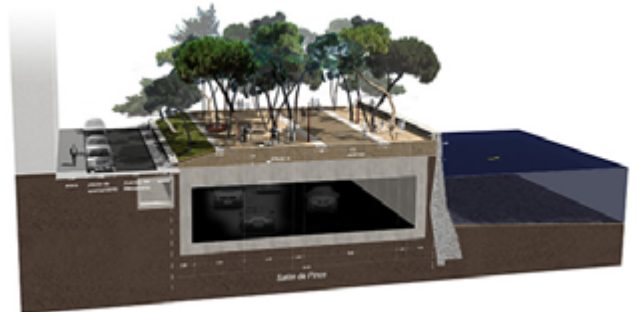
As found by the previously researcher, the urban landscape elements such as garden, park and plaza are not only the outdoor entertainment space for residents. As landscape architects, should consider the landscape and urban fabric are not separate entities. Hence, there is an urge to pay more attention to the dynamics of the cities and restate the link between landscape architecture and the ecology and social imagination. As mentioned by Zaitzevsky (1982) during the study of Boston Park System, "Olmsted consistently viewed every park design as part of a comprehensive city plan. For him a park was never an ornamental addition to a city but an integral part of its fabric and a force for future growth on several levels: geographic, economic, social, and cultural". Hence, the design thinking of landscape architecture should not be limited to a certain area of land, but to zoom out and have a whole picture of the urban landscape system and to pay more attention to the social and ecological interaction between landscape and urbanism.



## Madrid rio

West8  
2011

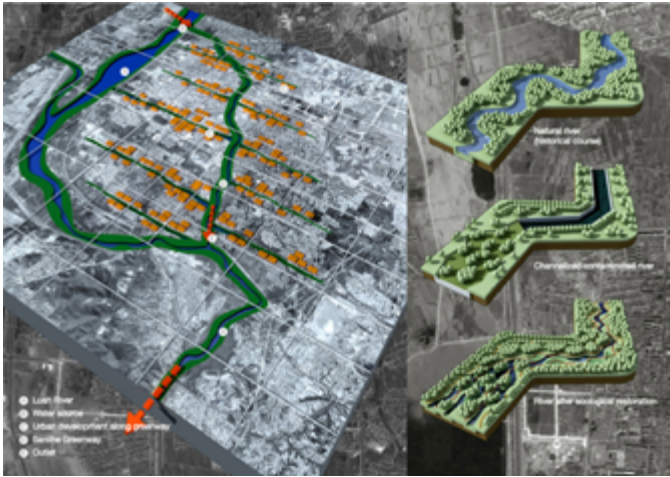
This case shows a solution to urban problems through landscape methods. In this case, the highway has been put underground, the newly built bridges strengthen the connections between the urban areas along the river. The specially designed trail system and park space provide the city with public outdoor space and enhance the city's vitality.



Infrastructure can be a type of landscape. This opinion is supported by the existing landscape practices, such as the design of Landschaftspark Duisburg-Nord in Germany. It is possible to identify at least four discourses of infrastructural design, which approach infrastructure as landscape from a spatial, ecological, technical, or social perspective (Nijhuis, 2015). This project is going to segment the regional scale design into four themes of spatial, ecological, technical, or social perspective, by brainstorming to maximize the advantages of designing on the certain topic. Then try to achieve an integrated urban landscape infrastructure by overlapping the different theme maps.

Landscape infrastructure is an integrated system that can activate urban development by the interaction between natural and human system. Landscape structure is a variety of artificial constructions or systems. landscape infrastructure contains many different types of landscape structures, so it is more like a man-made pattern. The urban landscape infrastructure is a mediator between nature and society, based on a material space that exists as a structure of man-made patterns as well as an ecological system, and is independent of perception (Nijhuis, 2015). Landscape infrastructure is a changing system, and this changing system can adapt to changes in natural and human environments. During the construction of landscape infrastructure, the cooperation of different disciplines is needed, such as ecology, hydrology and technology. But this does not mean that urban landscape infrastructure is equivalent to the ecological and technological constructions embedded in the landscape. Landscape infrastructure is a whole that integrates multiple disciplines. It is also a social-ecological integrated landscape completed by the fusion of various landscape structures and surrounding scenes.

In order to test the potential of urban infrastructure for sustainable urban development, this project is going to purpose the possible design in the social, ecological, technical, and spatial perspective, including the placement of landscape structure, and finally merge to get a complete set of landscape infrastructure.



## Qian'an Sanlihe River Ecological Corridor

Turenscape  
2010

The Sanlihe River uses landscape to revive and construct both existing and new city infrastructure; it is capable of reducing pollution, providing opportunity for urban land development, and serving ecological functions. (Turenscape,2010)



The project is divided into three sections: upstream diversion section, central urban section, and downstream wetland park section. With the combined pedestrian and cycle path for communication and recreation use through the integration of local traditional characteristics of art. The ecological benefits of the project and its interpretation of the new aesthetics have contributed to sustainable urban development in the region.



Old Summer Palace  
<https://cul.sohu.com/20060921/n245470172.shtml>

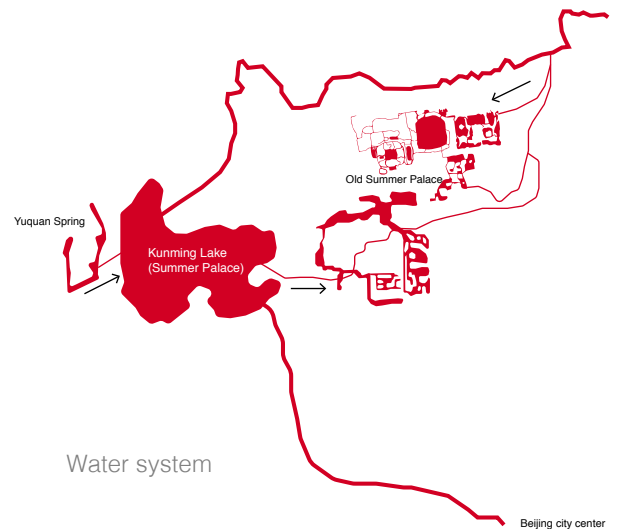
### Summer palace

Kangxi emperor  
 1709

The spring water from Yuquan Mountain poured out, gathered and stored in Kunming Lake. The Summer Palace built next to the Kunming lake served as a summer residence for the ancient emperor, the landscape garden copied the techniques of Jiangnan garden. The Old Summer Palace uses the spring water of Yuquan Mountain and the water of Wanquan River to form a leisure landscape similar to the gardens in southern China.



Water and garden system



Water system

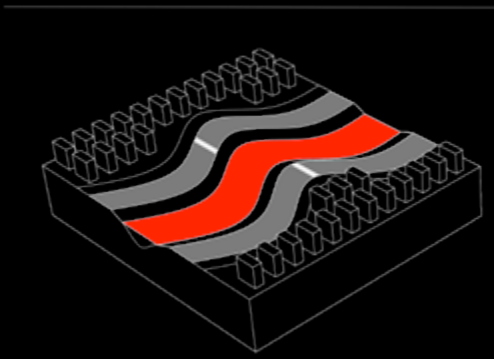


*To discover the opportunities to enhance connectivity of the city with the river, urban spaces can be improved so as to promote all levels of connectivity*

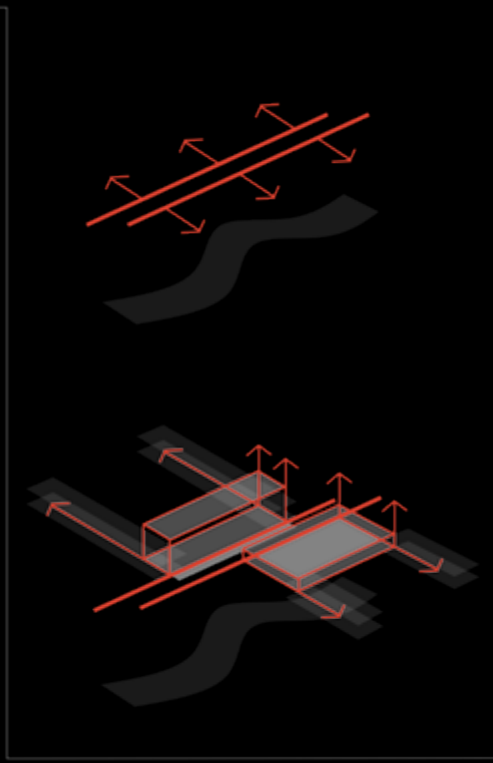
*One single activity, such as running along the riverbank, can require all three levels of connectivity to be present, in the street layout and in the design of the waterfront public spaces: from one's apartment onto the embankment (**lateral connectivity**), down to the shoreline park (**vertical connectivity**), and along it (**longitudinal connectivity**).*

- G. Mathias Kondolf. (2017)

As Kondolf(2017) said, to discover the opportunities to enhance connectivity of the city with river, urban spaces can be improved so as to promote all levels of connectivity. He considered the space in 3 dimensions. Longitudinal dimension means connectivity along the water, lateral connectivity shows as from one's apartment onto the embankment, vertical connectivity means the routing down to the shoreline park. Inspired by Kondolf, the design of Grand Canal in Tongzhou district should be considered as a zone rather



From longitudinal



connection between water and people,  
water and ecology

**vertical**

connection between water and city,  
ecology connection

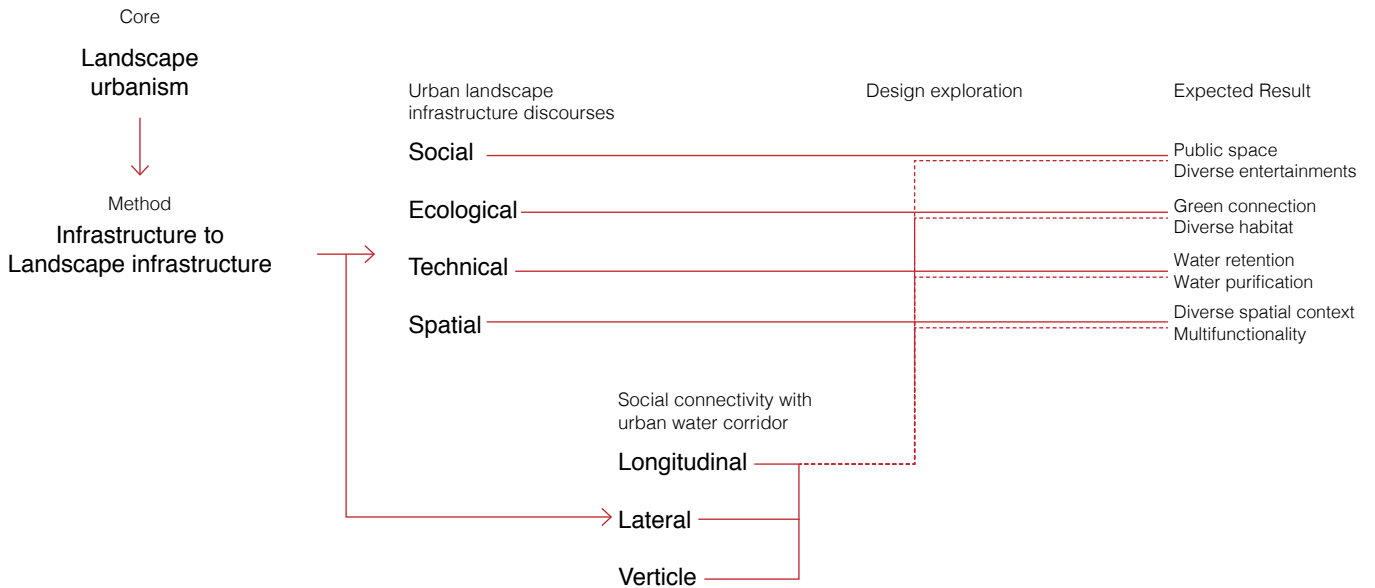
**lateral**

To longitudinal

Amount of water & Water connection

than a line. It can also be considered in the longitudinal, lateral and vertical connectivity other than only expand in the longitudinal dimension.

The definition of longitudinal here means the flow of water and amount of water. Lateral means the connection between water and city, ecological connection, vertical means connection between water and people, water and ecology.





The foundation of this design project is the theory of "Landscape Urbanism", proposed by Olmsted in 1982. Park design is not just the designing of a specific space, but is an integral design of the city. For cities, the green public space itself is the mediator of a city. It can change people's lifestyle, aesthetics, psychological state, and also has a natural adjustment effect on climate change or natural disasters. Hence, this project aims to learn from the theory of Landscape Urbanism, with the landscape architecture methods, create a closer social and ecological relationship with the city. At the same time, the watercourse on the site was originally urban infrastructure built for urban developing reason. In the case where it has lost its original function today, you can refer to the theory of "Infrastructure as Landscape" and "Landscape Infrastructure" proposed by Nijhuis (2015), carry out a re-integrated design, and explore its challenge and potential in social, ecological, technical and spatial aspects. Last but not least, because the project is also focusing on the design in a city context, we must consider how to strengthen the connection between the canal and the city and the connection with human life. Combining the 3 levels (longitudinal, lateral and vertical) of connectivity between city and water proposed by Kondolf (2017), to consider the relationship between the city and water, people and water in the three directions through scale.

Through the practice of the above theories, this project aims to strengthen the connectivity between city and water, create space for more diverse waterfront activities, achieve a more adaptive and resilient urban development in the region and shape a more active waterfront space.

In the diagnosis chapter, it will hence focus on the historical role of the Grand Canal, the analysis of the present situation. The analysis of the present situation will focus on social, ecological, hydrological, connectivity and urban context. In order to understand the Grand Canal from history to modern time to diagnose how it could respond to the society and environment.

# DIAGNOSIS



This chapter investigates the excavation history of the Beijing-Hangzhou Grand Canal, the historical value and significance of the Beijing-Hangzhou Grand Canal for urban development. How does the Grand Canal function as an operative landscape structure? The Grand Canal in history were invented for transportation purpose but it also brings other value to the city and people.

How did people use the water shore of the Grand Canal and interact with the waterbody in history? Through the survey from the national scale to the city scale to the street scale, to study how the water has historically been connected with the city and human life, and how it has created a diverse lifestyle and living space for people.

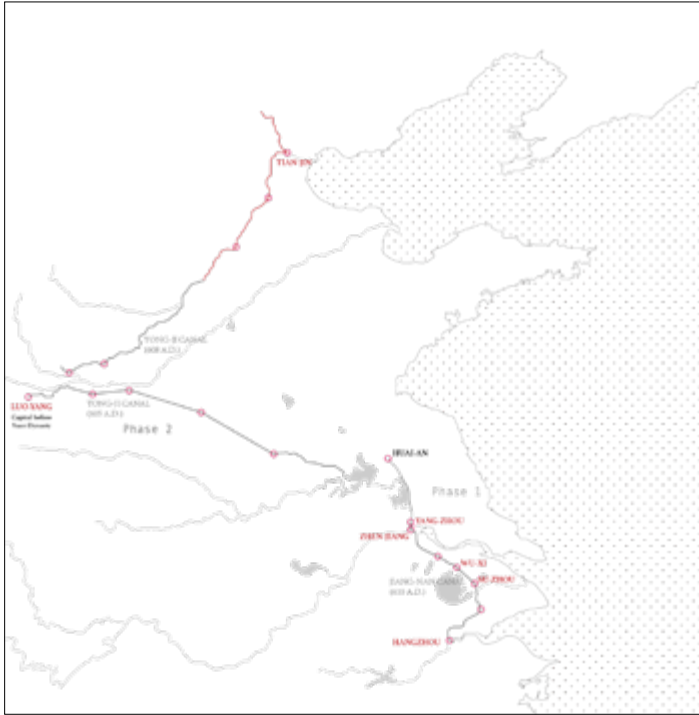
What is the situation of the Grand Canal in Tongzhou district in different scale? This chapter also introduces the sources of water in the Beijing section of the Beijing-Hangzhou Grand Canal and analysis of the Beijing-Hangzhou Grand Canal in the Tongzhou section, including a detailed introduction of the humanities and ecological environment around the canal.

# I/History and value of the Grand Canal

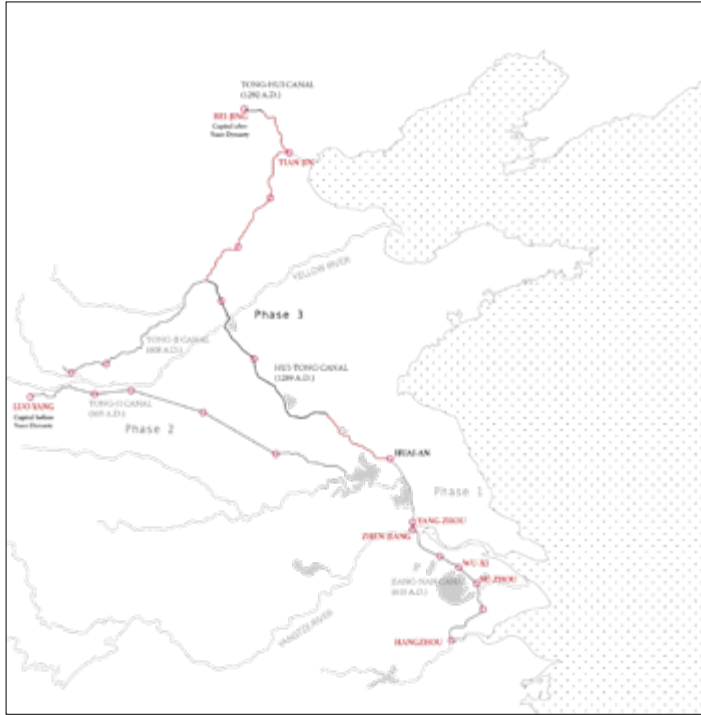
Phase 1



Phase 2

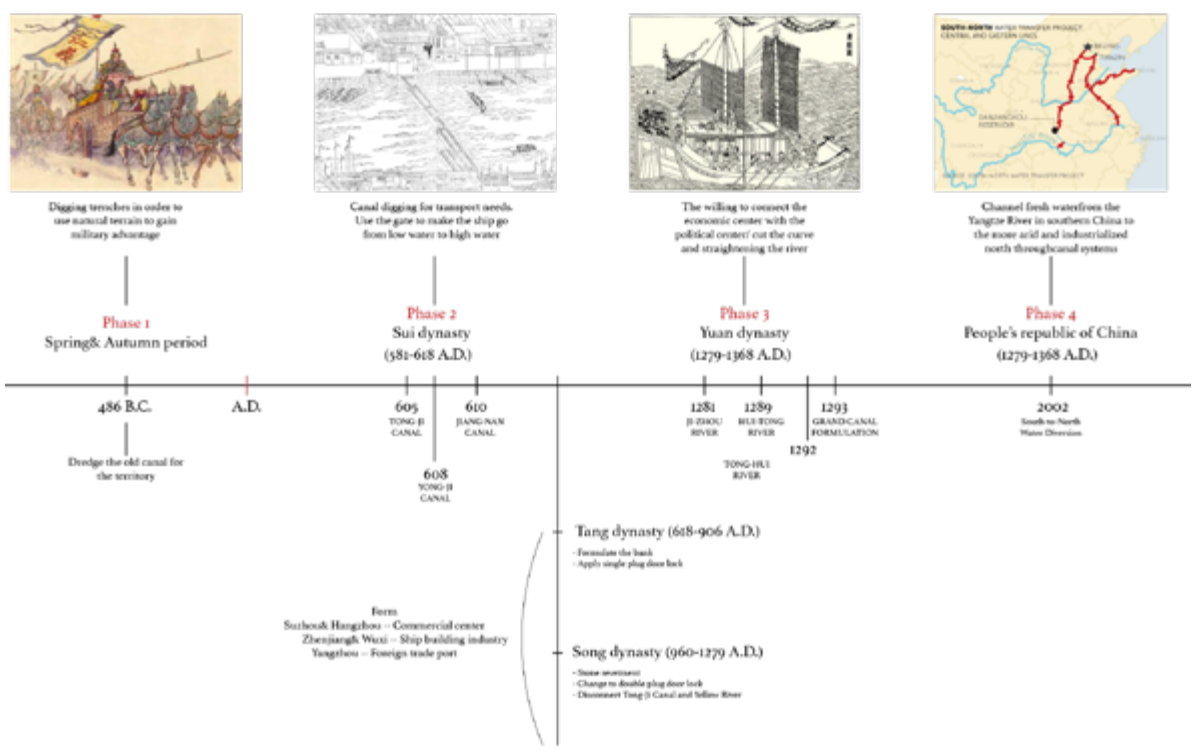


### Phase 3



From the study, there are 3 main phases in building the Grand Canal. The Canal was first made for military reasons (phase 1), then in Sui dynasty (phase 2), the emperor decided to make a road on the water to connect the south and north China. The Grand Canal we see nowadays was finalized in Yuan (phase 3) dynasty.



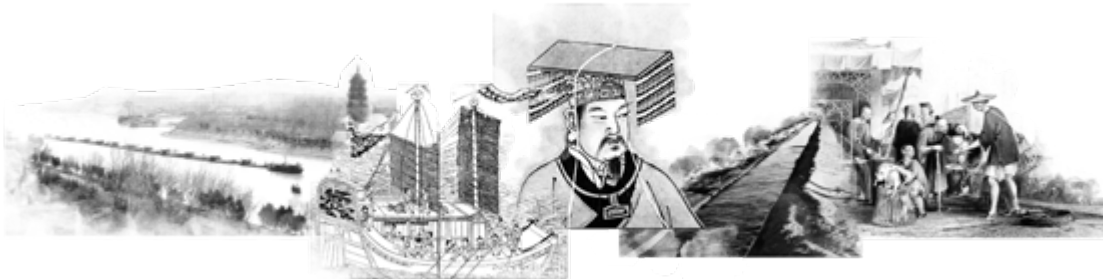
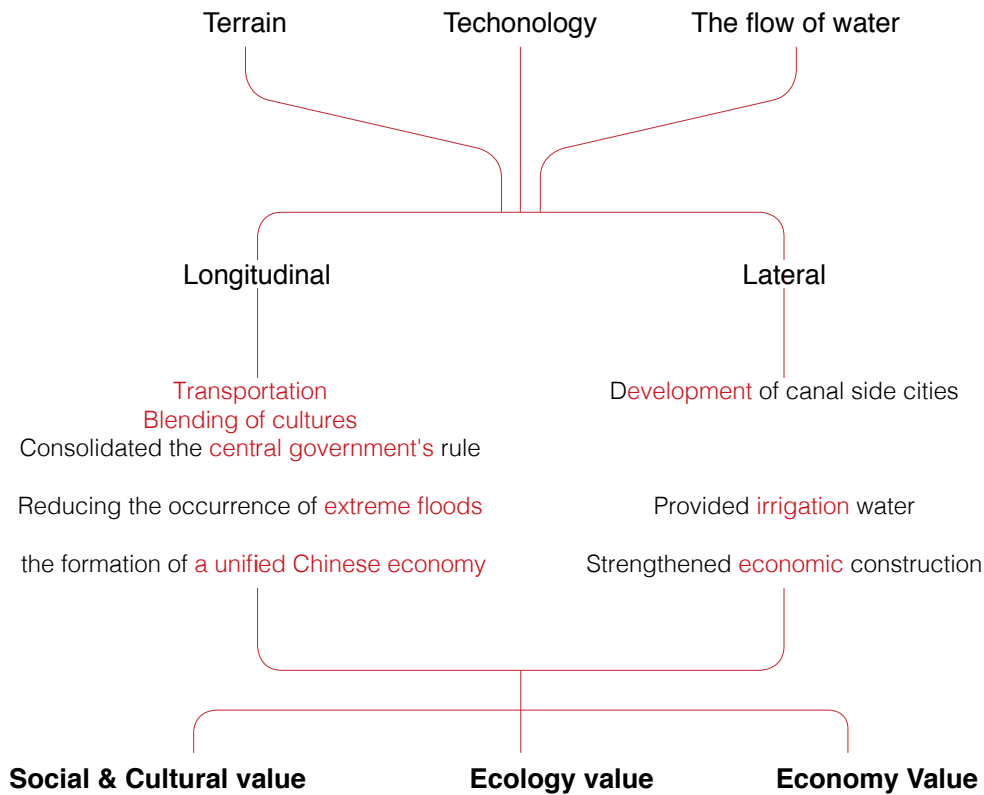


The Grand Canal was first built for military reasons follow the natural terrain in 500 B.C. Then dig for transport needs in year 600, use the gate to transfer ship from low water to high water.

Then the capital city switched to Beijing, so in year 1300, the made a new connection by changing the flow of water.

By using the natural terrain, technology and changing the flow of water. The Grand Canal has connected China longitudinally from south to north, helped achieve social and cultural value, ecological value in China and cities along the Canal.

In 2014, the Grand Canal was honoured as the world heritage site. It crosses 6 provinces and links the Yellow River and Yangtze River. If you compare with Europe, it might be more than 6 countries. As the longest canal in the world, the length of it is 1794km, even longer than the Rhin. The ships did not have trouble to reach the different elevation because there are pound locks invented in the 10th century.



China's Grand Canal is one of the oldest man-made waterways in the world which has been historically viewed as the link connecting the social, economic, and cultural developments of China (Jie, 2015). In the ancient time, it played the role as a grain transportation line, flood control and drainage, irrigation, and landscape entertainment. Furthermore, it helped to strengthen economic construction in the Jiangnan region and form a unified Chinese economy. It was a lifeline for the residents, city and the country.



In Liao Dynasty(916-1125 CE) the Grand Canal plays as the lifeline in Tongzhou district. The city center located next to the water confluence spot. All the villages located next to the water course. There is also a wetland formed in the south side with willows grew just as they liked.

Water context in Liao Dynasty 🕒

Map of Tongzhou district in 916-1125 CE  
Photo taken by author in "SANMIAOYITA"  
Museum in Tongzhou district





1 Confluence of two waters 二水汇流



5 Willow shade and dragon boat 柳荫龙舟



2 Savanna and the peak 平野孤峰



6 Bridge and the moon reflection 长桥映月



3 High platform and the grove 高台树丛



7 Pagoda valley above the clouds 古塔凌云



4 Water wave and the diversion marsh 波分凤沼



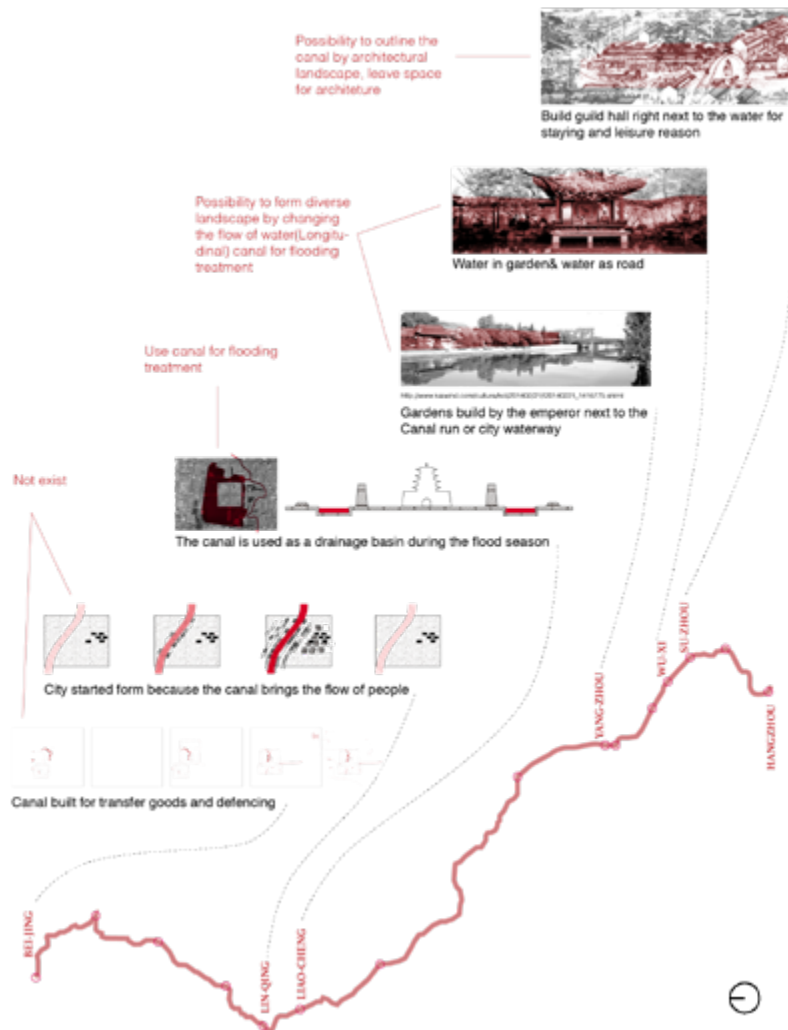
8 Ferries run neck and neck 万船骈集

The Grand Canal in history not only played as the important infrastructure, but also created the landscape and brought a lot of unique spatial experience. There are eight famous scenic spots in Tongzhou along the Grand Canal in history. With the social development, these scenes have already disappeared, we can only experience the spatial atmosphere from the drawings.

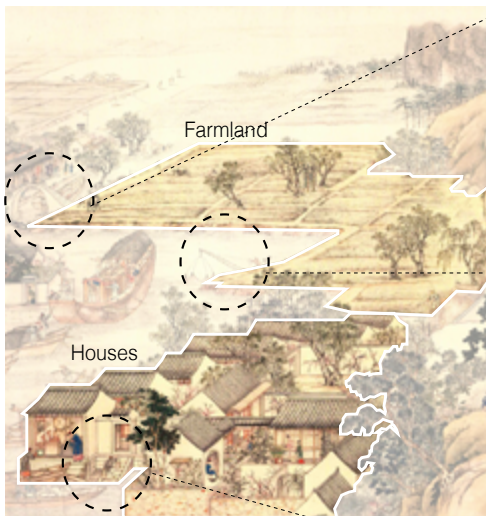
#### Eight scenic spots in Tongzhou

Source from Wechat account "Beiyuntongzhou"





If we take a closer look to the entire canal, it is easy to see that the Grand Canal was really part of people's life, from rural to city in ancient time. The grand canal has formed part of the urban landscape and the rural landscape. People do trading, fishing and other landscape entertainments based on the Grand Canal. The Grand Canal connects people from producing, trade and entertainments. Studying from history, the canal is not only a water container but also can play the role as part of people's life.



Bridge



Fishing

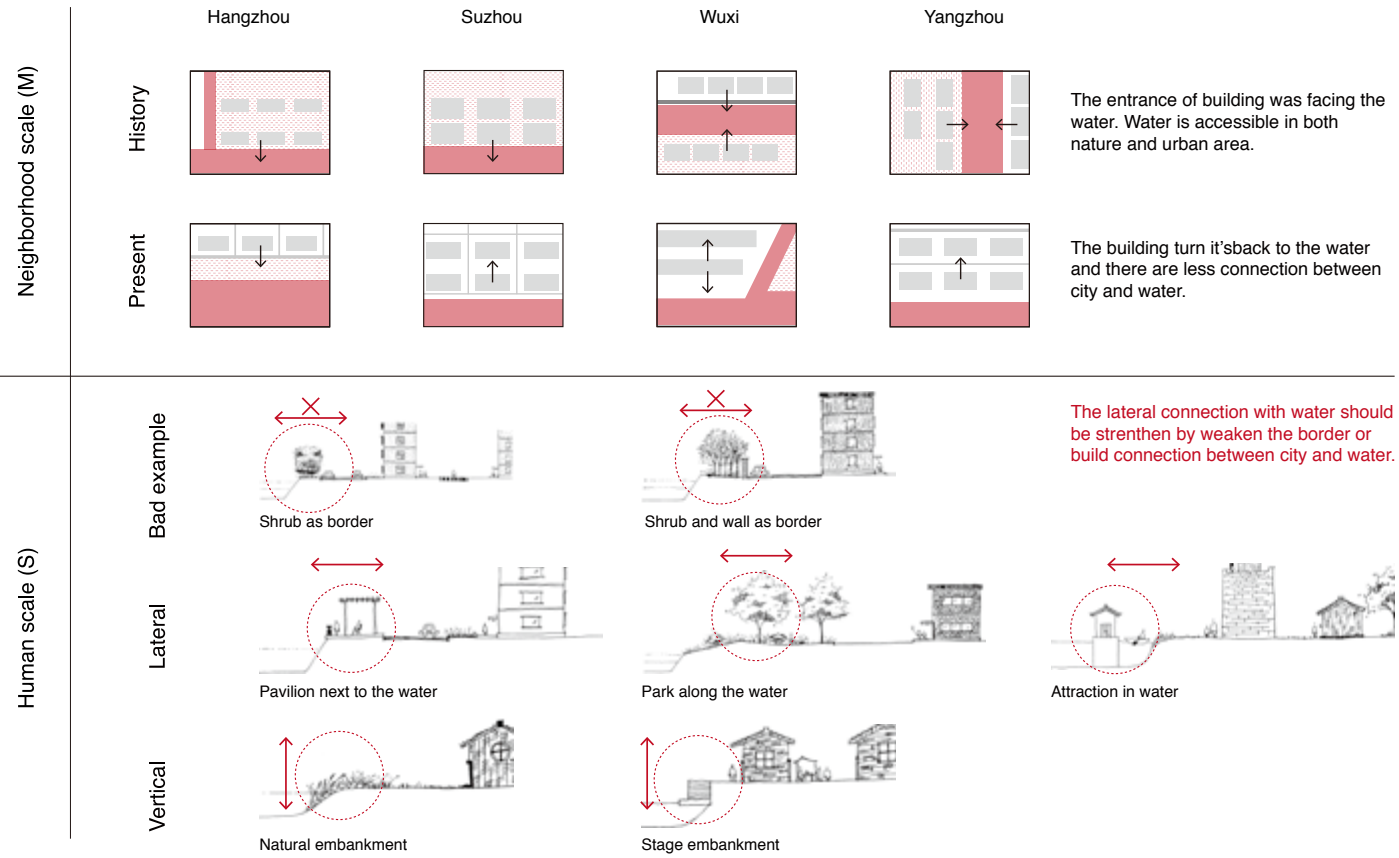


Door to the canal



People also enjoyed the convenience brought by the canal. Such as irrigation and do business on the water. The traffic was also easily connected by bridges.

The Qianlong Emperor's Southern Inspection Tour, Scroll Six  
 Xu yang, 1770



However, the role has changed nowadays. In lots of cities along the Grand Canal, buildings start to turn their back to the water and boundaries were built rough. Like shrub as border or wall as a boarder.

In the urbanism process, there are lots of precious cases between water and city we left behind. Water and city can be connected again by learning from historical cases.

**Social**

**Ecological**

**Technical**

**Spatial**

**L**



Garden system provide public space



Coherent habitat



Water storage



Urban water road system



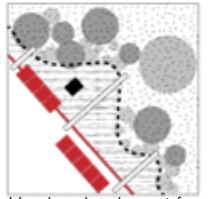
Flooding control



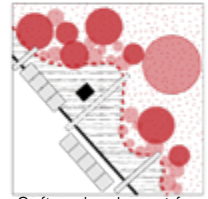
Coherent drainage system



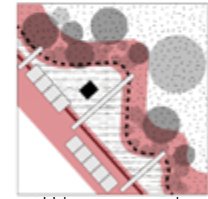
**M&S**



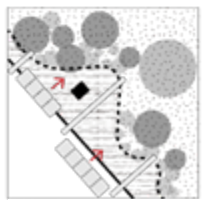
Hard embankment for urban development



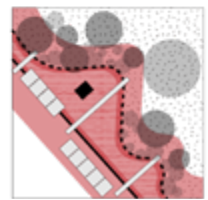
Soft embankment for natural development



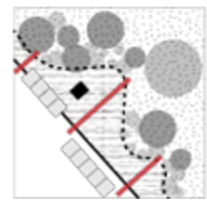
Urban area and natural area



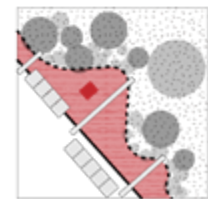
Bridge increase cross-strait connectivity



Diverse water habitat



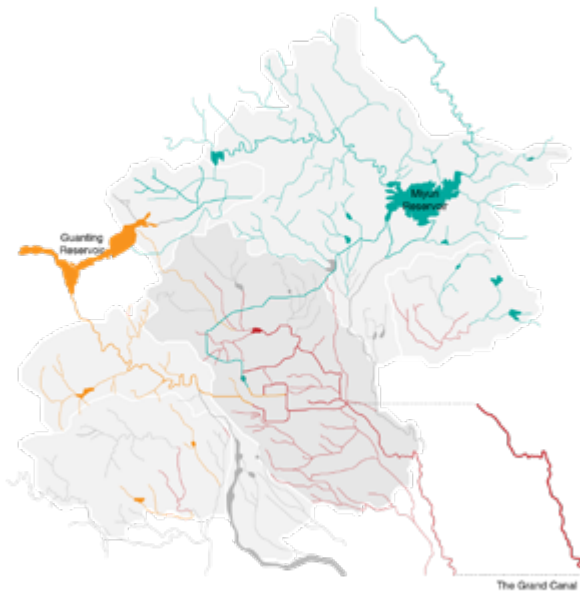
Bridge increase cross-strait connectivity



Water space

In history, by connecting the water infrastructure, the Grand Canal has achieved the social, ecological and technical values in many cities. The connected green-blue structure has provided green space for people and diverse habitat for fauna and flora. Also, the connected water system has functioned as road system and flooding control. The many ponds in city they provide space for water storage. There are different types of embankments in history for the development of urban and natural area. The interface between neighborhood and water was well structured by the bridge and diverse entertainments.

Beijing Water Quality Map



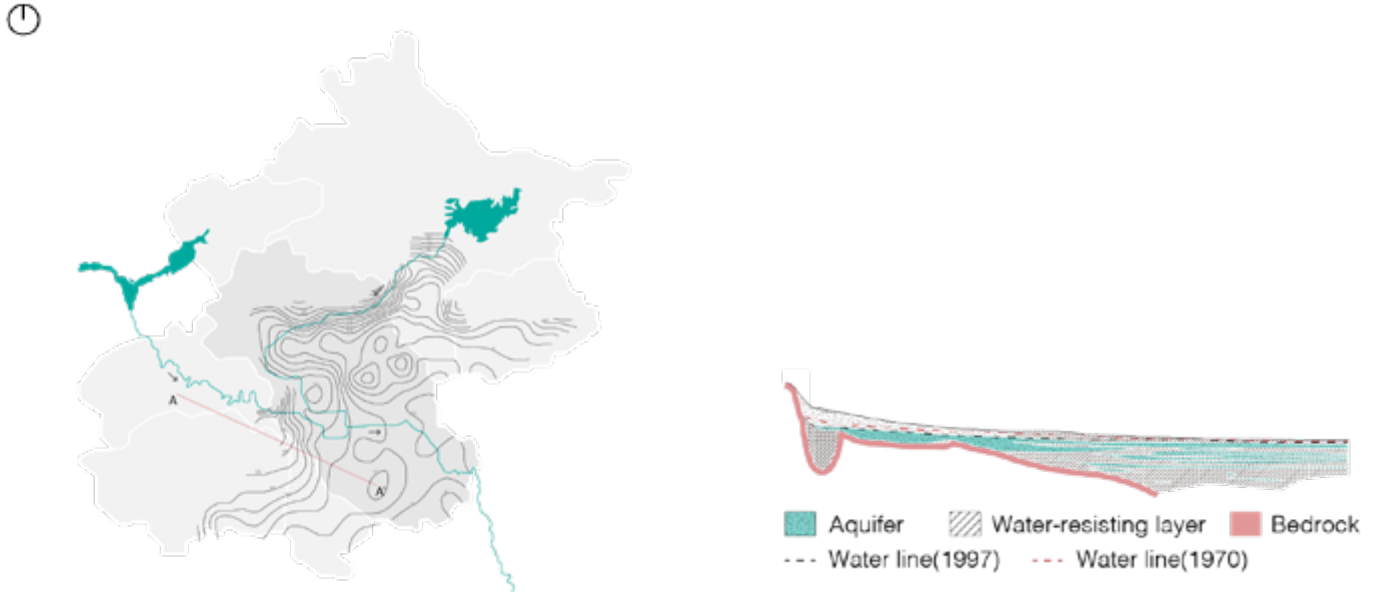
Water source of Grand Canal



The Beijing section of the Beijing-Hangzhou Grand Canal is located in the middle and lower reaches of Beijing, and the water quality is relatively poor compared to the whole city. At the same time, the Beijing-Hangzhou Grand Canal is also an

important urban sewage pipeline. In future planning and design, in order to ensure water quality, it is necessary to separate rain and sewage pipes and cooperate with river self-purification measures to ensure and improve water quality.

Groundwater Level Contours in the Plains of Beijing(2019)



Presently, the water supply for the Grand Canal system is derived from two main channels (Guo et al. 2012): (1) Miyun reservoir - Jingmi diversion canal - Kunyu River - Chanhe River - Moat - Tonghui River and (2) Guanting reservoir - Yongding river diversion canal - Moat - Tonghui River. (Jie, 2015)

Based on the underground water in Tongzhou region and the hydrogeology section. Plus the water is collected from north-west to south-east, the water can be retained in the south-east side of the site.

Compare with open basin, the wetland is more efficient for water retention and can also purify the water.

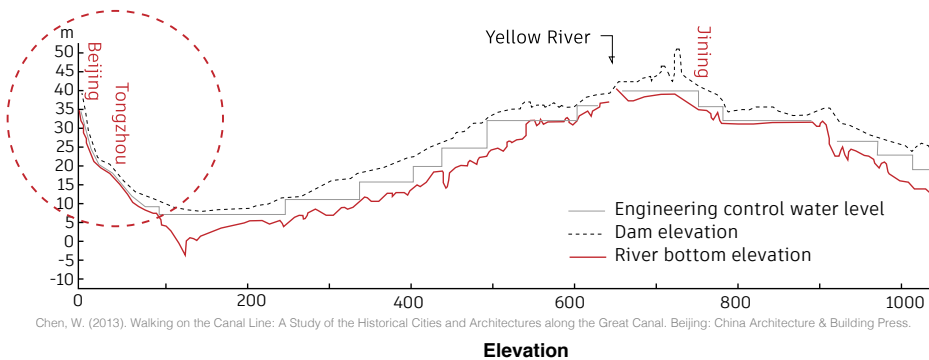
The Beijing-Hangzhou Grand Canal is located downstream of the city center. It is a very important sewage pipeline and it also has the responsibility of clean water. The purification methods are: self-purification, ecological purification and separation of rain and sewage pipes.



## VI /Understanding Tongzhou district

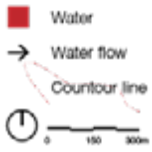
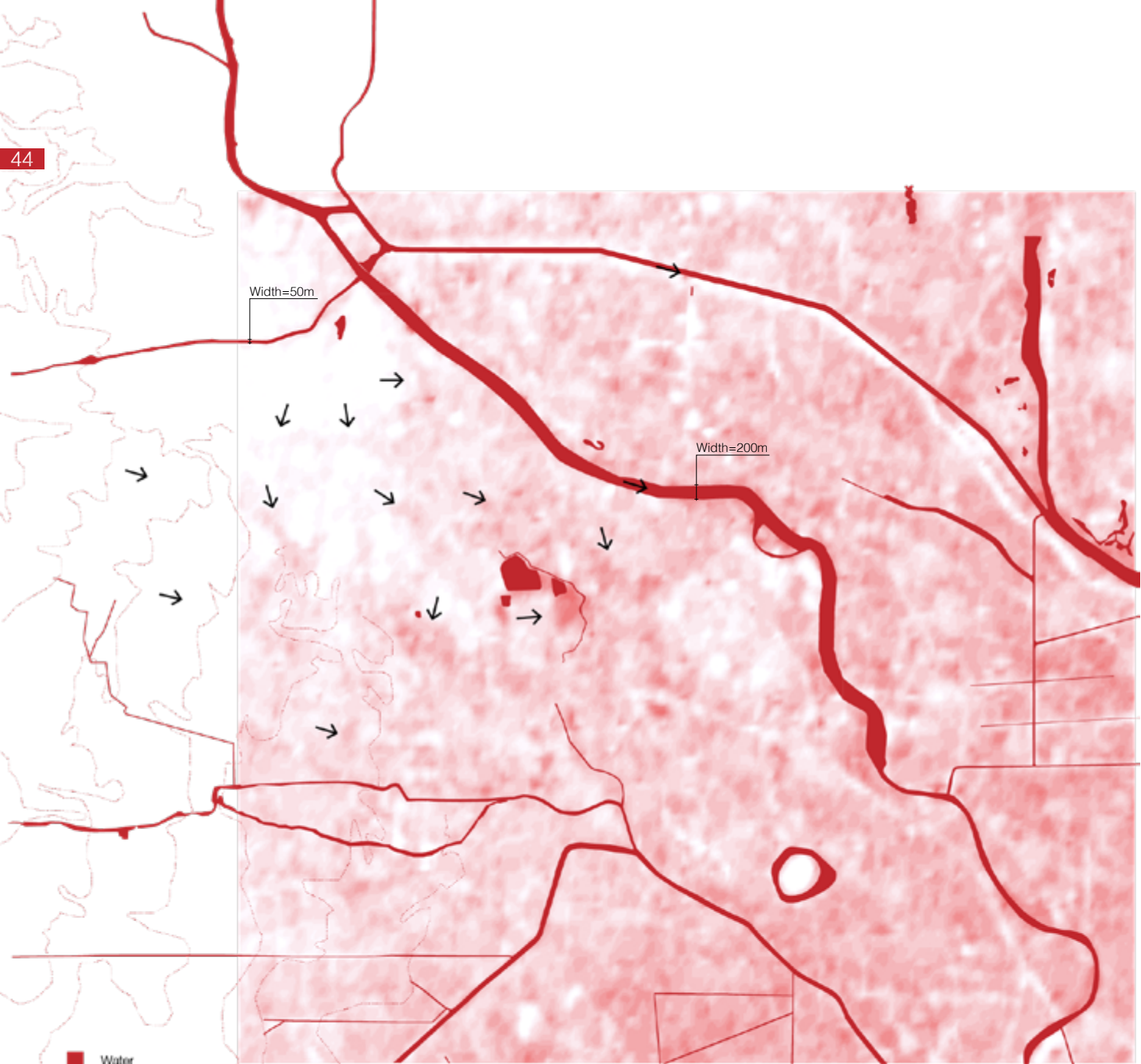
43

### i. Water flow



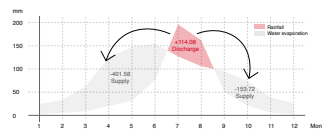
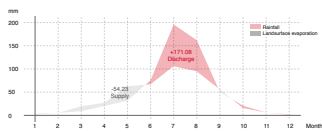
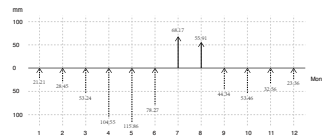
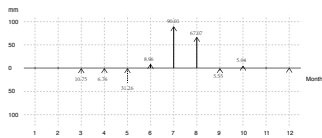
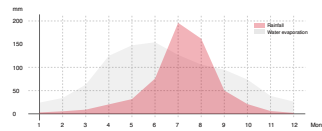
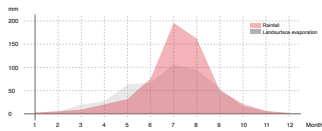
Tongzhou district located in a low-lying area in the southeast corner of Beijing, is a plain, with only 20 meters height difference in the whole region. Moreover, the water to the Grand Canal is mostly from the Miyun Reservoir, also connected to other waterbodies. Water flows from the city center to the Grand Canal. Beijing is a city with uneven rainfall and the temperature varies greatly between summer and winter. In summer, there are extreme rainfall and there are almost no rain in winter. As a city lack of water, the canal water is only 2-3 meters deep.

The municipality is planning Tongzhou district as a subcenter for Beijing city center, so there would an influx of people in Tongzhou, hence there would be need for a new landscape infrastructure to enhance the social and ecological connectivity.



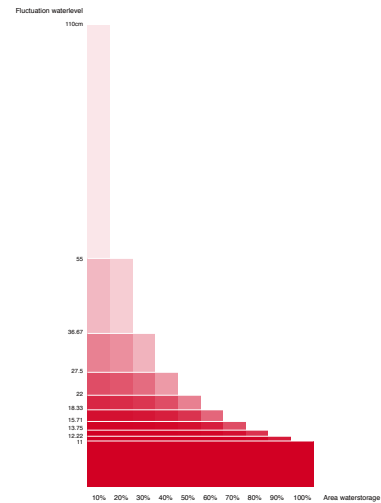


## ii. Rain and evaporation



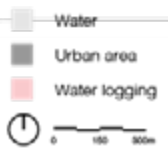
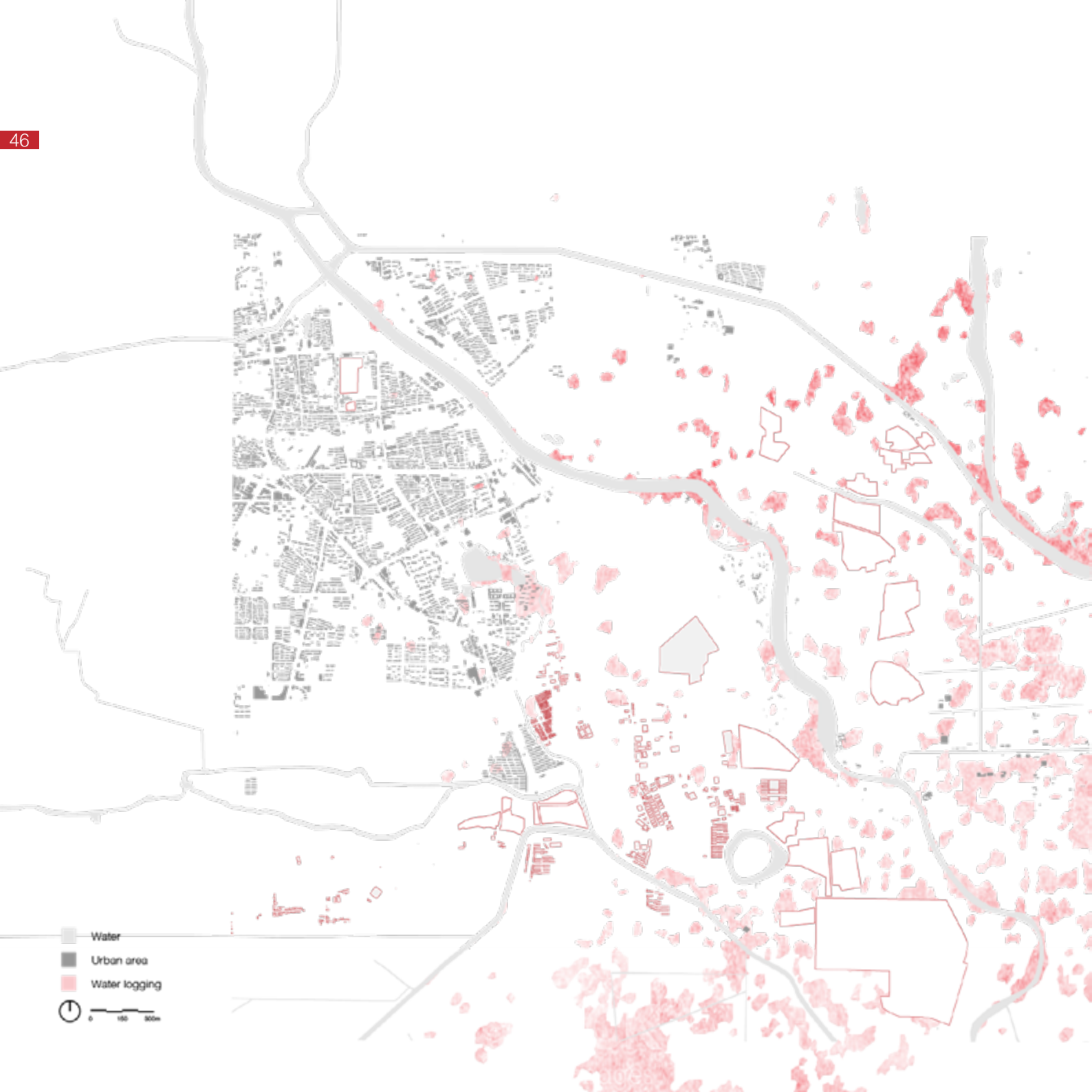
Landsurface

Water



- Water logging issue in few urban area
- Potential for a connected rainwater system
- Need for water infiltration
- Fluctuated area for water storage and waterlevel

There are water logging issue in few urban areas. To solve this problem, we can infiltrate water in local area and build a connected rainwater system. The chart of fluctuated area for water storage and water level can be used for further regional design.



## iii. Green and blue

## Pictures



There are separate public green spaces in the city and along the canal, such as garden, community park, plaza, sports field, natural park etc. In the existing condition, the green spaces in the city are just closed green space. There are challenge to transform the urban green to part of the urban landscape infrastructure. The waterfront open space has the potential to connect with each other, together with the canal, to transform to a type of landscape infrastructure.



- 1 Music theme park
- 2 City park
- 3 Neighborhood garden
- 4 Green corridor
- 5 City plaza
- 6 Sportsfield
- 7 Community park
- 8 Natural park
- 9 Park
- 10 Forest park
- 11 Community park
- 12 Historical remaining
- 13 Community park
- 14 Chinese garden
- 15 Universal

■ Water

■ Green space

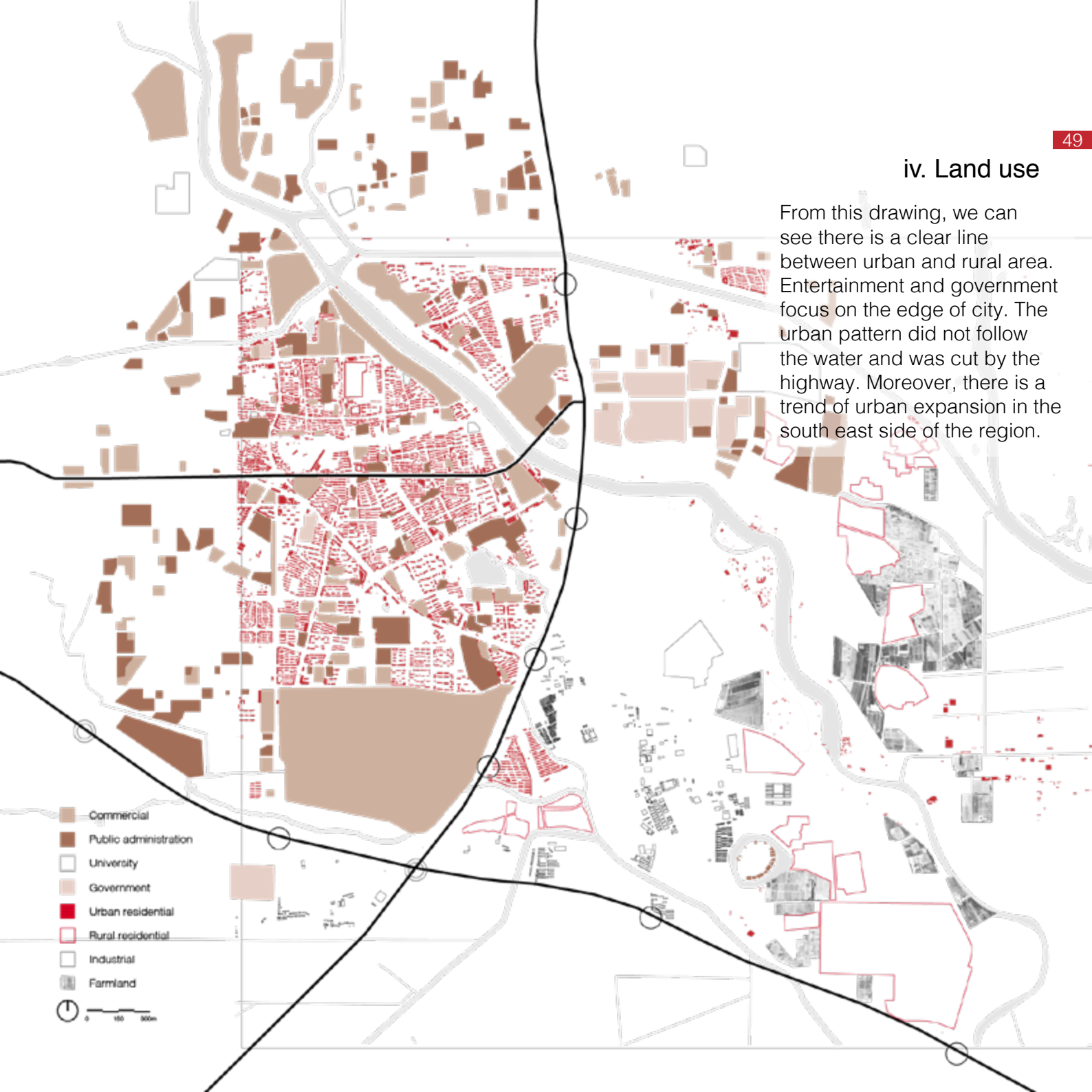
■ Building

⌚ 0 150 300m

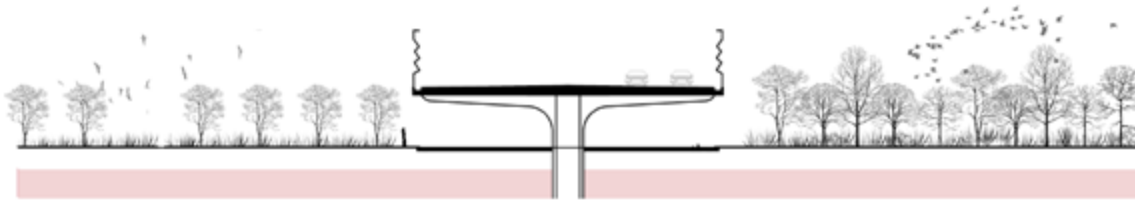


#### iv. Land use

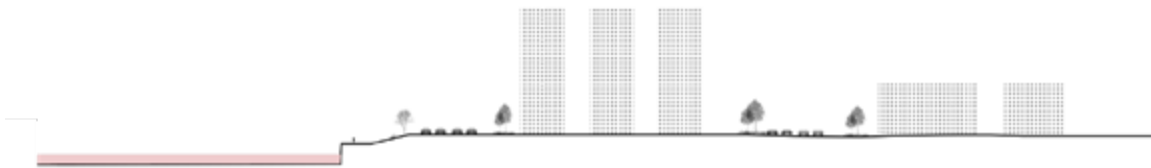
From this drawing, we can see there is a clear line between urban and rural area. Entertainment and government focus on the edge of city. The urban pattern did not follow the water and was cut by the highway. Moreover, there is a trend of urban expansion in the south east side of the region.



## v. Mobility pattern



Road cross the canal

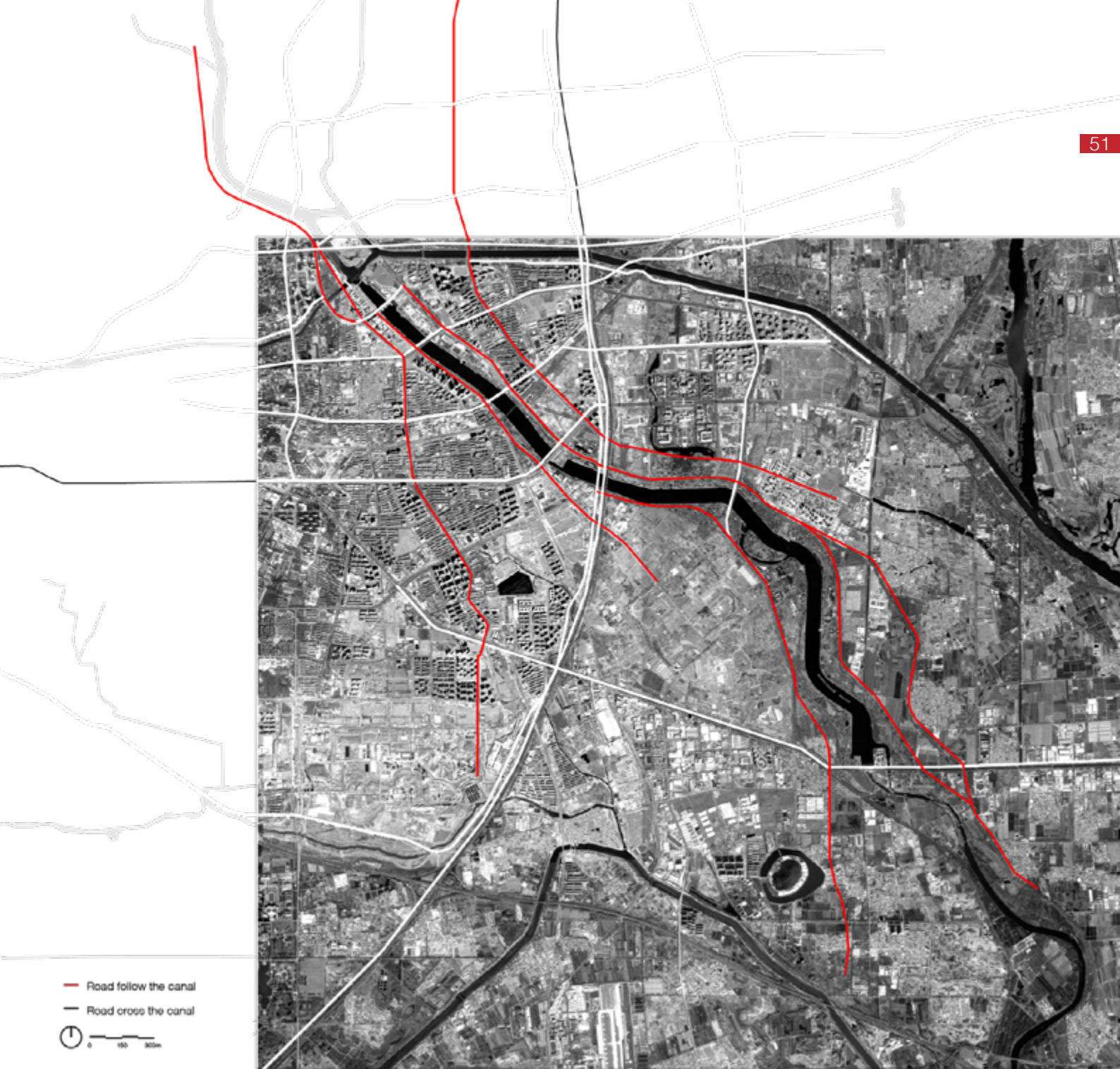


Road follow the canal

The roads cross the canal are the only connection between the two sides of the canal. Most of the roads mainly works for the vehicles or trains, which is not friendly for pedestrians or bicycles. Moreover, the space under the bridges blocked the longitudinal spatial communication along the canal.

The wide roads along the canal has cut the city and waterfront spaces. And there are few lateral connections from neighborhood to water.

So there is a potential to improve the connection between the canal sides for pedestrians and bicycles and improve the longitudinal connection along the canal by connecting the space under the bridges. Also, to narrow down the water side roads or create better connection between neighborhoods and waterfront.



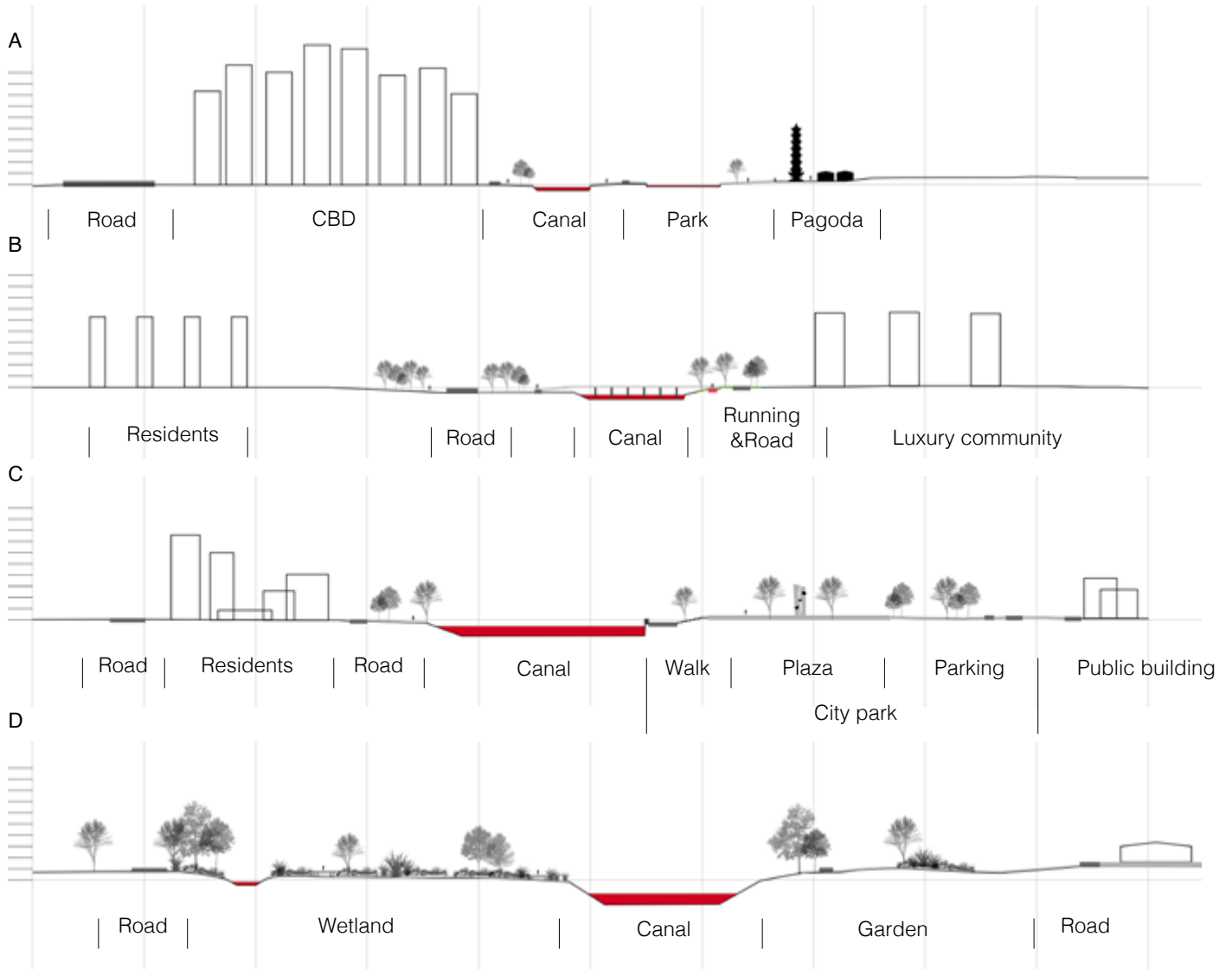


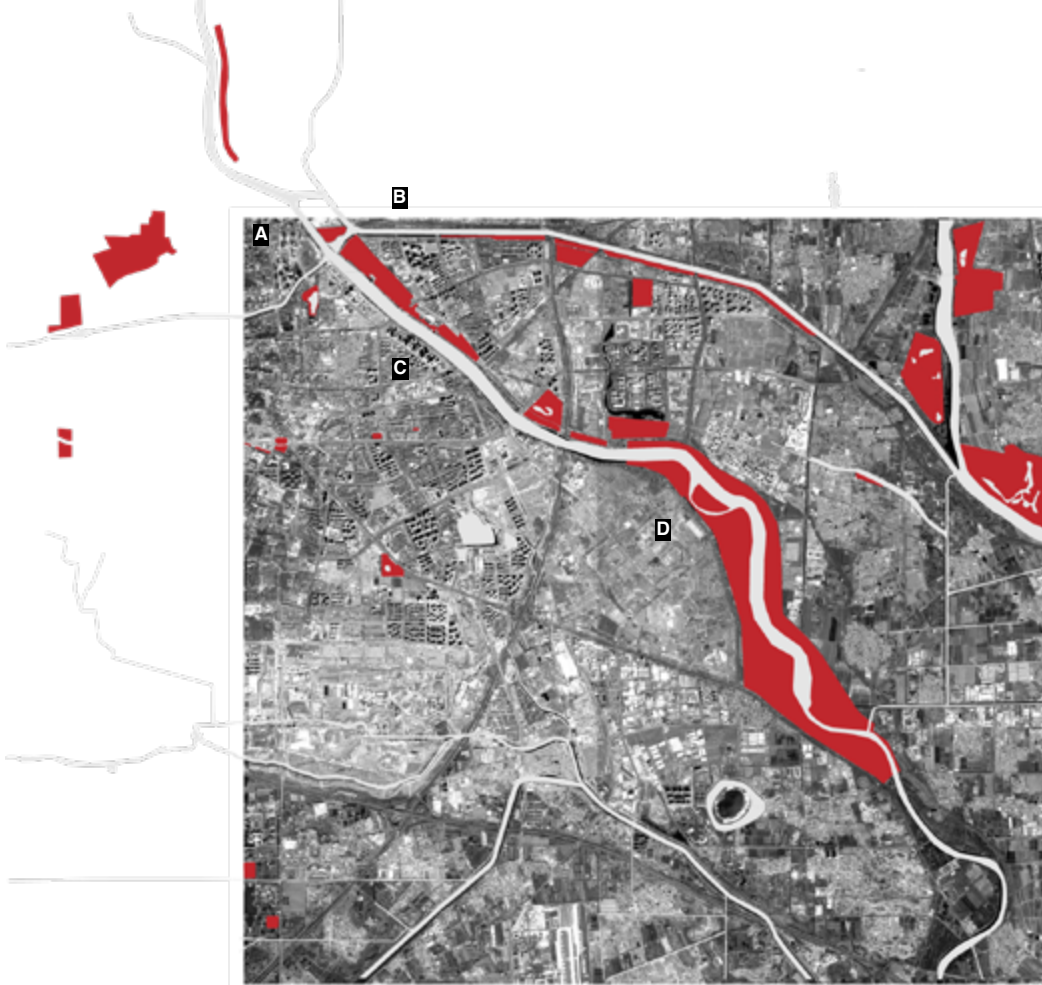
## vi. Canal-side

- Public space with weak connection to the community
- Lack of architectural context

Space along the canal was planned as Central Business District zone, luxury community and commercial center, city park and forest park. However, those spaces were not planned as a whole but separate system that disconnected with nearby communities, also the water was inaccessible for the public.





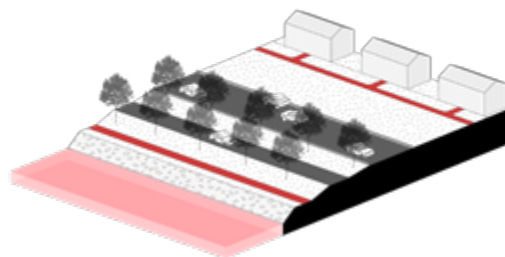
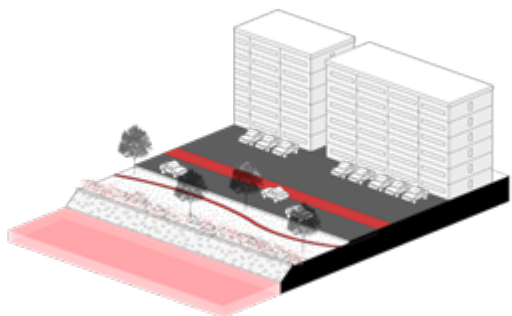


## vii. Lateral connection

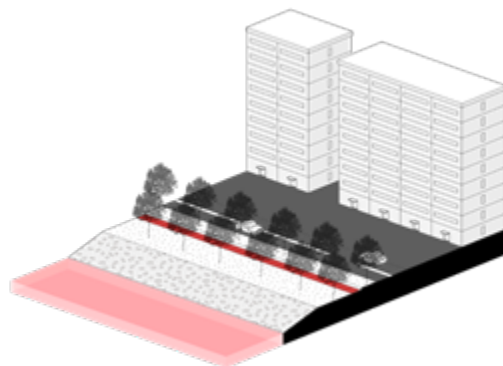
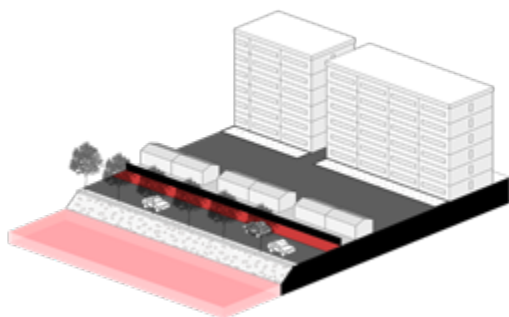
- Separate public system along the canal
- Space around the canal is a line instead of a zone
- Roads and boundary between community and water

Nowadays, both side of the Canal is busy with all kind of buildings, the Canal were framed by a stretch of green or parks. But less connection was made from buildings to the Canal. Space were only considered in the longitudinal way. The connection from neighborhood to the canal were mostly cut by road or highway. There are no visual connection or ecological connection.

A Central business center

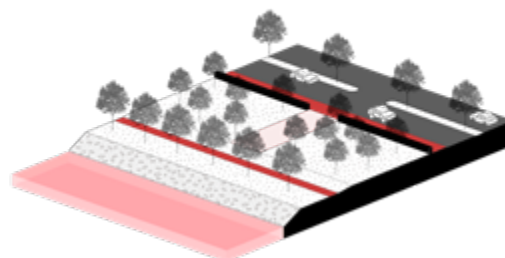
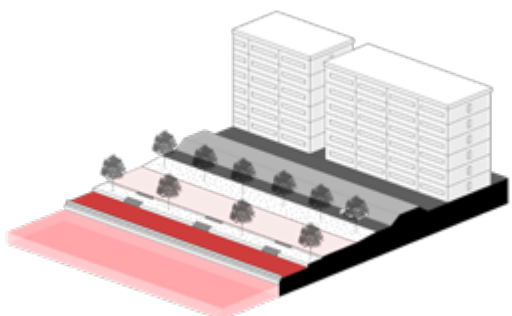


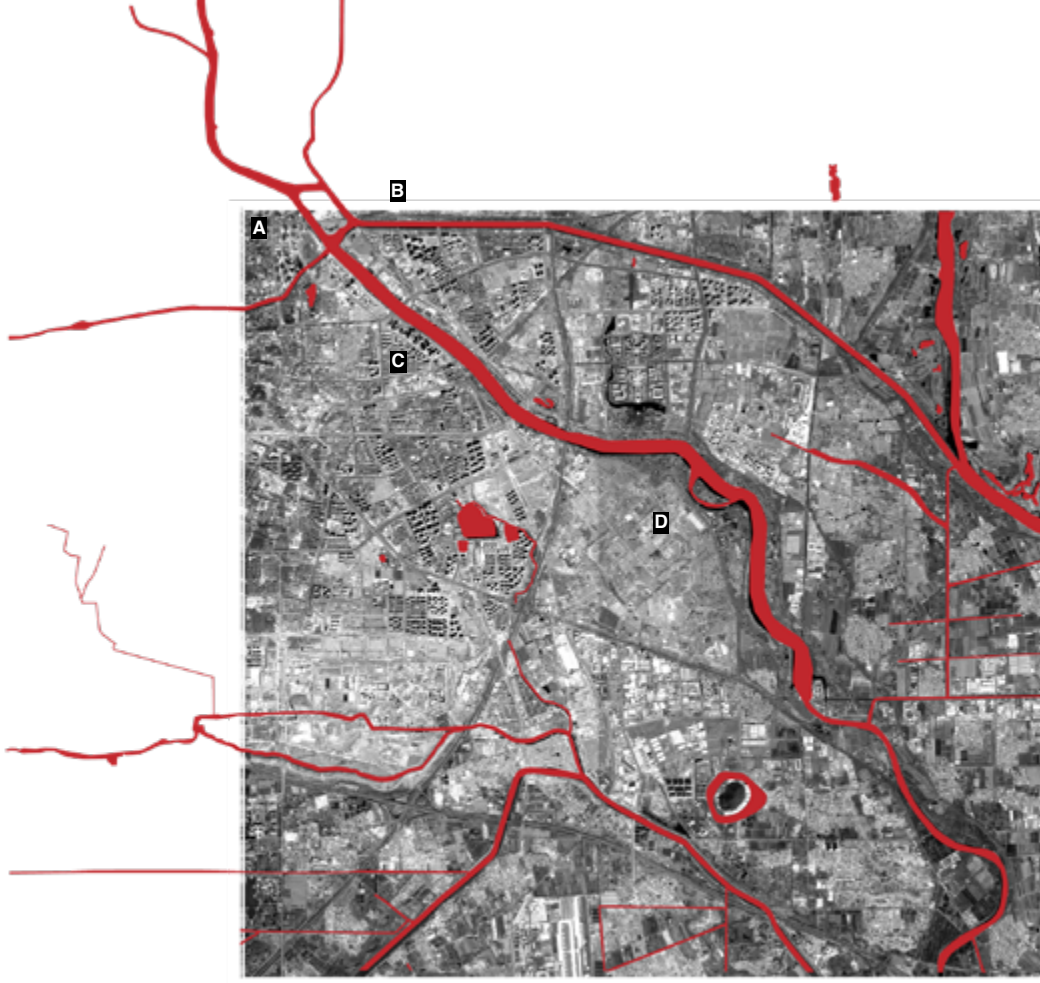
B Luxury community



C City park

D Forest park





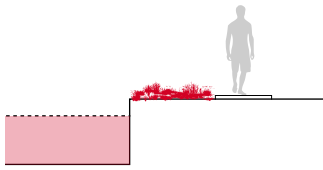
## viii. Vertical connection

- Boundary in the boarder of water
- Hard embankments all along the canal

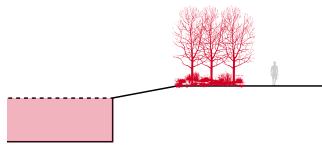
The space between people and water is also cut by all kinds of boundaries, such as shrub, wall or deep slope in different zone. No matter densified area or natural area.

There are no vertical connection for people to get to the waterfront. All the embankments are hard embankment, without possibility of diverse habitat.

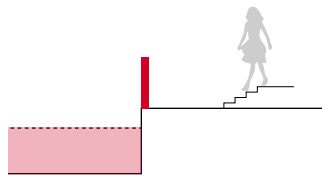
**A**



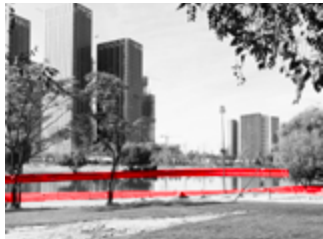
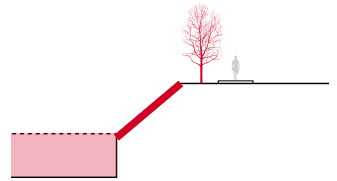
**B**



**C**



**D**



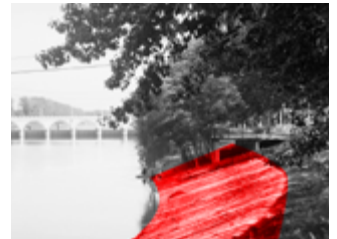
Central bussiness center



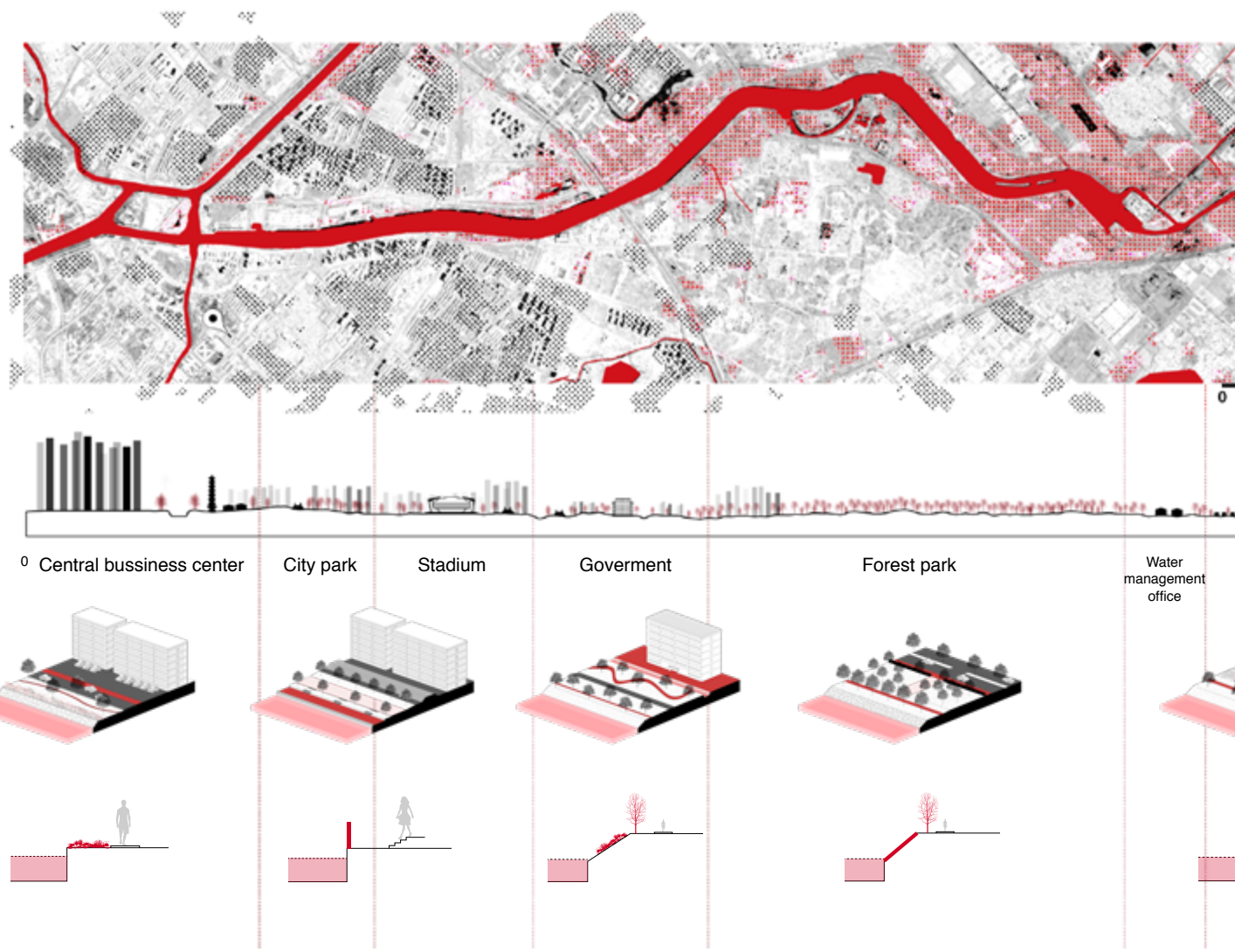
Luxury community & commercial



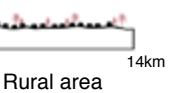
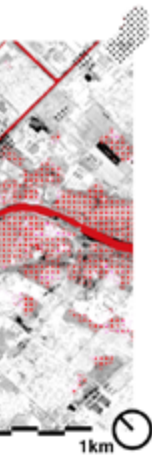
City park



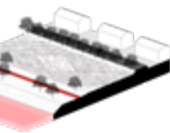
Forest park







Regional scale



Neighborhood scale



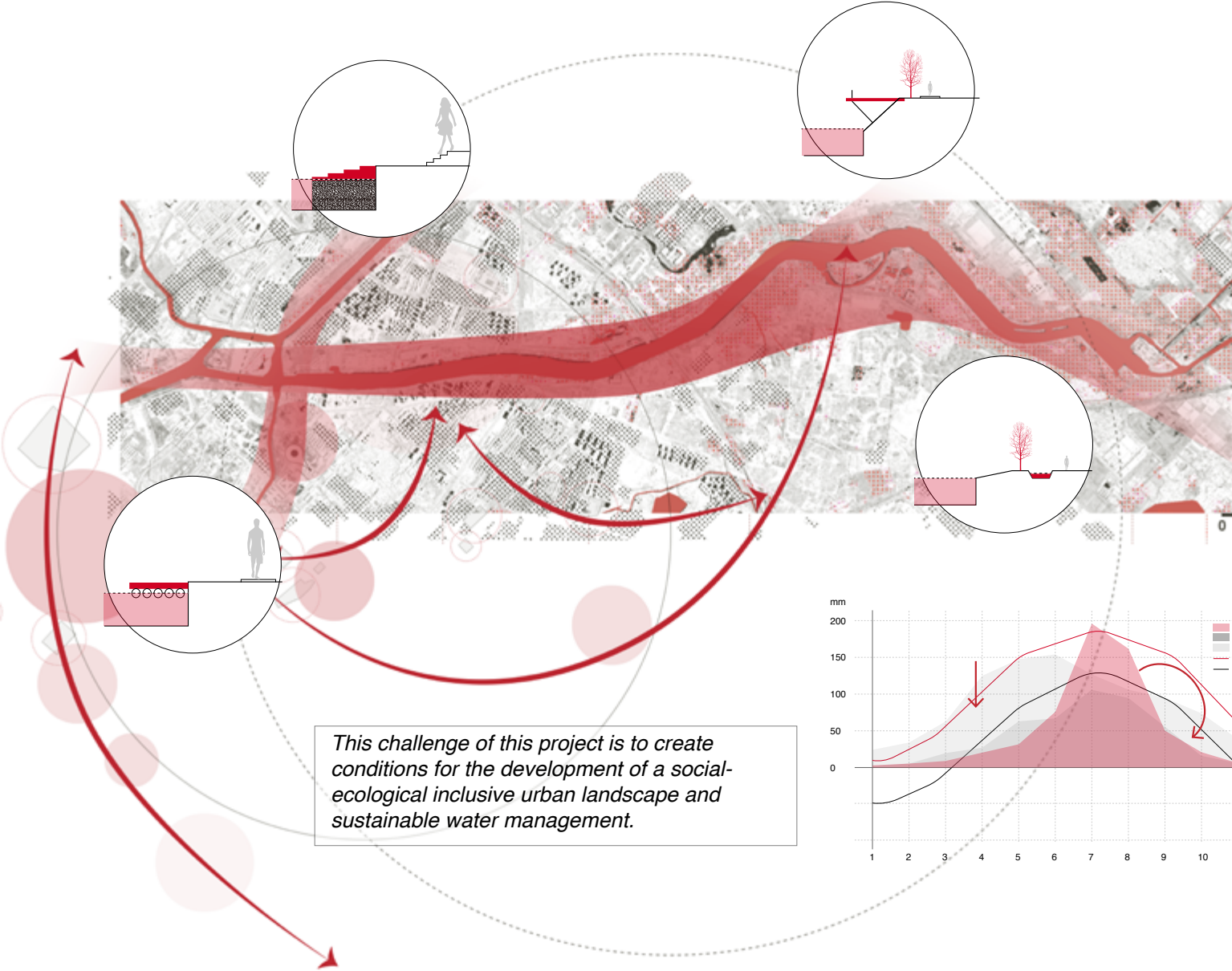
Human scale

In conclusion, the context from north to south is changed rapidly from dense to scattered. Lateral and vertical connection between neighborhood and water, people and water, ecological connection are missing.

Nowadays, the Grand Canal has lost its identity in urban area like Tongzhou. Regarding the social aspect, there are weak longitudinal, lateral and vertical connection. Public space along the canal is separated from each other, the canal side is a line instead of a zone. The public space has a weak connection to the community, there are always boundary between people and water. For ecological aspect, there are no coherent green system to benefit an adaptive and resilient city. By this measure, it can solve the water logging issue, help with water infiltration and retention, form diverse habitat for fauna and flora.

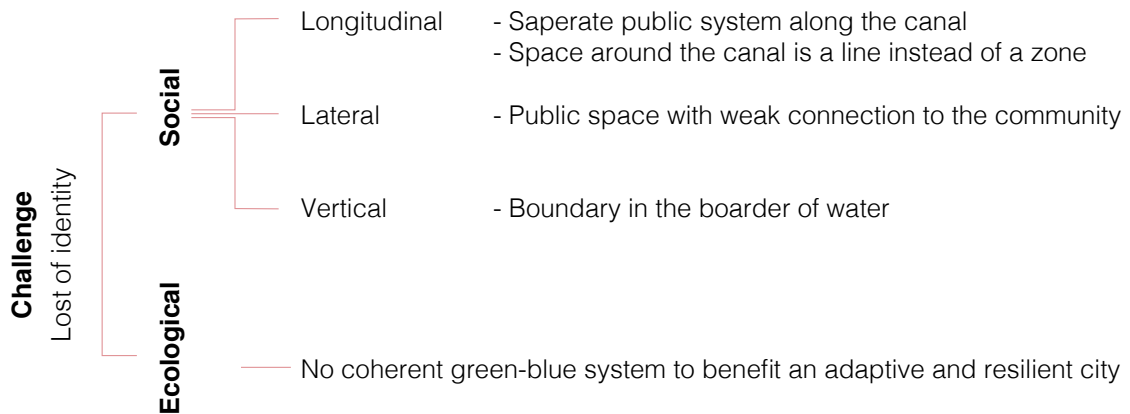
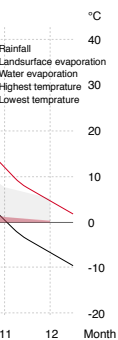
# V /Summary

## Challenge



*This challenge of this project is to create conditions for the development of a social-ecological inclusive urban landscape and sustainable water management.*

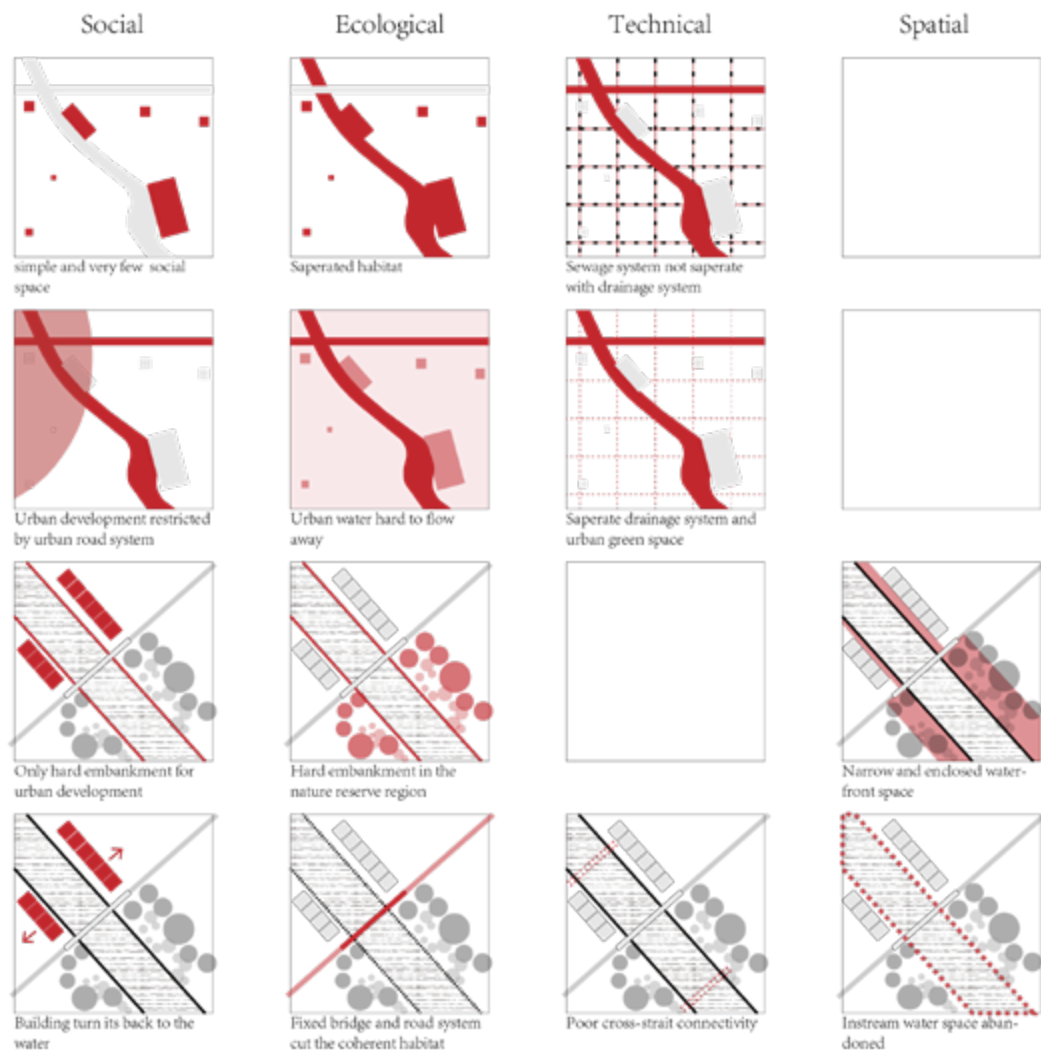




This chapter sorts out the construction process of the Beijing-Hangzhou Grand Canal from ancient times to the present. Through the study of the Grand Canal at different scales, we have learned the historical value of the canal, the basic form of the canal, and the relationship between people's lives and the canal. Historically, the value of the Grand Canal was mainly social and cultural, ecological value, and economic value. It is reflected in several aspects: diverse lifestyle and entertainments, cultural spread of cities along the canal, promoting the economic development, the treatment of rain and flood, providing water sources for agricultural production, and also promoting people's aesthetic level, drove the development of architecture, etc. Later, through analysis of Beijing's water resources and analysis of Tongzhou in ecological and social aspects, it was found that Tongzhou is a city with uneven rainfall. There are storms in summer and less rain in other seasons. Most of the cities are hard paved, and few green spaces can collect rainwater and guide rainwater infiltration. The conclusion from the social perspective is that the space along the canal lacks integrity and the waterfront space lacks connectivity with neighborhoods and people. It can be classified as a lack of social connectivity in longitudinal, lateral, and vertical directions.

# Potential framework

Comparing with and studying from the history



Tongzhou



Social

Ecological

Technical

Spatial



Garden system provid public space



Coherent habitat



Water storage



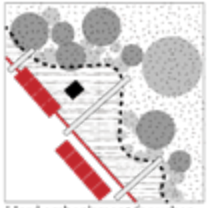
Urban water road system



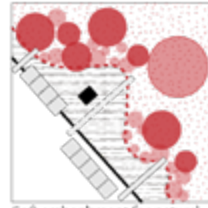
Flood control



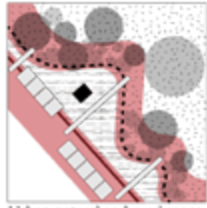
Coherent drainage system



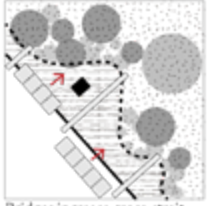
Hard embankment for urban development



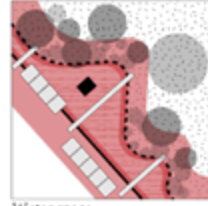
Soft embankment for natural development



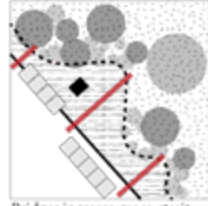
Urban natural and rural space



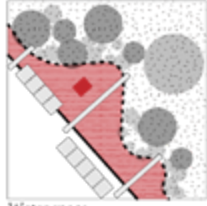
Bridges increase cross-strait connectivity



Water space



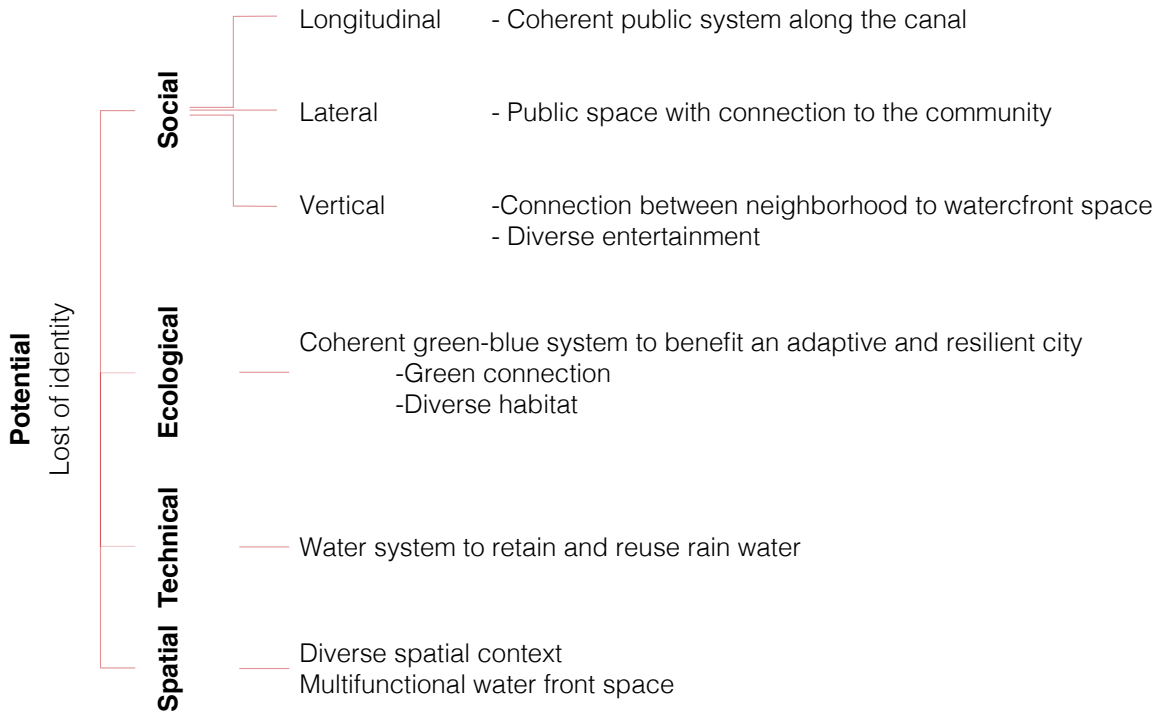
Bridges increase cross-strait connectivity



Water space

History





Comparing the historical functions and values of the Grand Canal, it is found that in present time, the function of canal in Tongzhou section is relatively simple. It is mainly reflected in the canal's urban function and the interaction between the canal and people. Through the study of history and referring it to the theoretical framework, the value of the Grand Canal can be enhanced in social, ecological, technical and spatial aspects. For example, enhancing social connectivity in the three directions: longitudinal, lateral and vertical. It is mainly reflected in connecting the public space around canal, designing guiding structures between the community and the waterfront space, and choosing the corresponding form of revetment according to the surrounding environment. Moreover, by establishing a complete green system, to strengthen the connectivity of green space and to create diverse habitats Thirdly, establishing an independent rainwater collection system, combining green space to mitigate rainstorm issues and dry issues, and collecting and reusing rainwater. Last but not least, by combining the strategy of the above aspects and the spatial context of the city, create a diverse social-ecological environment and diverse waterfront space. All in all, this project aims to create conditions for the development of a social-ecological inclusive urban landscape and sustainable water management.

In the next chapter, we will explore the design by different scenario, and extend the design for the potential in social, ecological, technical and spatial aspects. Then select the appropriate design strategy and interpret from different scales.

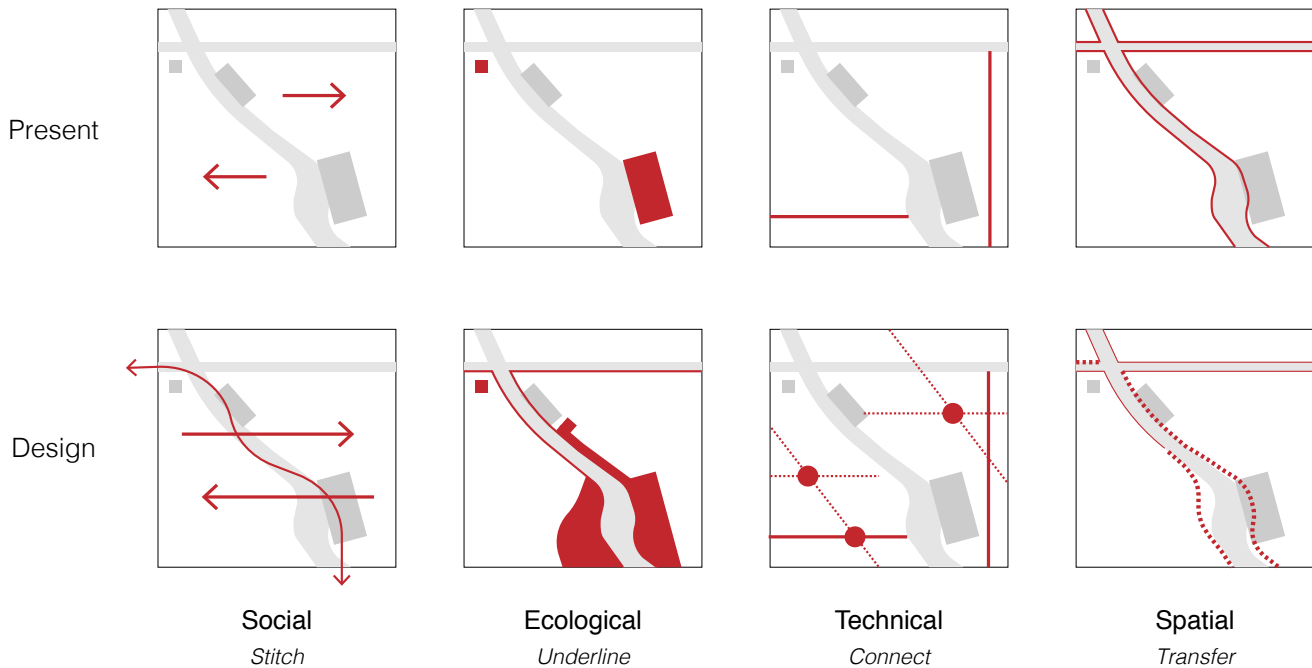
# SCENARIO



This project aims to create conditions for the development of a social-ecological inclusive urban landscape and sustainable water management. By enhancing the character of the Grand canal. Build physical and visual connection between neighbourhood and water. Build connection between people and water, strengthen in vertical connection. Mitigate flooding and lack of water by lateral principles.

According to the four discourses, social, ecological, spatial and technical mentioned in the methodology chapter, there are four extreme design ideas for different design themes. By researching and brainstorming, conclude the principles from history, case study and theories. The final design is to select and combine the prominent parts of the four designs to form a social-ecological integrated design.

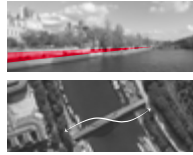
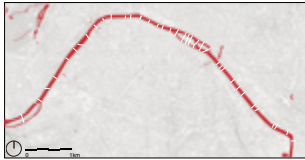
This chapter addresses the question:  
How to transform the canal to a **landscape infrastructure**?



- Stitch** Enhance the longitudinal connection along the watercourse, enhance the lateral connection between the city and waterfront zone
- Underline** More green space and green corridor
- Connect** Connect the urban rainwater system with public green, turn part of the pipes and covered waterway to open water
- Transfer** Redesign the vertical connection between soil and water, soften the embankment

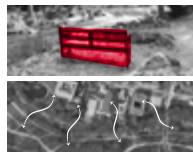
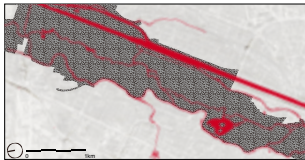
## i. Stitch

### Stitch the city and waterfront



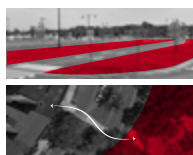
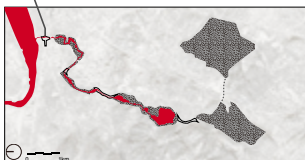
River Seine

- Similar width and length as Grand Canal in Tongzhou, with 30 different bridges stitch up both sides of the canal



English Garden

- Park form longitudinally
- Natural reserve
- Connection with the neighborhood



Emerald Necklace

- Continuous green longitudinally
- Boulevard connect parks
- Guide for pedestrian to the park

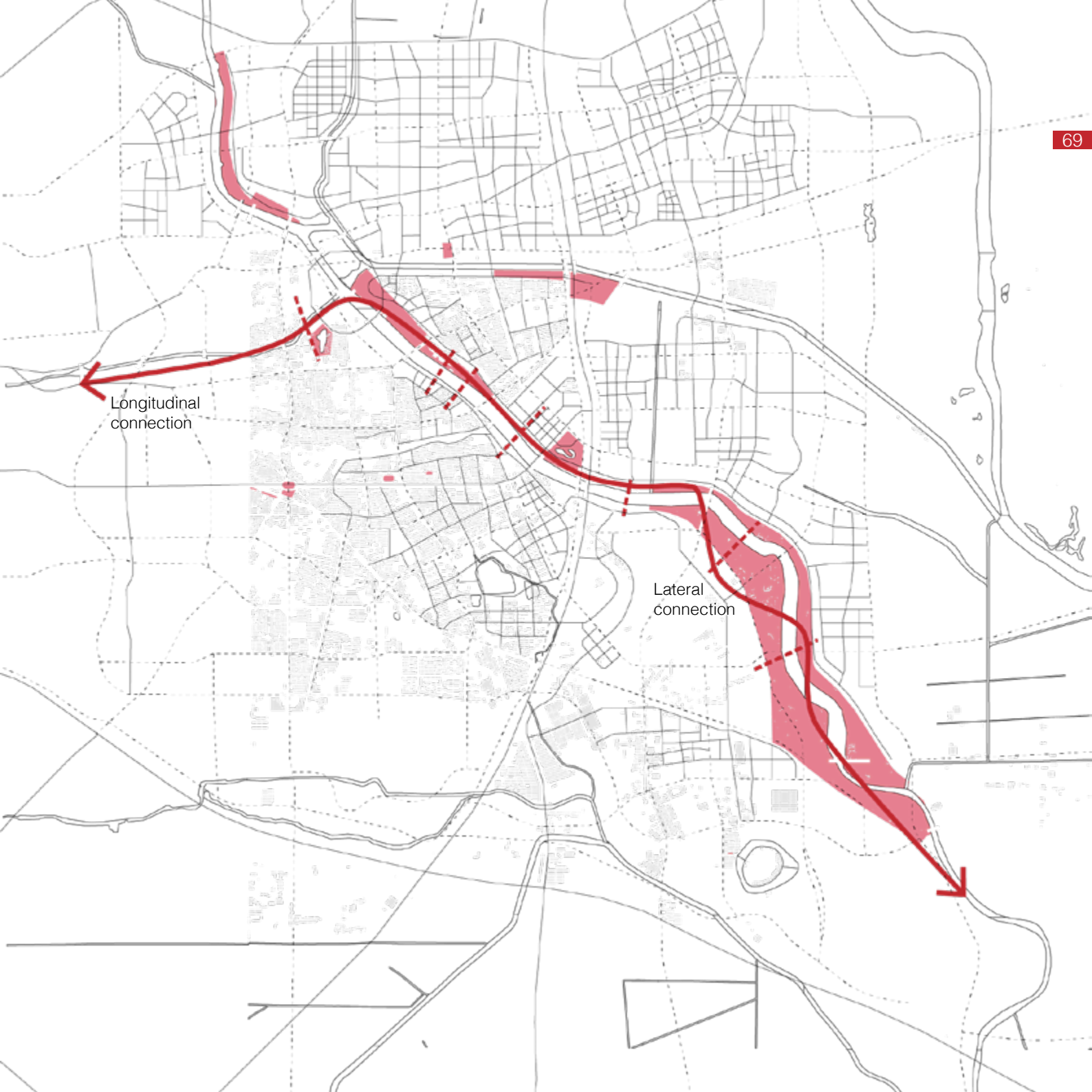
Source: Google map & Personal archive

The first design assignment is to focus on the longitudinal connection and the lateral connection.

As expounded in the diagnosis chapter, there are separate waterfront space along the grand canal. In this assignment, there is a focus to design a longitudinal connection between different waterfront public space. The idea is to design a coherent routing system, for example, the cycle route and walking way along the canal. Moreover, using differ the atmosphere of the waterfront space based on the surrounding urban context and the urban fabric.

Secondly, to stitch the two sides of the canal and to build the lateral connection from the neighbourhood to the waterfront. Learning from the River Seine in Paris, there is a potential to double the number of bridges along the canal, especially the pedestrian bridges. From the case Emerald Necklace in Boston and the English Garden in Munich, there can be more openings from the neighbourhood to the waterfront. Also, using boulevard or continuous green to guide the neighbourhood to the waterfront. The backyard of the neighbourhood can also be connected to the waterfront green space.



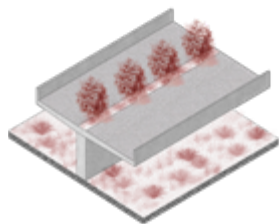


Longitudinal connection

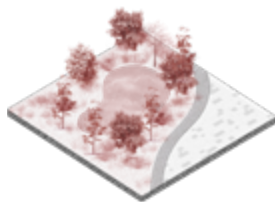
Lateral connection

## ii. Underline

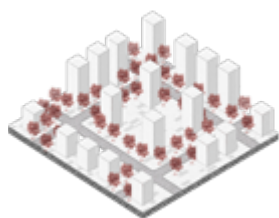
### Attractive corridor



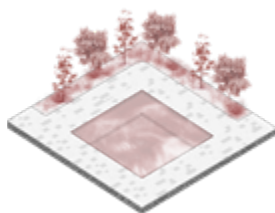
Green band



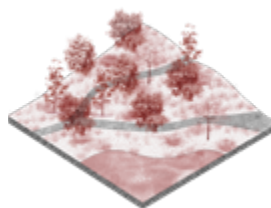
City park



Green grid



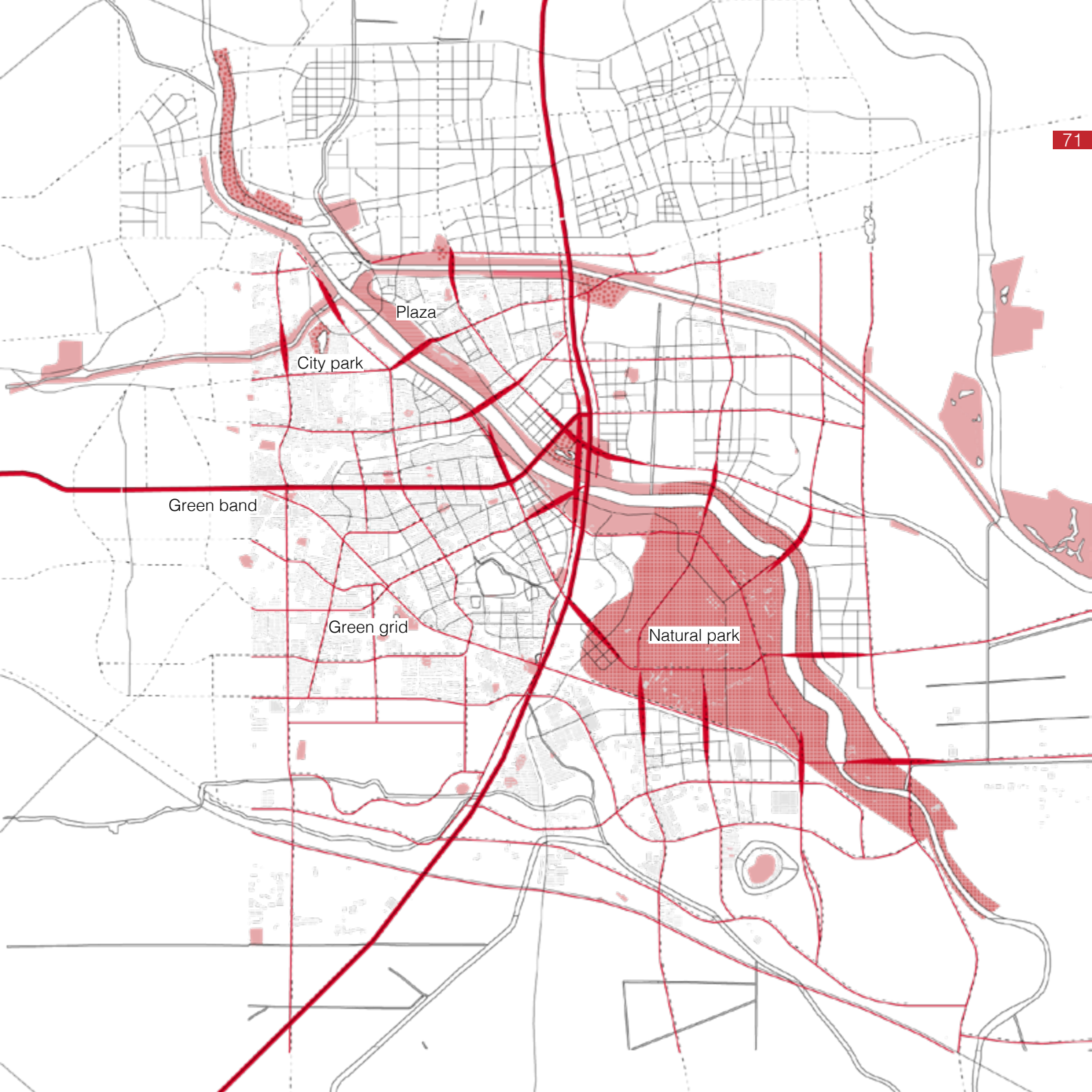
Plaza



Natural park

The second design assignment is to focus on the coherent green-blue system to benefit an adaptive and resilient city.

As explained in the diagnosis chapter, most of the urban space is taken over by building or other kinds of infrastructures, the ground was covered by hard pavements. Moreover, there are few parks or other kinds of green space in the urban area. The existing plaza was mostly covered by hard pavements, which lack the consideration of the ecological development. Hence, the waterfront area has the potential to focus on ecological dimension and to make habitats for fauna and flora. In the meantime, since there are waterlogging issues in few of the urban area and there are storms in summer in that region, there is a need for water collection and drainage. In order to do this, ponds or water tank are considered to design together with the green system. Also, there is a potential to apply the green corridors like line trees, rain garden or other kinds of ecological corridors along with the road system.



Plaza

City park

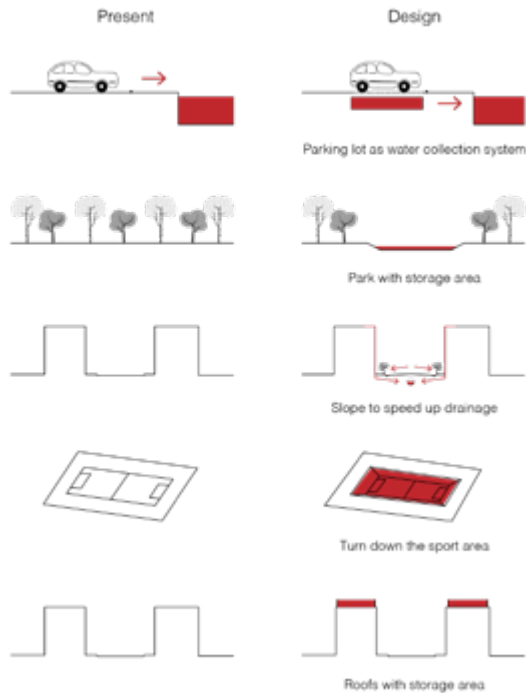
Green band

Green grid

Natural park

### iii. Connect

#### Every drop count

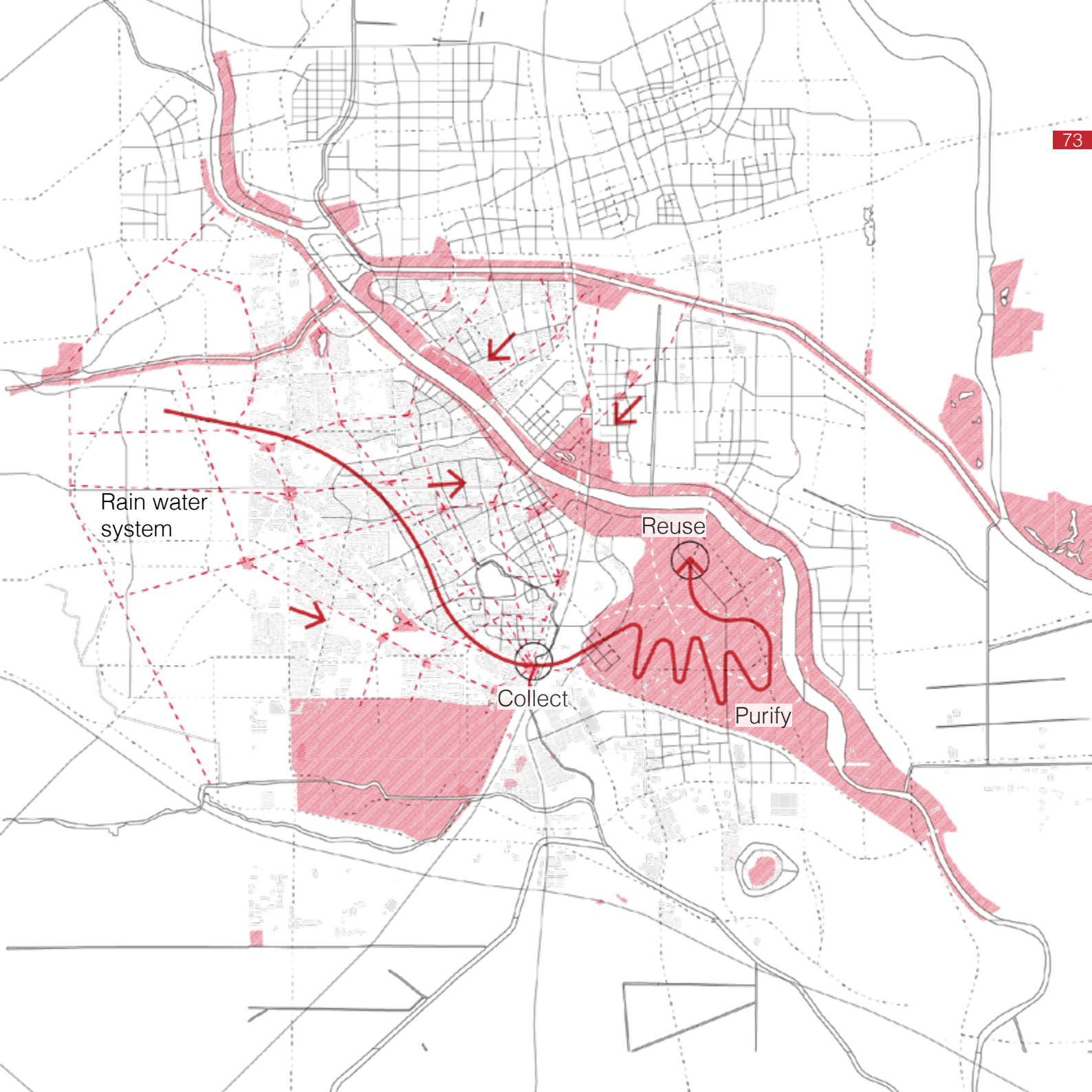


Inspired by: Viganò, Paola. Water and asphalt : the project of isotropy

There are problems of uneven rainfall in that region. In summer, there are storm while in winter, there are almost no water. Moreover, the sewage system and rainwater system in this region is a combined system now.

The assignment is to collect the rainwater in summer and reuse them in the dry season. First, to disconnect the sewage system and the rainwater system. Connect the rainwater system following the pattern of the roads. Using parking lot, rooftop, sports area, storage area in parks and rain garden along the road to collect rainwater. Invite more public space such as plaza or park in the water logging area for water storage. In the end, all the water flow to the south based on the natural terrain, after few processes of purification, the rainwater were reused in the recreational natural park.





Rain water system

Collect

Reuse

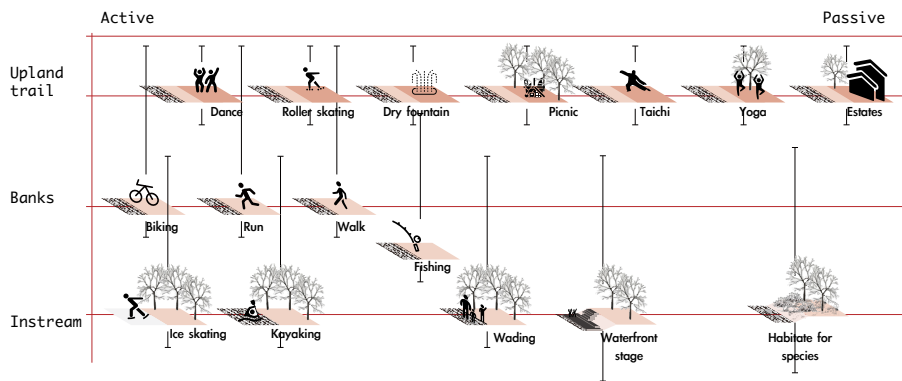
Purify

## iv. Transfer

### Water as the urban landscape substrate

G.M. Kondolf, P.J. Peira / *Geography* 277 (2017) 192–206

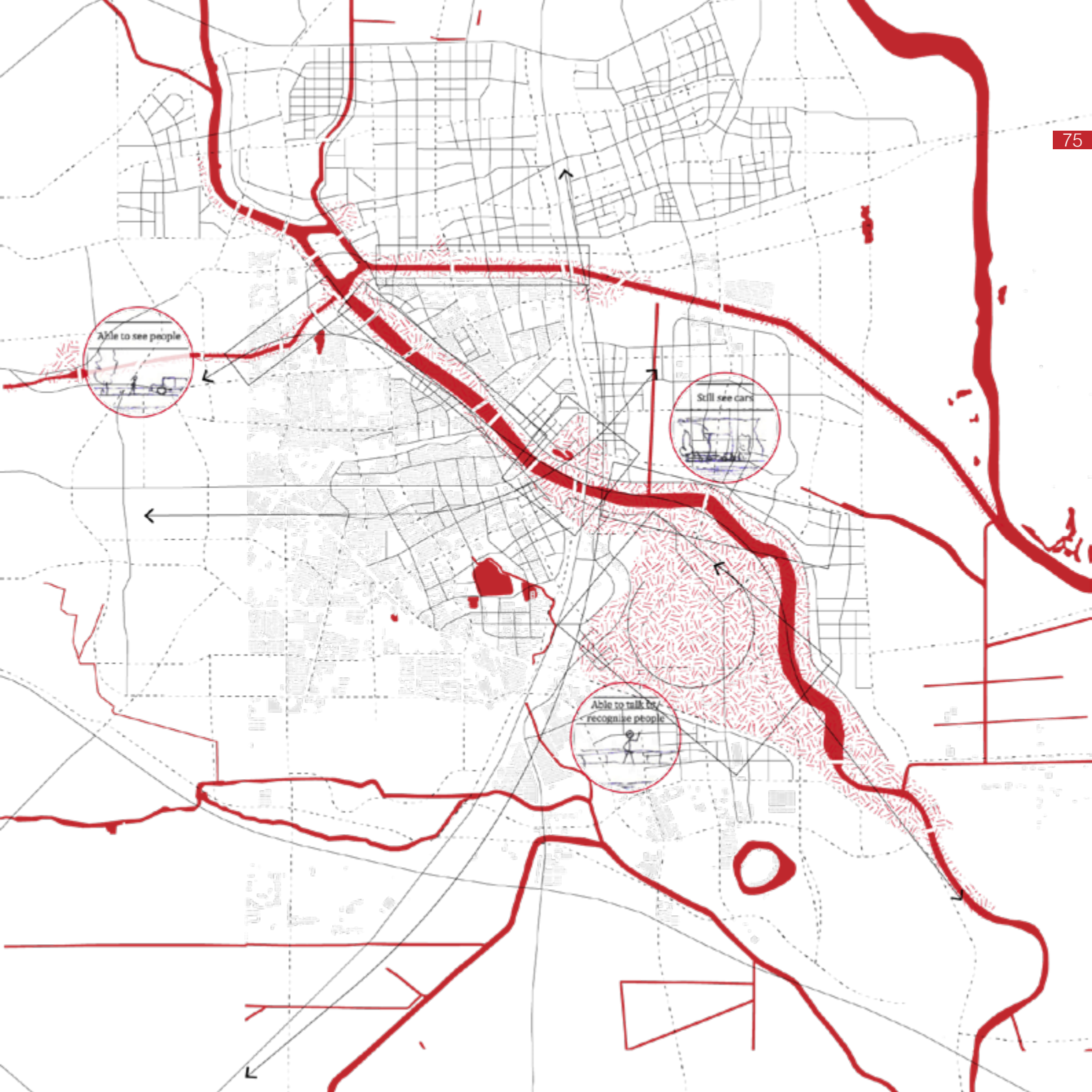
	0	10	20	30	40	50
How "close" is the urban bank?	Able to talk to recreation people	Able to see people	Still see cars	See large trees	Still see buildings	See skyline
Bridging the river	Culverting easy	Bridging easy	Bridging normal	Bridging hard	Bridging rare	Only major crossings
Does the street pattern follow the river?	Streets ignore river	Organic street patterns follow river, grids do not	Grids follow river	Grids follow river	Highways follow river	
What kind of waterfront uses?	Little or no setback	Narrow streets	Embarkments, narrow gardens	Water streets, waterfront gardens and squares, docks	Water linear infrastructure and waterfront squares	Large port areas, piers and docklands, waterfront parks



Inspired by: Kondolf. The social connectivity of urban rivers

This assignment is focusing on the waterfront space, to develop the spatial atmosphere along the canal.

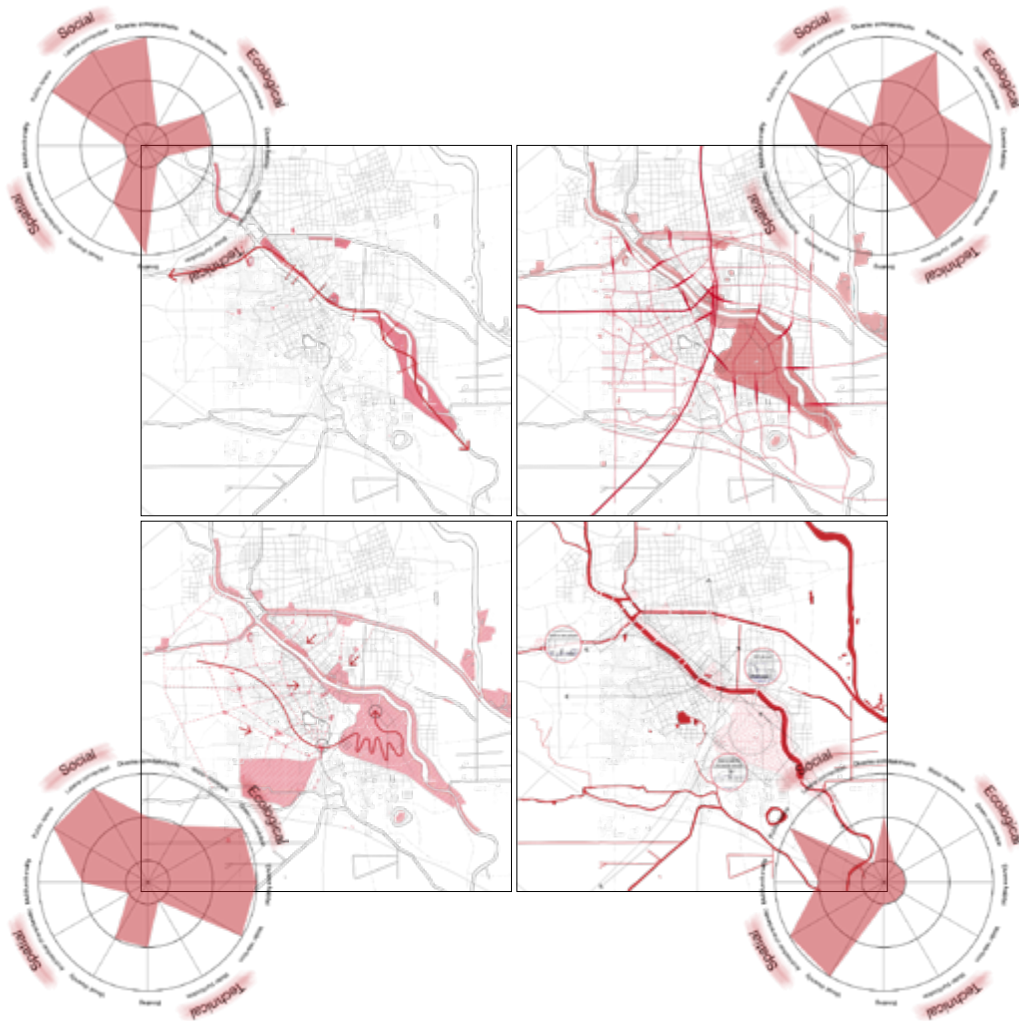
Since the canal is narrow in an east-west way and wide in a north-south way, the visual quality diverse along the canal. There can be different waterfront space along the canal based on the urban context. Also, there is a potential to change the type of embankment and make space for diverse waterfront activities. Inspired by Kondolf, the waterfront activates can be considered by upland trail, banks and instream. Diverse embankments are to be considered along the canal, for example, stairs or soft embankments.



Able to see people

Still see cars

Able to talk but recognise people



## v. Conclusion

The design can be reflected on four themes of stitch, underline, connect and transfer to test how to achieve the social-ecological integrated design.

This chapter proposed corresponding design strategies to different discourses from four topics: stitch, underline, connect and transfer. Evaluating the value of each topic in social, ecological, technical and spatial aspects, there are overlay in the four themes. The final regional scale plan is obtained by selecting and superimposing the design of four themes. The next chapter will explain the regional-scale strategies.





# REGIONAL STRATEGY

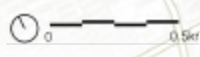
How to use the **water source** in  
Tongzhou as **part of the urban**  
**infrastructure?**



- Open soil
- Water
- Hard pavement
- Wetland
- Forest
- Residential zone
- Line trees

- Intervention**
- a. Green buffer
  - b. Fountain(water inlet)
  - c. Natural park
  - d. Wetland
  - e. Bio-swale
  - Longitudinal connection
  - New bridge
  - Lateral corridor
  - Water interactive infrastructure
  - View tower

- Existing**
- 1. Community Garden
  - 2. City park
  - 3. Historical park
  - 4. Community park
  - 5. Forest park



Collect



# I /Development strategy

Regional scale



RURAL RESIDENTIAL AREA

30min E.S.

5

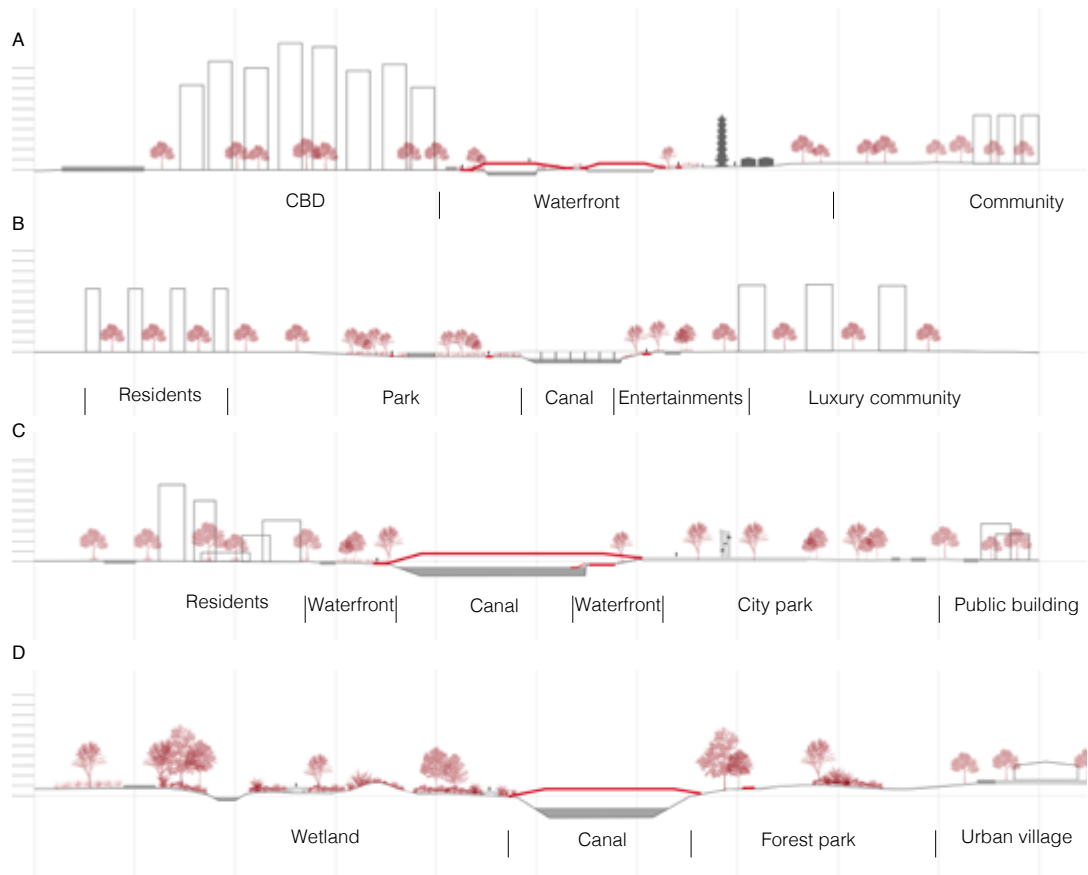
d

Purification

Reuse

Discharge





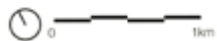
In this layer the design focus on the new longitudinal connection of the waterfront space, and the lateral connection from the neighbourhood to the waterfront space.

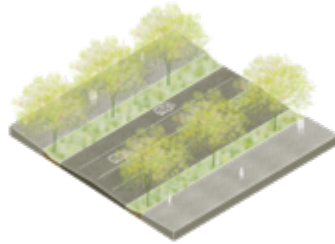
Increase the connectivity between the two sides by applying more bridges, increase the lateral connection for pedestrian from the community to the waterfront, and increase the longitudinal connectivity through the pedestrian system, biking system and various activity spaces.



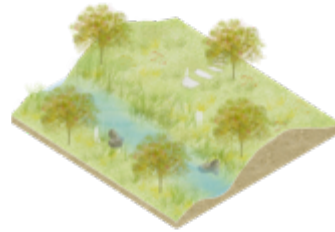


- Natural park
- Wetland
- Urban park
- Public open green
- Plaza
- Green infrastructure





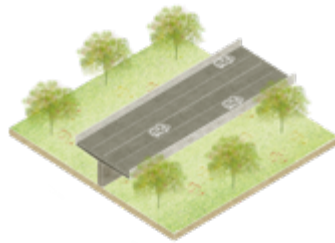
Green infrastructure



Wetland



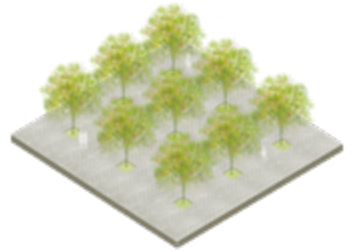
Natural area



Open soil



Urban park



Plaza

This layer focus on the ecological value brought by the landscape method. The site is a highly residential area with dense apartments, there are limited green space in the city.

By redesigning and connecting the urban green system and waterfront space, the green space is divided into green infrastructure (line trees), wetland, natural area, public open green, urban park, and plaza. Connect the green infrastructure with the public green space to form a green system in the city. The green space system not only provides activity space, diverse habitat but also can be used as a sponge for water infiltration, which can accelerate the infiltration of rainwater and relief the flooding issues caused by heavy rain.





- Waterway
- Flooding zone
- Open soil
- Hardpavement for water storage
- Green infrastructure for water storage
- Underground rain water system





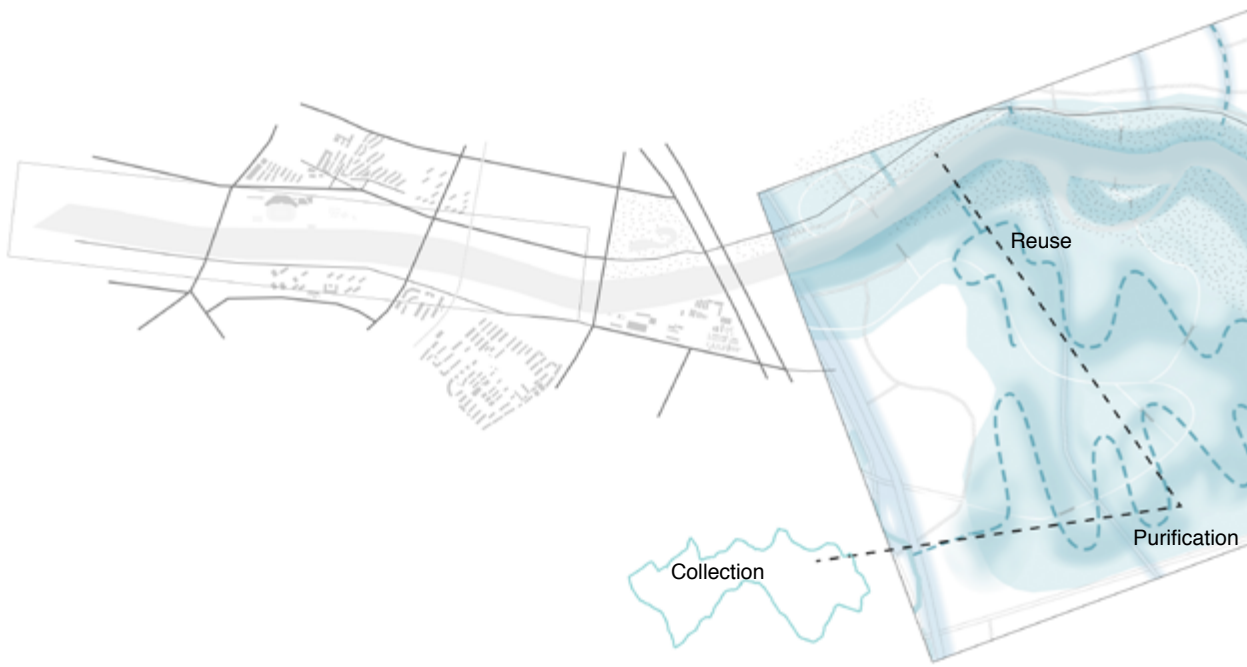
Dry season



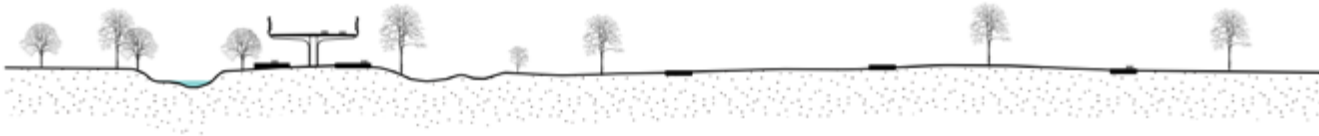
Rain season

This layer focus on the adaptability of Tongzhou district to extreme climates. In Tongzhou, there are heavy rains in summer, and other seasons are dry and lack of water. By collecting rainwater during the rainy season and reusing it during the dry season, alleviate the extreme conditions facing by the city.

There are soft surfaces, sports field, rooftop, infiltration hard surface, waterway and ponds in the city to retain the rainwater. Connecting these spaces by a separate rainwater system, and collecting rainwater in the relatively low-lying southeast side. Then purify, store and reuse rainwater through the wetland.



Previous

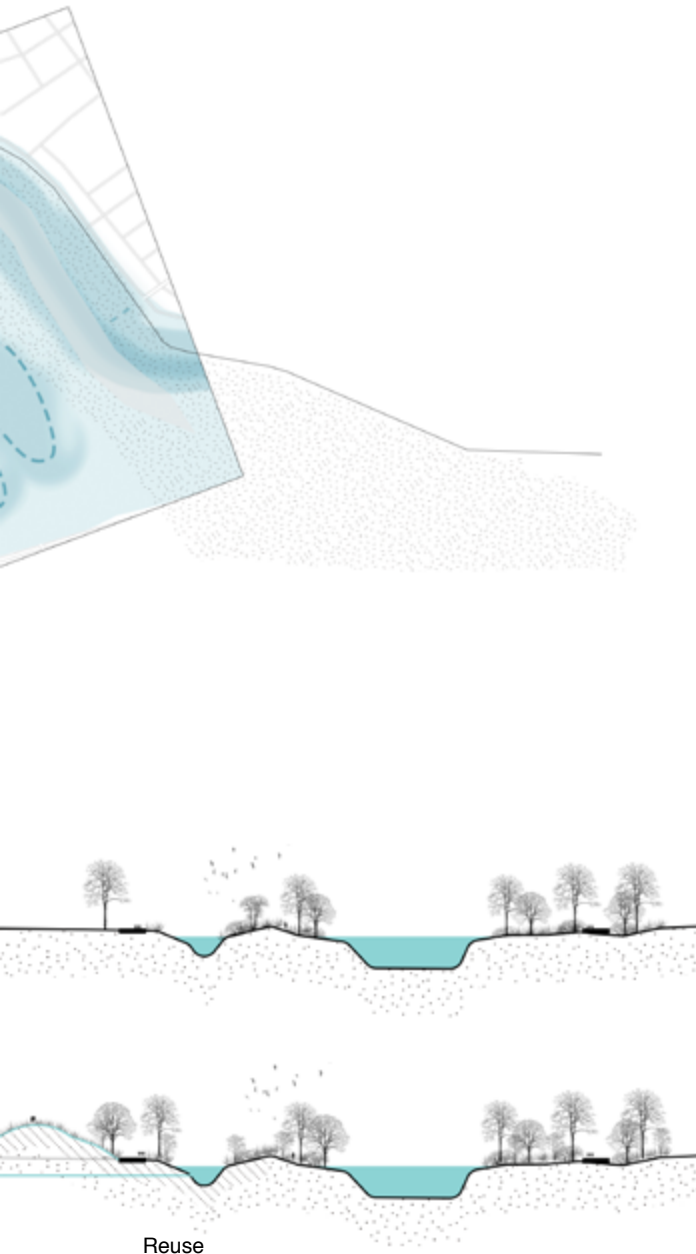


Design



Collection

Purification



The rainwater collected from the urban area will be purified through the meandering water corridor and retain here as water source for the wetland.

This area was originally abandoned industrial land. The artificial terrain was formed by the principle of balance between digging and filling. Through the natural terrain and drainage system in the city, the rainwater flows to the collection center. After the preliminary decontamination treatment in the rainwater collection center, the treated rainwater enters the wetland through underground pipes for further purification. In the dry season, when the water level of the river drops to the lowest, the low-lying water in the site will remain in the wetland, ensuring that there is water in the wetland all year round. These winding waterways and the gradient between islands and depressions provide a diverse habitat for wildlife.

Visitors can also enjoy the walk system, footbridge, lookout and hillocks in the venue while integrating people and nature, and ensuring that the human activities will minimize the disturbance and destruction of natural habitats.

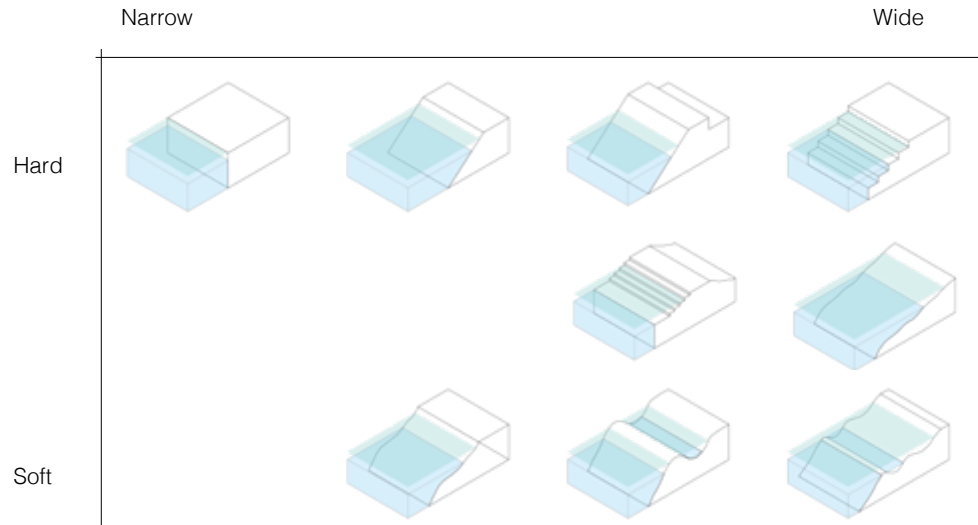


This layer shows  
visual experience  
Canal flows from  
from concrete to  
different forms of  
and interactive

is the spatial-  
 ce along the Grand  
 n urban to natural,  
 o soft by applying  
 of embankments  
 infrastructures.



## Embankment



## Interactive infrastructure



Chair



Look out



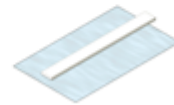
Pavillion



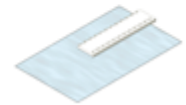
Observation  
 path



Floating  
 deck



Bridge



Dock





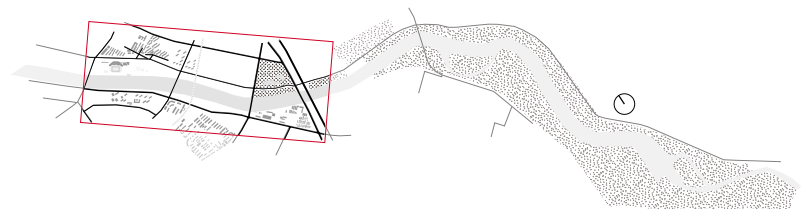
# LOCAL IMPLEMENTATION



Select the transition part of the site, where the context transforms from urban to natural.

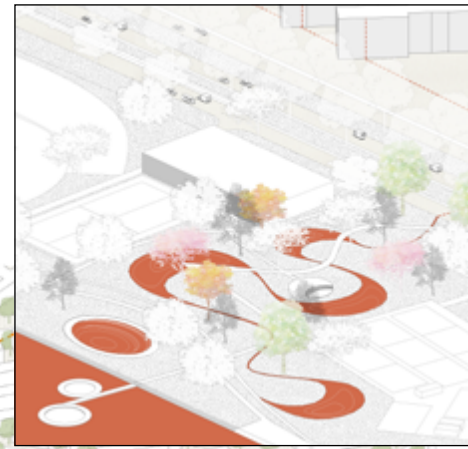
In the urban context, there are dense residential areas and various sports fields on different sides of the canal. Connecting the two sides through bridges, and strengthen the connectivity of the community and the canal space by applying new road systems and green space systems **(stitch)**. Redesign the waterfront and waterfront space, turn infrastructure as landscape. At the same time, despite the social functions of the green space, it is also designed for fluctuated rainfall and water purification. The rainwater in the community will be collected, purified and reused **(connect)**. Reflects the social-ecological value of the waterfront space.

In the natural context, use the canal space as a multifunctional space to provide diverse habitat and diverse landscape **(underline)**. Break the spatial division caused by the bridge and strengthen the lateral connectivity along the canal **(transfer)**.



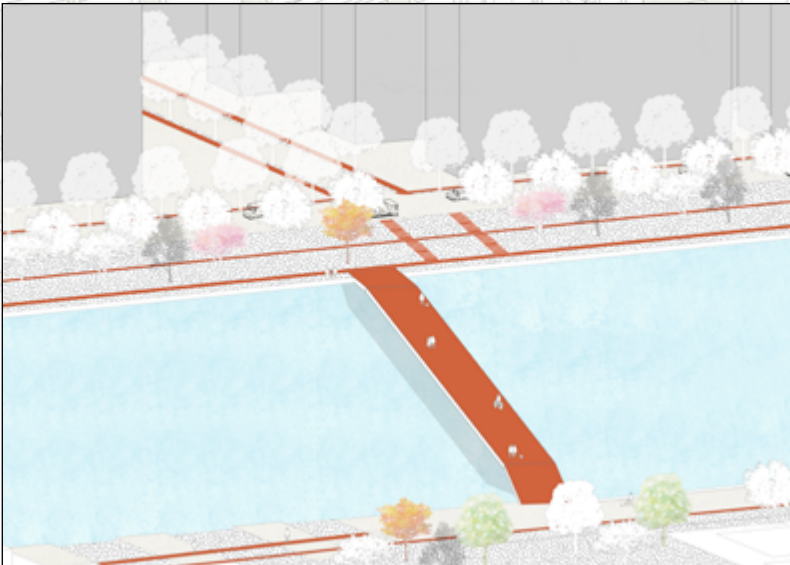
### Technical aspect- Connect

Connect the urban rainwater system with public green, by purification and restoration, reuse the rain water in the community park.



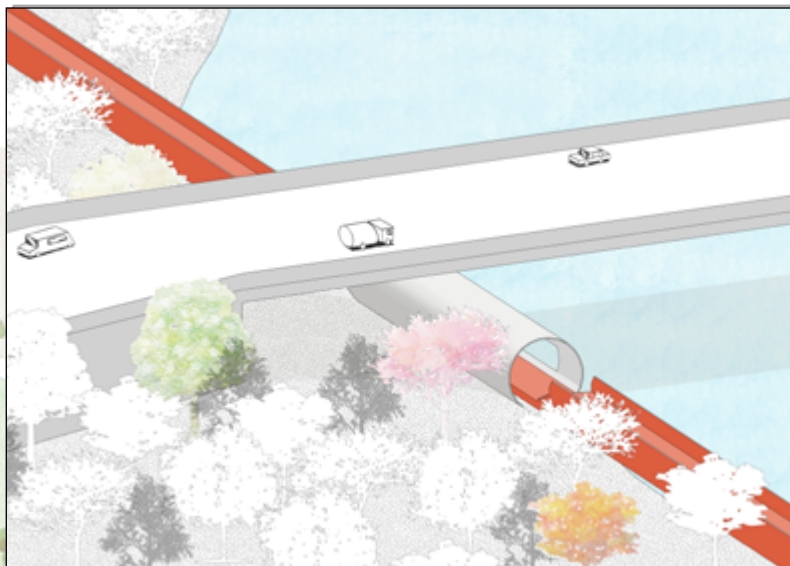
### Social aspect- Stitch

Bridging up and line up the space to enhance the longitudinal connection along the watercourse, and the lateral connection between the neighborhood and waterfront zone.



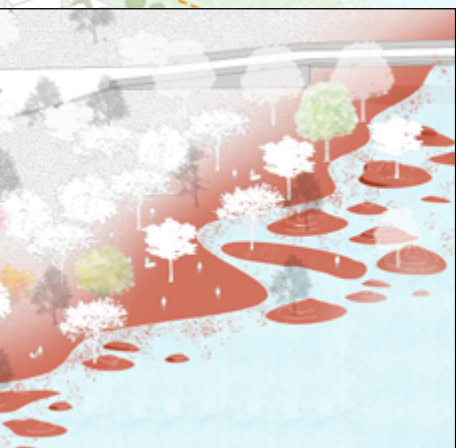
### Spatial aspect- Transfer

Developing the spatial atmosphere along the canal. Increase the longitudinal and vertical connectivity by landscape method, in the meanwhile make space for diverse waterfront activities.



### Ecological aspect- Underline

Transfer the bank to a soft edge and create habitat for fauna and flora. In the meanwhile increase the adaptivity of the venue to extreme weather.





Scale and view



Waterfront space



# Spatial context

Connection with neighborhood



The border of water







4

1

2

2

6

13

14

15

9

8

7

10

4

5

15



# II /Activate a resilient neighbourhood

## i. Overall system

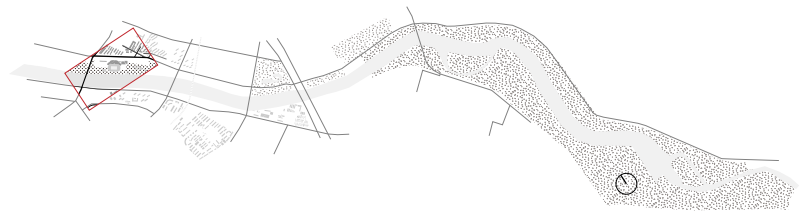
- | Water retention        | Social connectivity     |
|------------------------|-------------------------|
| 1 Parking lot          | 7 Pedestrian            |
| 2 Sports field         | 8 Biking lane           |
| 3 Neighborhood park    | 9 Bridge                |
| 4 Open green           | 10 Zebra cross          |
| 5 Green infrastructure | 11 Green corridor       |
| 6 Retention pond       | 12 Performance stage    |
|                        | 13 Hydrophilic platform |
|                        | 14 Swimming pool        |
|                        | 15 Floating deck        |



The crucial zone 1 along the canal, located next to the sports fields. The design of this site focuses mainly on enhancing the social connectivity and sustainable water management to achieve a social-ecological inclusive urban landscape.

The site connects to the surrounding open space by the sidewalk and bike lane, it connects the two sides of the canal by a bridge only for pedestrian and bicycles. More opening, line trees, zebra crossing are applied in the plan in order to enhance the lateral connectivity between the waterfront space to the communities. There are different activities in the upland trail, waterfront area and the instream space.

Moreover, the space around the site is largely covered with hard pavement, there are several strategies applied for sustainable water management. First, turn down the sports fields to hold and store the rainwater. Second, use permeable pavement for the parking lot and design water collection system under it. Third, collect the water by the rainwater system, purify and reuse in the park.





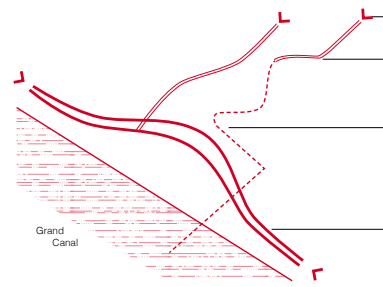


Detail plan

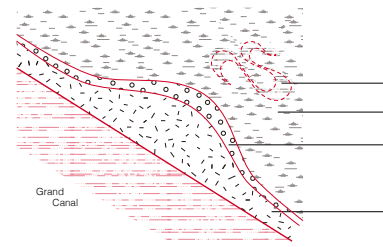


- 1 Main entrance
- 2 Secondary entrance
- 3 performing stage
- 4 Hydrophilic platform
- 5 Bicycle lane
- 6 Pedestrian lane
- 7 Swimming pool
- 8 Floating deck
- 9 Parking lot
- 10 Sports field
- 11 Retention ponds
- 12 Underground tunnel

Social network

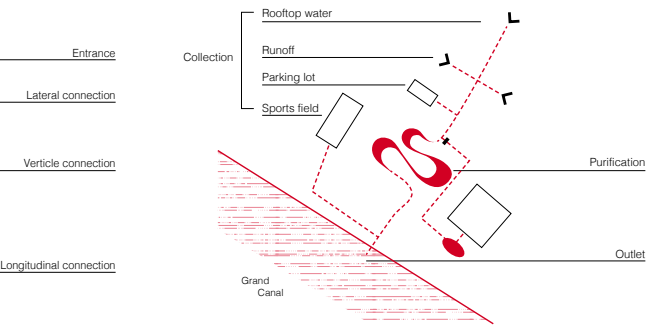


Ecological network



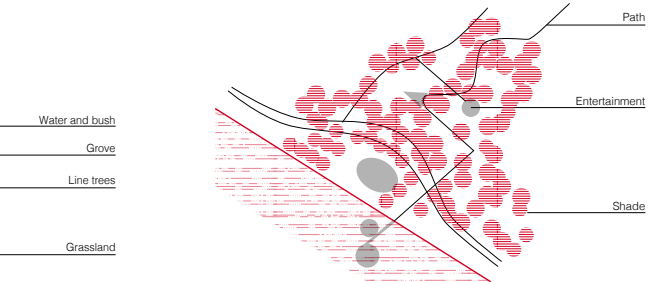
Detail plan

Hydrological network



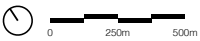
“Community and Park” focus on the lateral connection between the neighbourhood to the green space and from the green space to the waterfront. The route from the neighbourhood to the green space is highlighted by line trees and zebra crossing. There are two openings to enter the park, a shortcut and a meandering path. The meandering path leads the visitor directly to the waterfront space, along the route, there are performance stage, resting platform, swimming pool and hydrophilic platform. There are different waterfront activities and multiple functions in the park. It is not only green space for social activities but also water management facility.

Spatial network





Planting plan



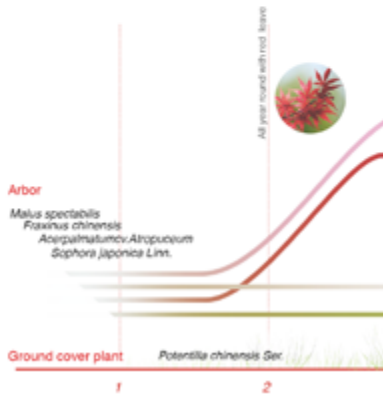
Plant list

**Sophora japonica Linn.**

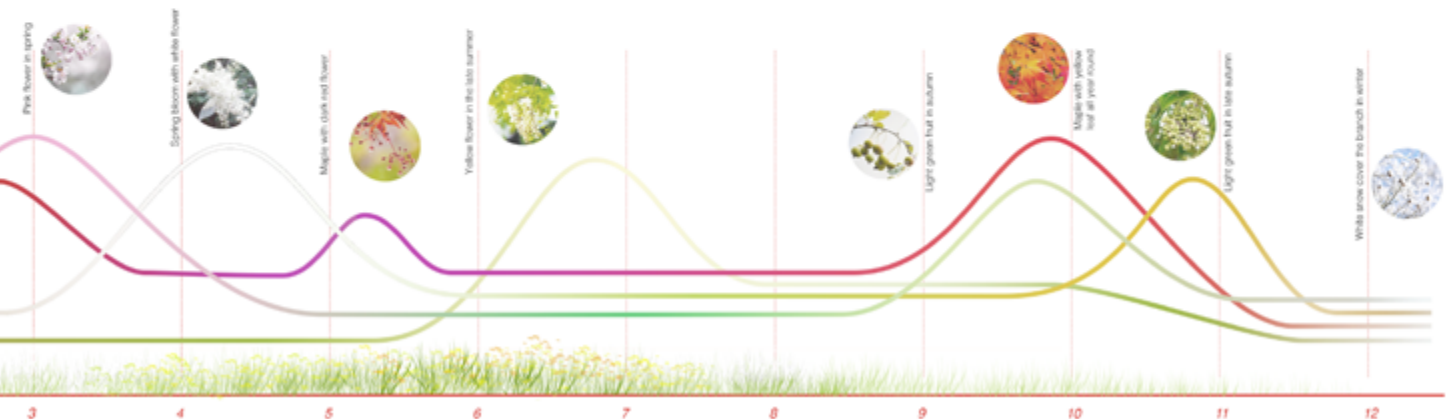
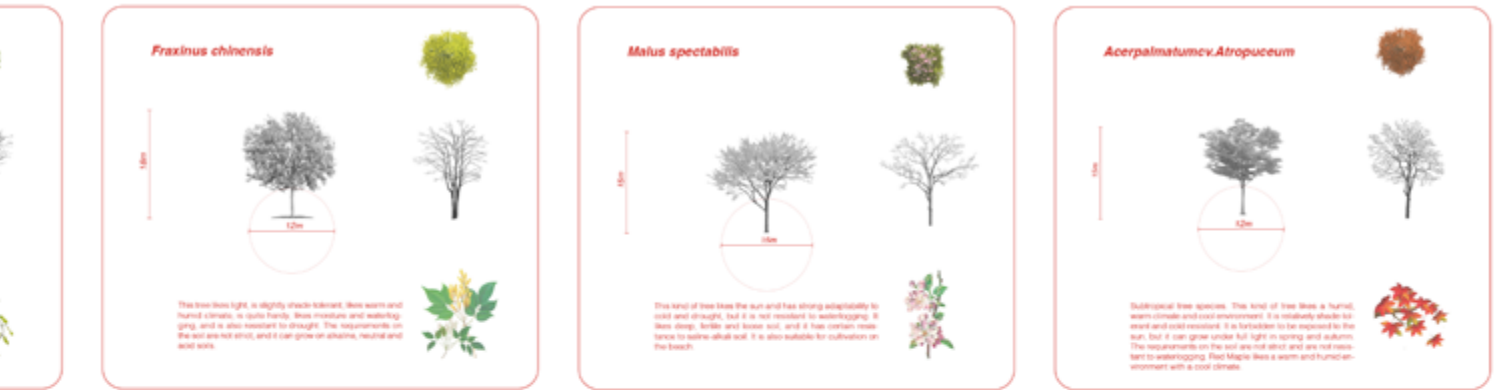
25m  
15m

This tree is light and slightly shade-tolerant. Can adapt to colder climates. Plants are deep and developed. The requirements on the soil are not strict, and it adapts to the various environmental conditions such as urban soil compaction. But it grows poorly in low lying water. Strong resistance to pollution such as sulfur dioxide and acid.

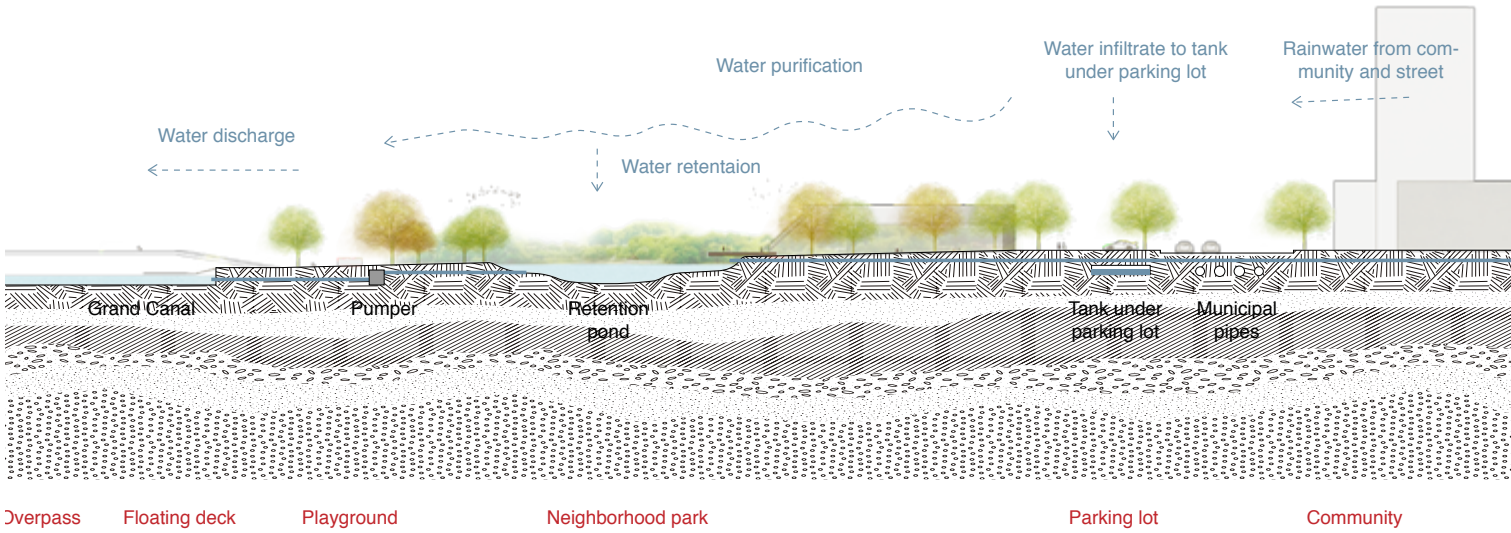
Color spectrum

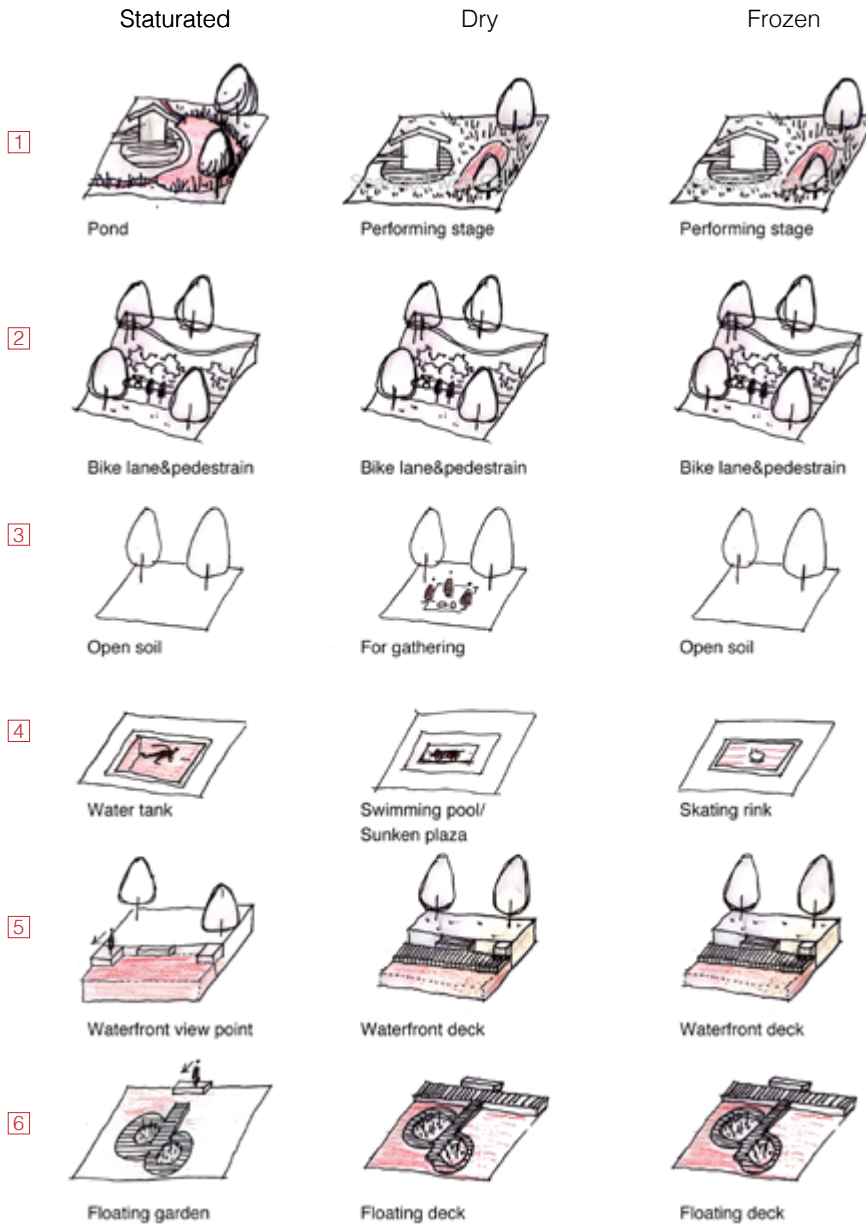


The plants chosen for the park has been considered by the criteria of water-resistant, local species and deciduous. There are single trees applied in the entrance of the park, roof trees in the park and line trees along the bike lane. The shapes and forms of the trees are different, creating a transition from urban to natural space and forming shade in the natural area, using diverse colour trees and shrubs to provide different colours for space.









The neighborhood park serves as the urban landscape infrastructure for the nearby neighborhood. The rainwater from the community and street flows to the park, after purification discharge to the Grand Canal. In saturated season, dry season and frozen season, there are diverse outdoor activities in different zones in the neighborhood park. For example, the swimming pool serves as the water tank in the saturated season, swimming pool in the dry season, skating rink in the frozen season.

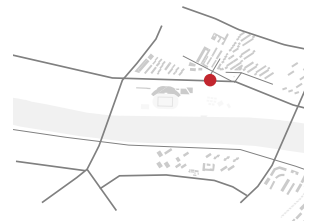




Lateral connection 105  
**Dry season**

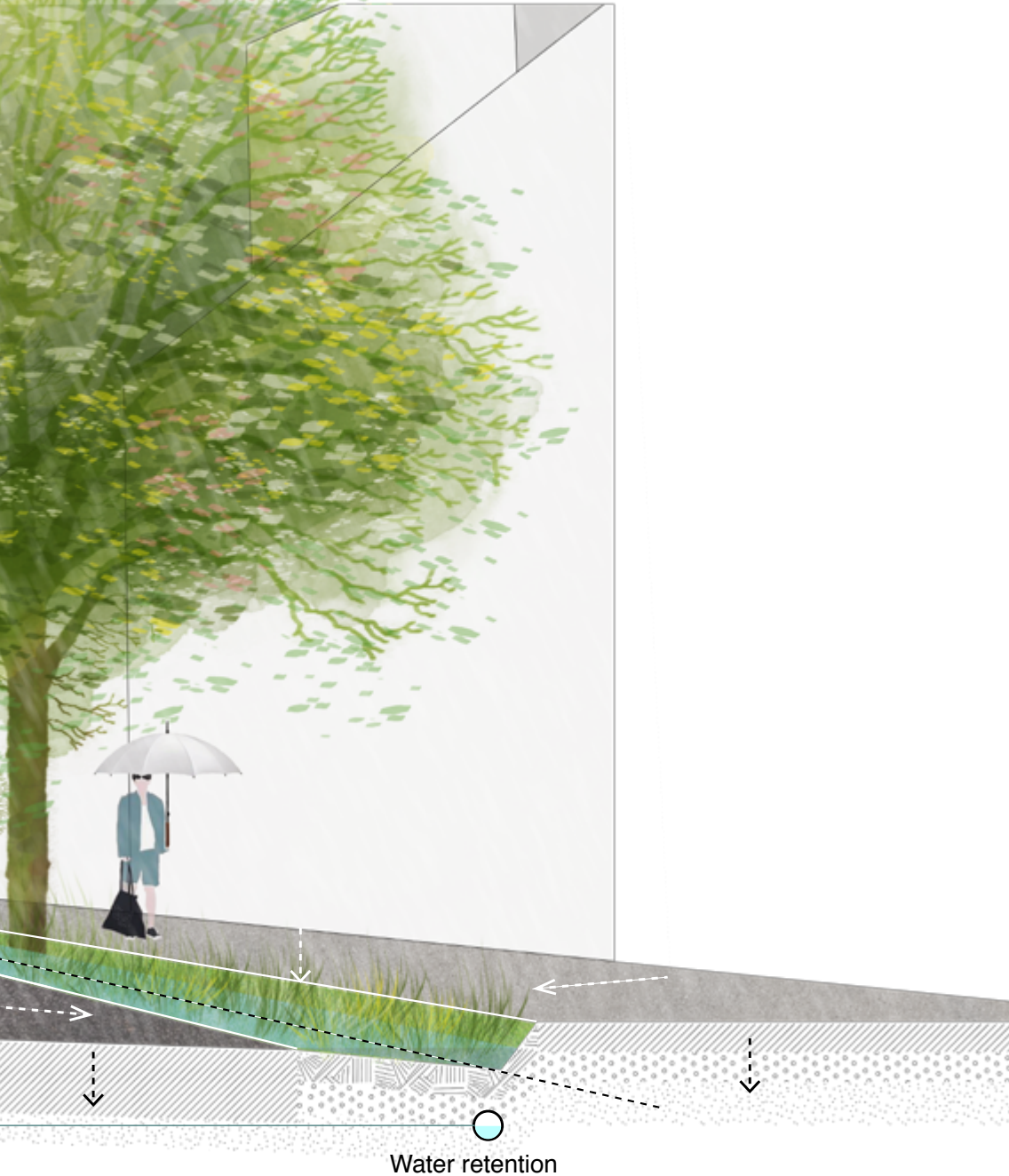


The connection between the neighborhood to the community park are formed by the line trees and shrub. By the same arbor species, creating the continuous visual experience from the neighborhood to the park. This not only enhance the lateral connection, but also introduce the visitors to the waterfront.

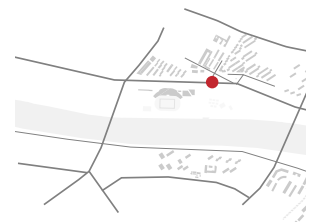








In the storm season, the integral part of rainwater and surface water runoff flows to the ditch between the road and sidewalk. The remaining water on the pavement infiltrate to the water tank underneath the road then flows to the neighborhood park by the pipeline.



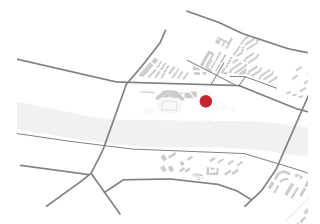


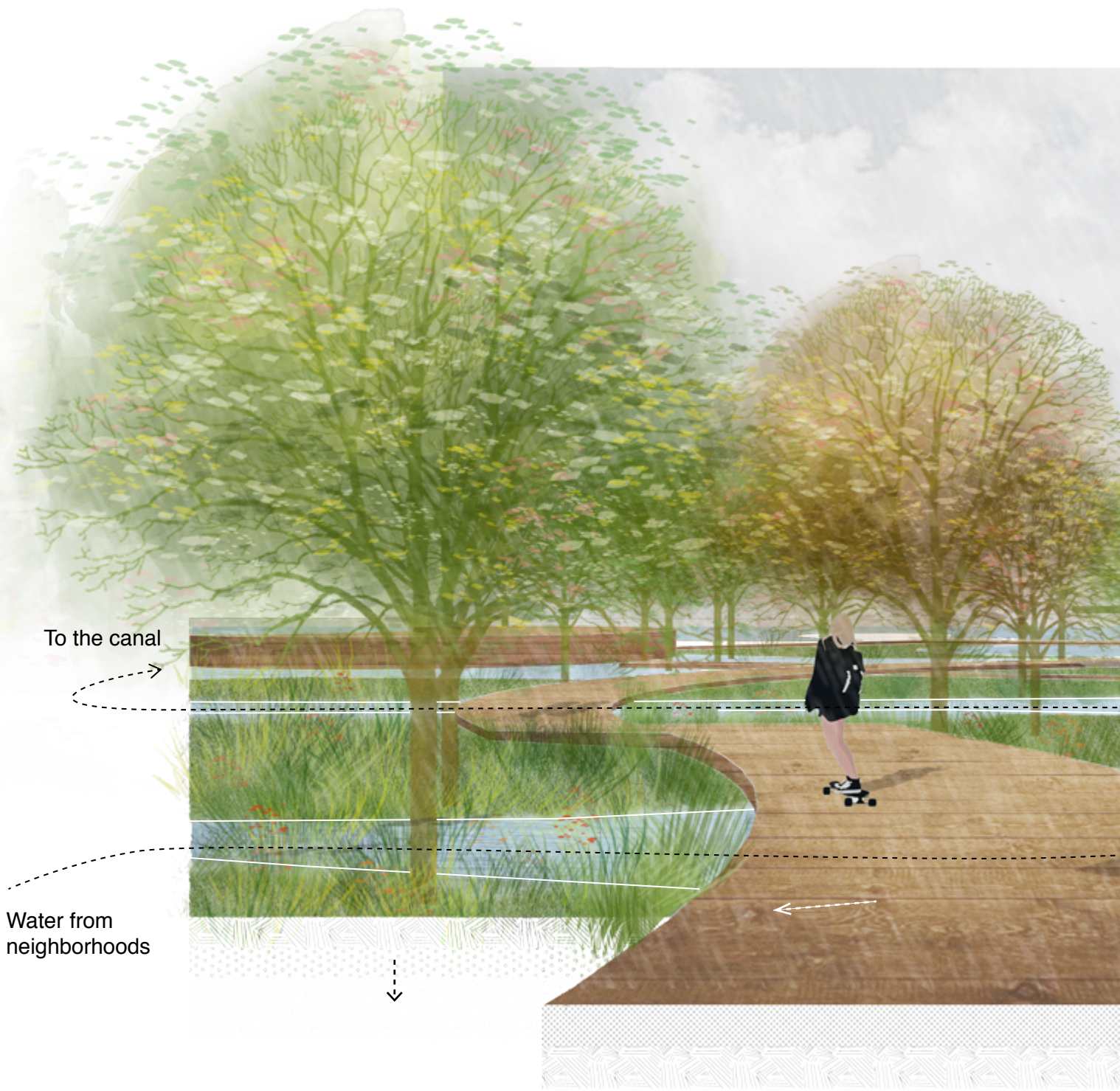






The community park in the dry season serves as the leisure area for the neighborhood. The space serves as a semi-active space to active space from the neighborhood to the waterfront. The shallow water is the rain water retained in the pond. In the extremely dry period, pump the canal water to the pond to prevent the habitat and to keep the stable ecosystem.



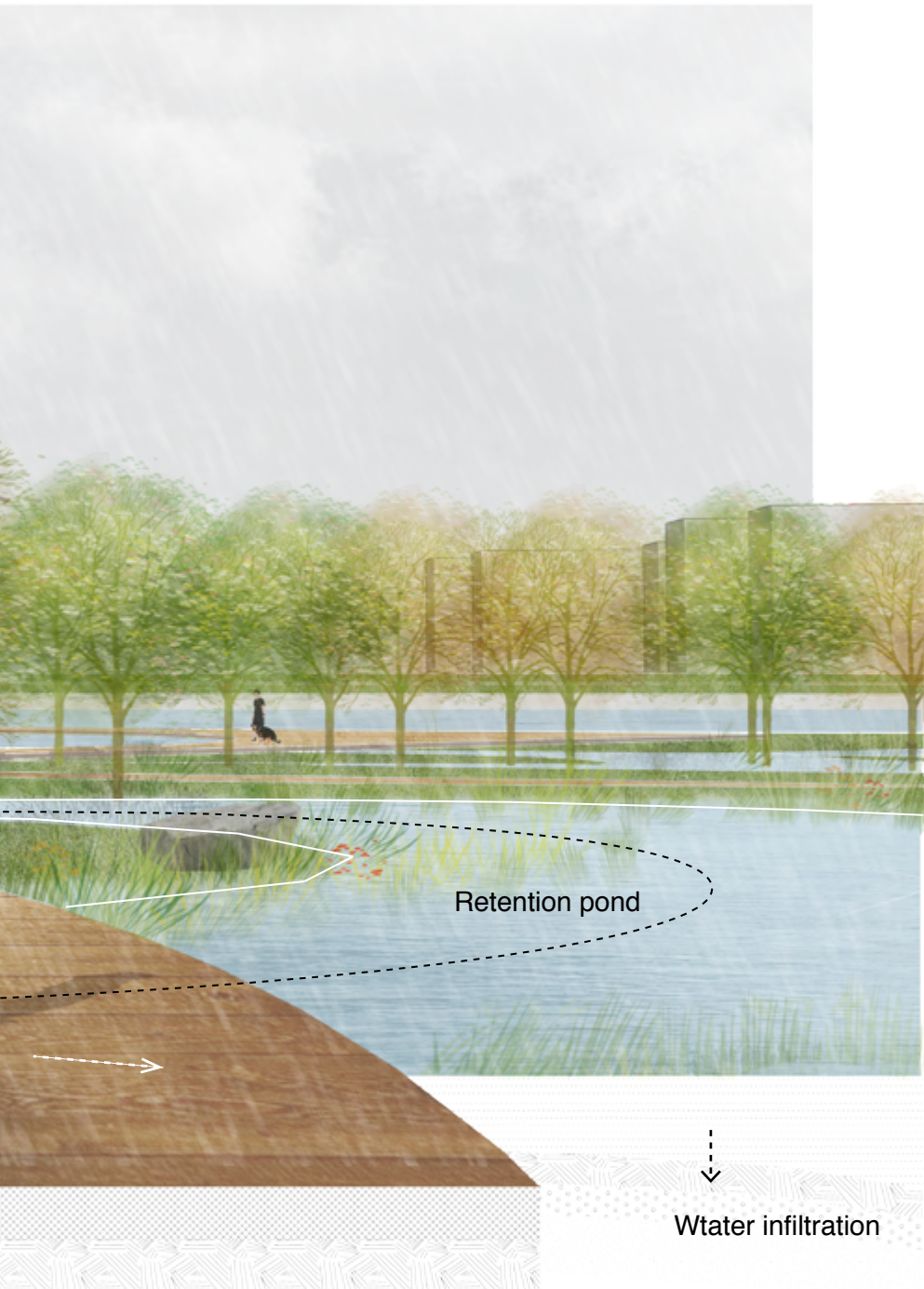


To the canal

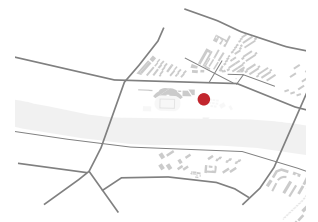
Water from neighborhoods

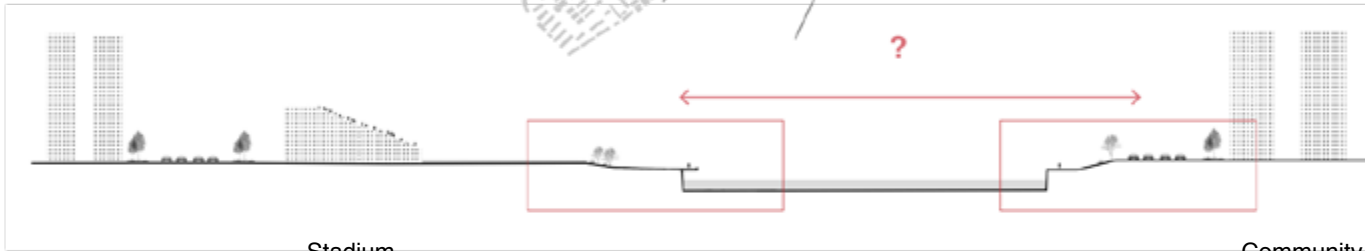
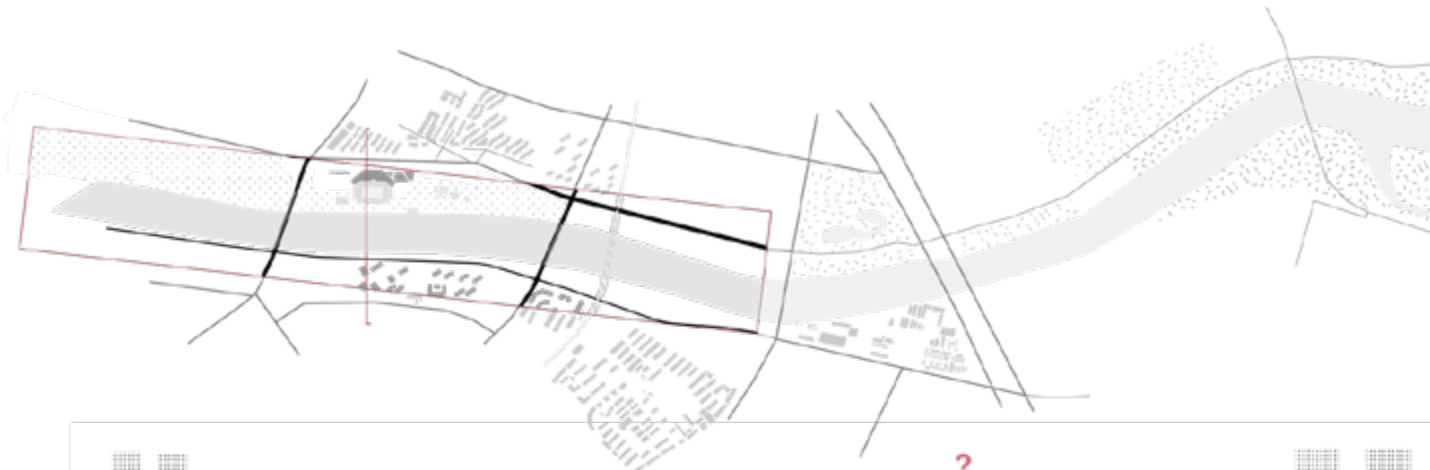




**Storm season**

In the storm season, the surface water runoff and rain water fill in the shallow gradient in the park. By flowing from the higher level to the lower level, the water from the city were purified in the park by the purification plants. Part of the water also infiltrate to the soil to recharge the groundwater. By the same strategy applied to the whole region, hence to relief the subsidence issue in Tongzhou district.

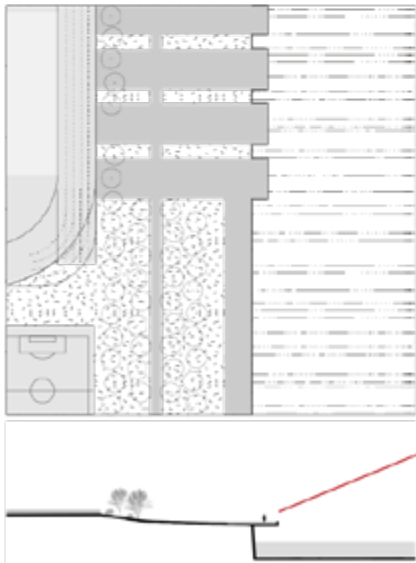




Stadium

No connection to the other side of the canal

Community



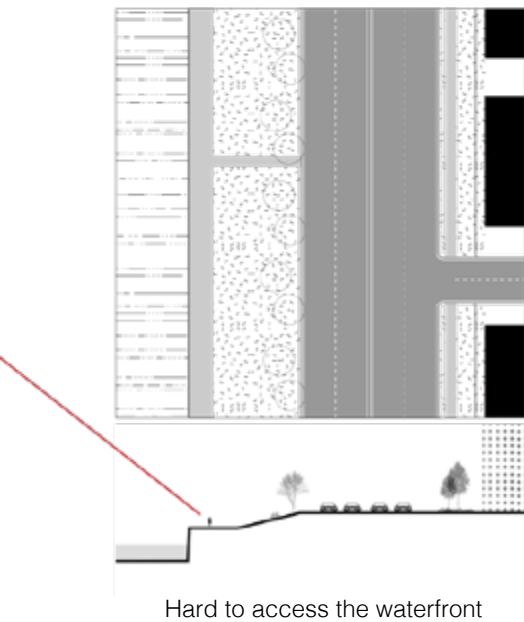
Few waterfront entertainments



Challenge and potential



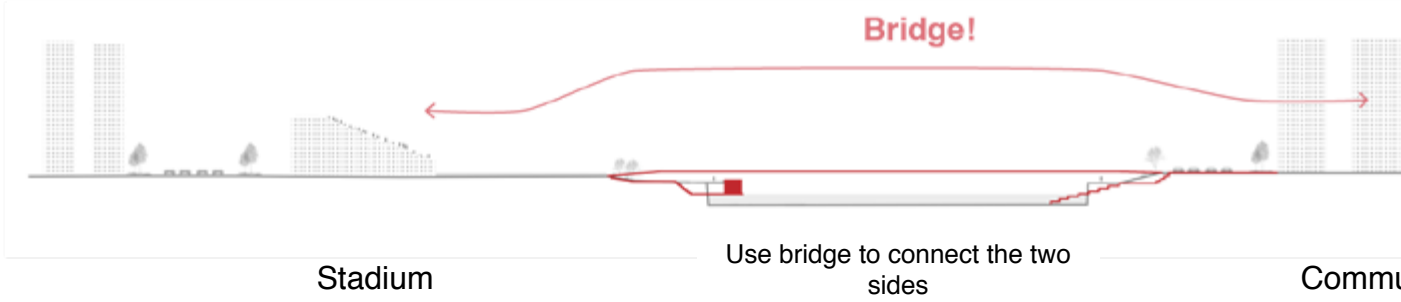
The canal zone in the stadium side is currently a plaza, has a nice view of the sunset, it has the potential to be an urban entertainment centre. The other side is next to many communities and nice view to the stadium, but hard to access the waterfront.



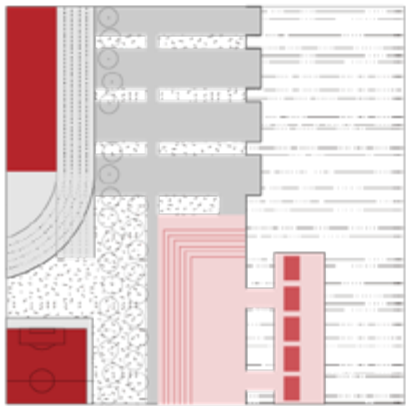
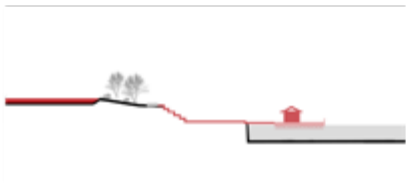
Hard to access the waterfront



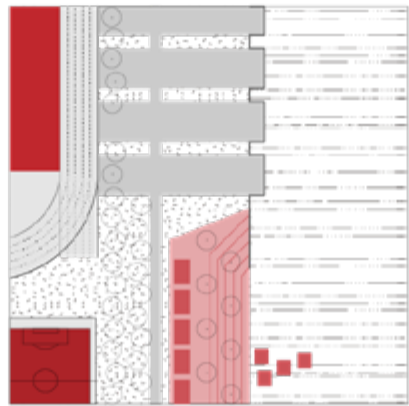




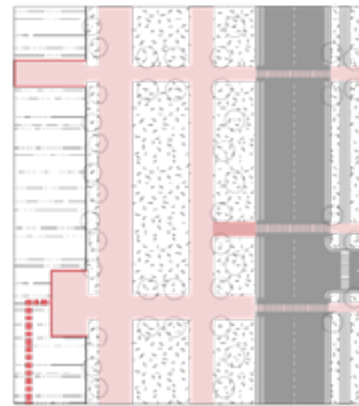
Design A



Design B

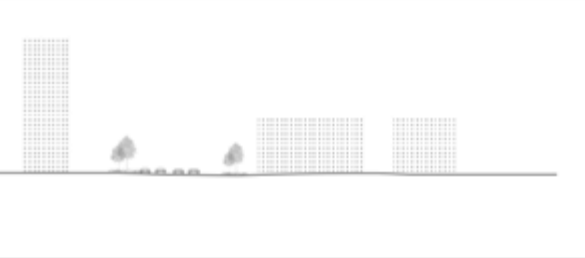


Design A



More waterfront entertainments based on  
the urban context  
Turn down the sports area

Lateral  
Better



community

Design B



The intention is to connect the community and urban entertainment centre. In the stadium side, more waterfront entertainments and turn down the sports area. In the community side, narrow the road, make lateral connection to the community, more waterfront space, better vertical connection to water and viewpoint.

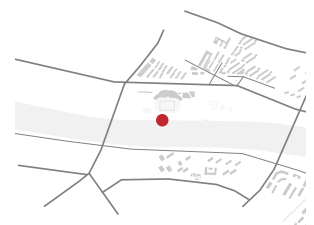
connection to the community  
 More waterfront space  
 vertical connection to water  
 View point



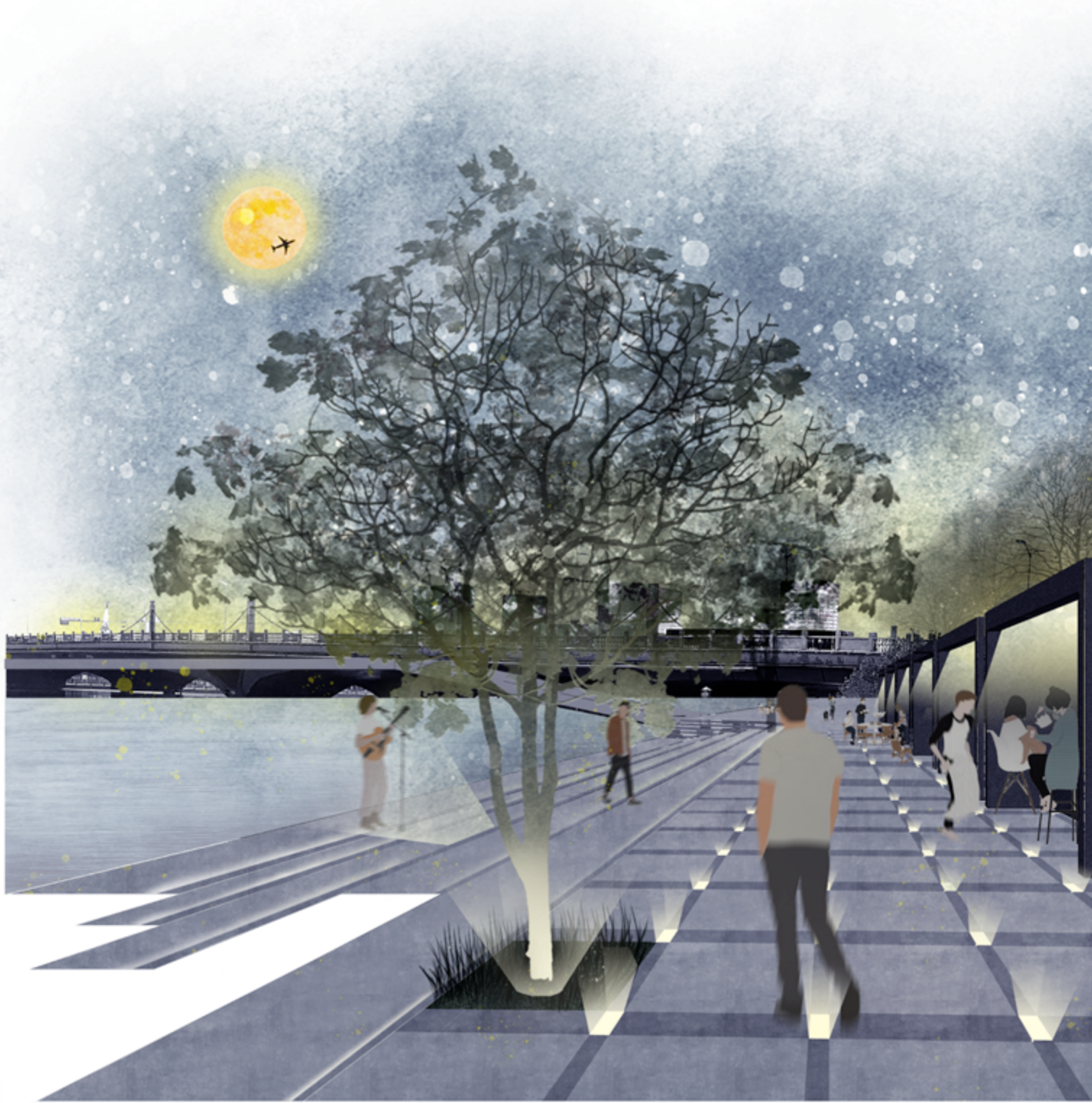




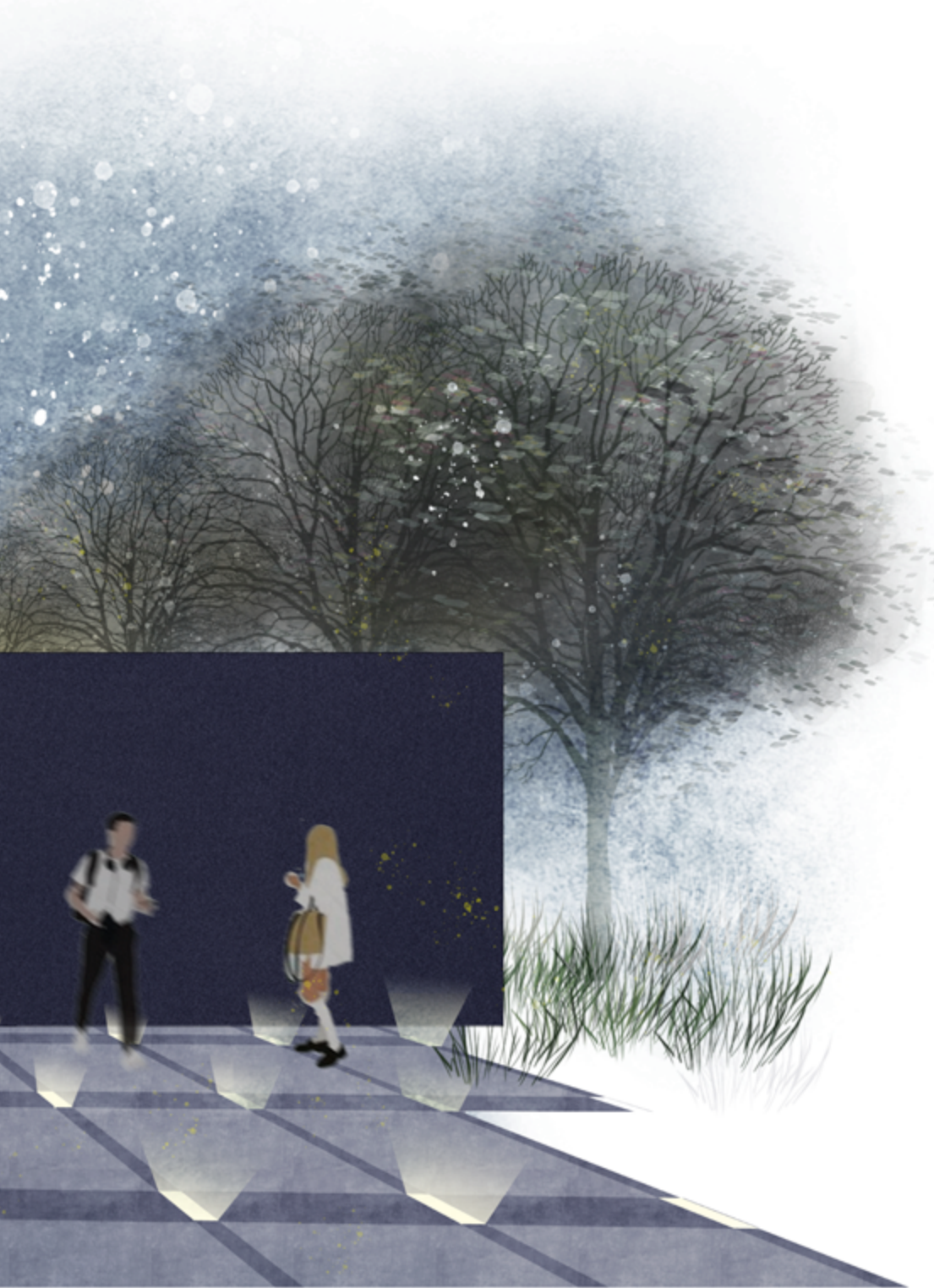
This drawing shows the commercial activity in the stadium side. There are markets along the canal which activate the waterfront space. With the connection by the bridge, brings the people from the opposite bank to the waterfront. The stages leads to the instream water create space for people to stop and enjoy the opening view along the canal side.







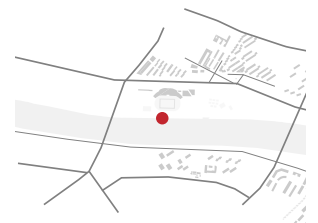




At night time, the boxes turn to bars to enrich people's nightlife.

There is possibility to have multiple activities in this area such as square dance, after party, street singing etc. The simple pavement design and rich floor lighting will leave the imagination to future users.

Since the space is far from the residential area, there will not be noise problem.





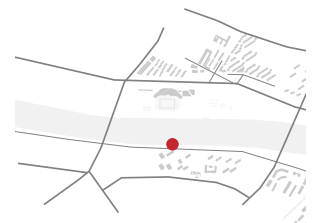


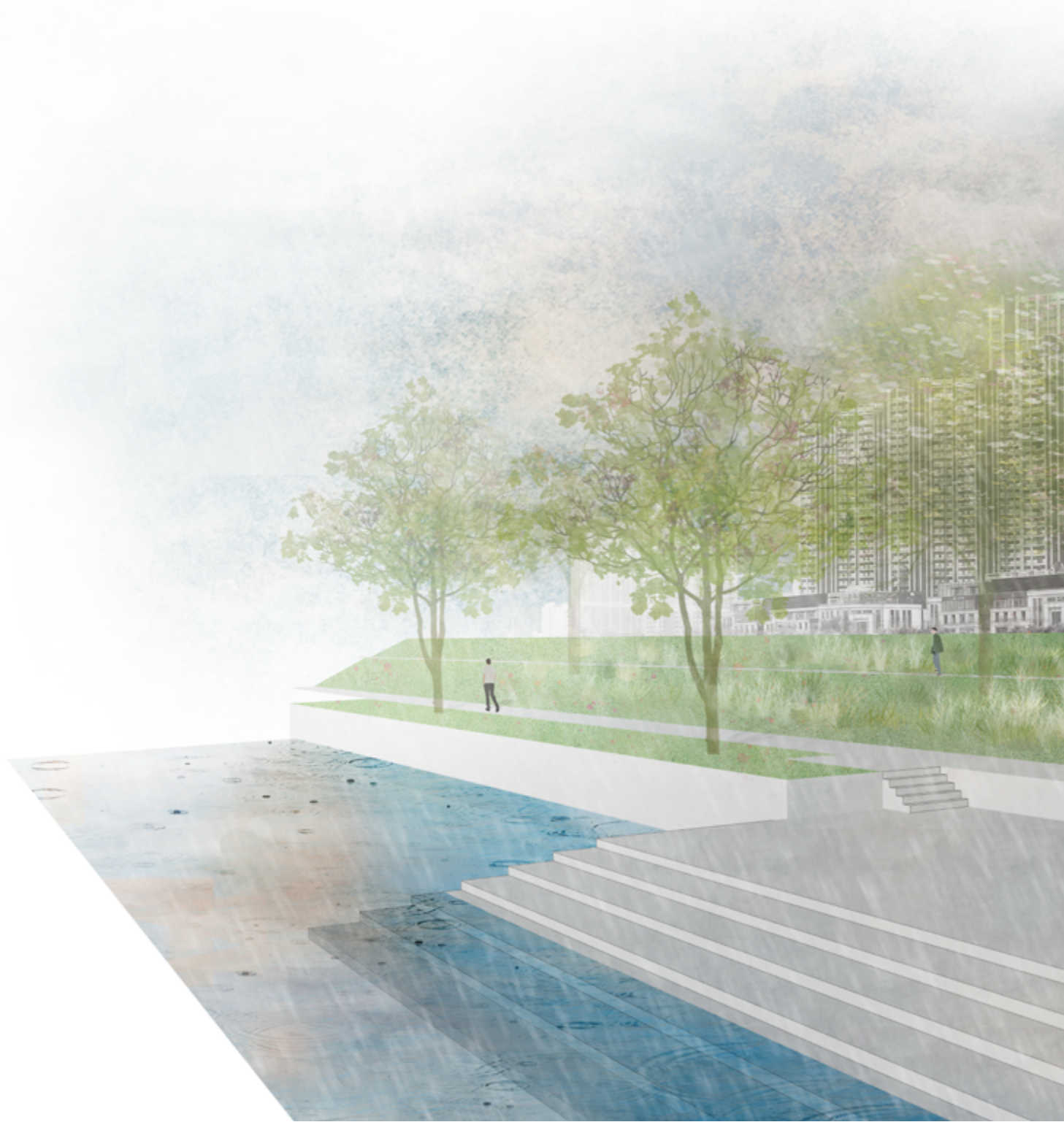
## Community 121

### Dry season



In the opposite bank, inspired by the remaining structure in the canal-side cities, design space for people to get close to the water and use stages to bring visitors to the waterfront. The wide waterfront platform create space for more people to get close to the water.

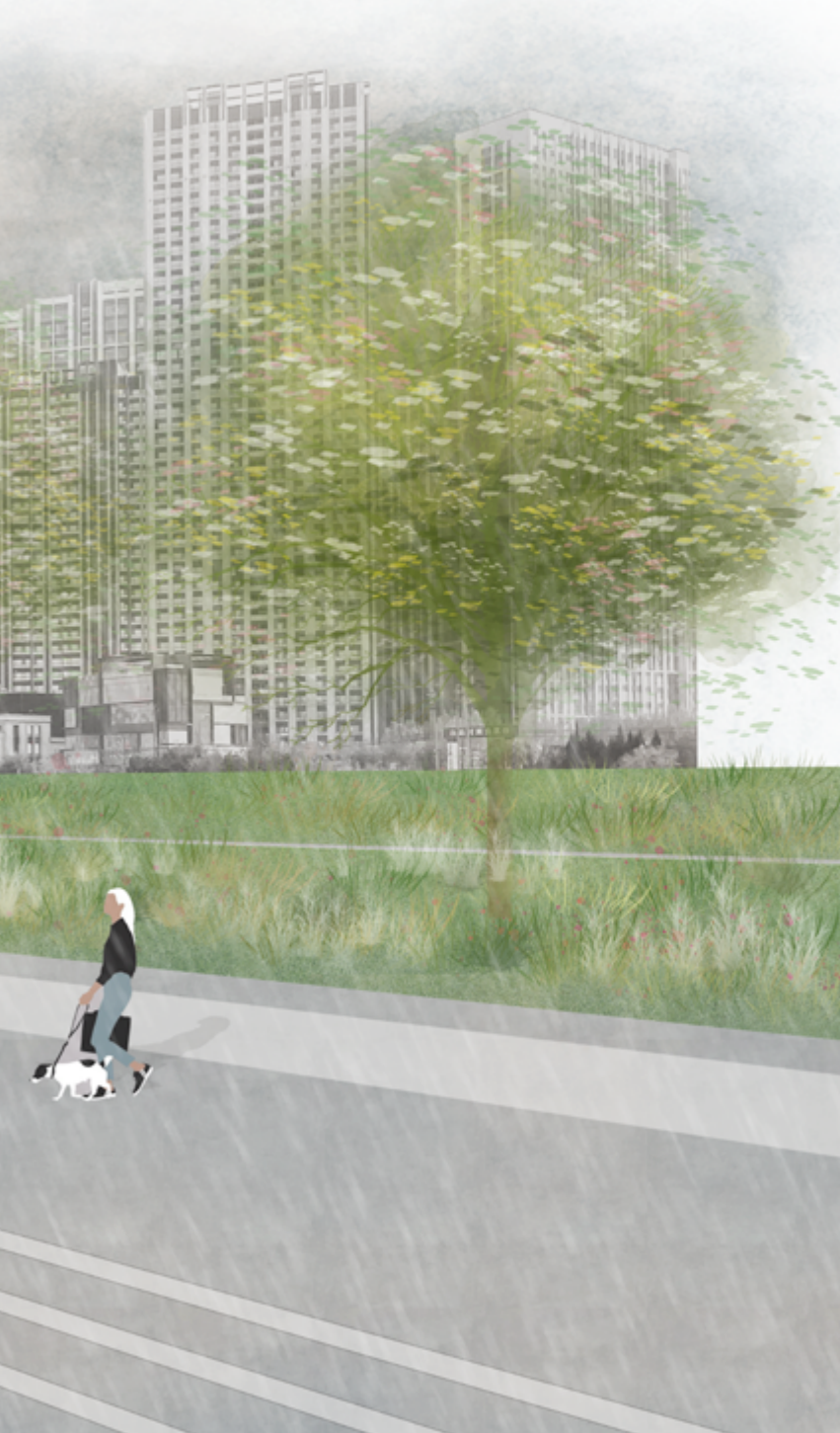




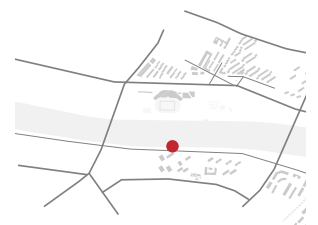


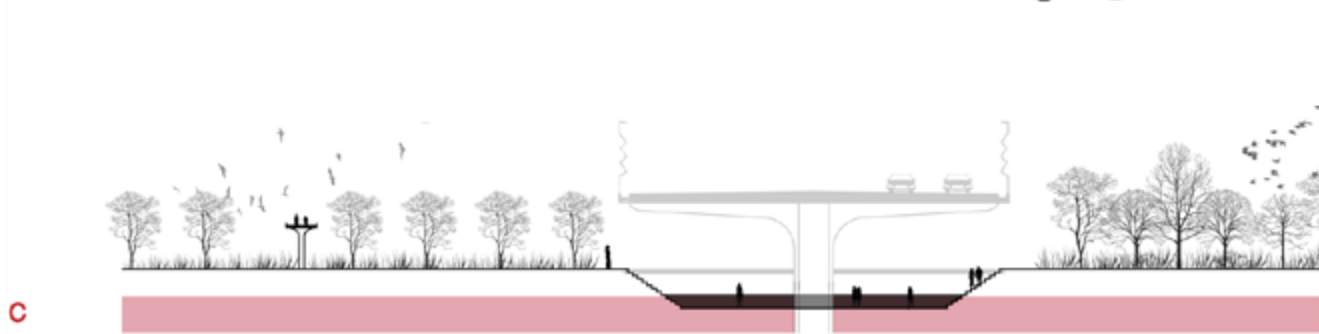
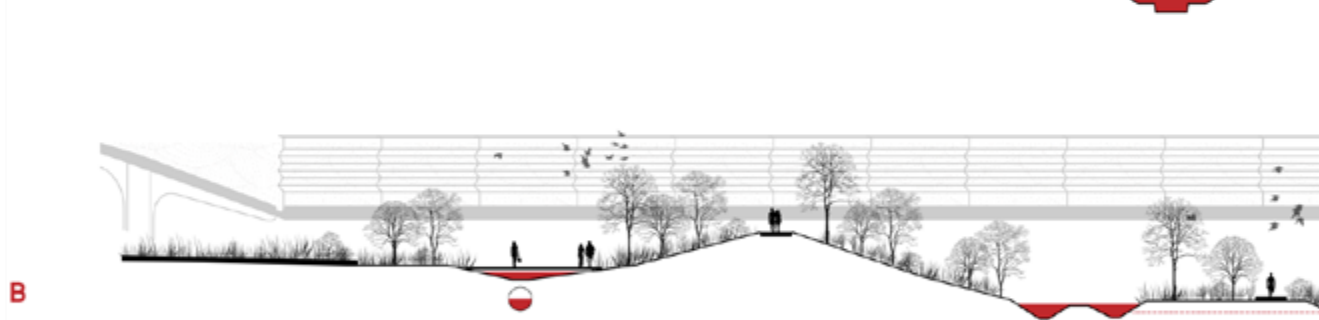
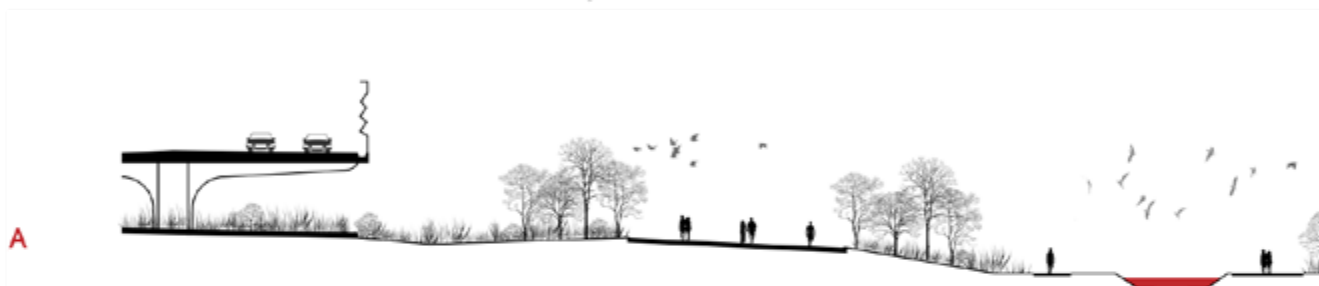
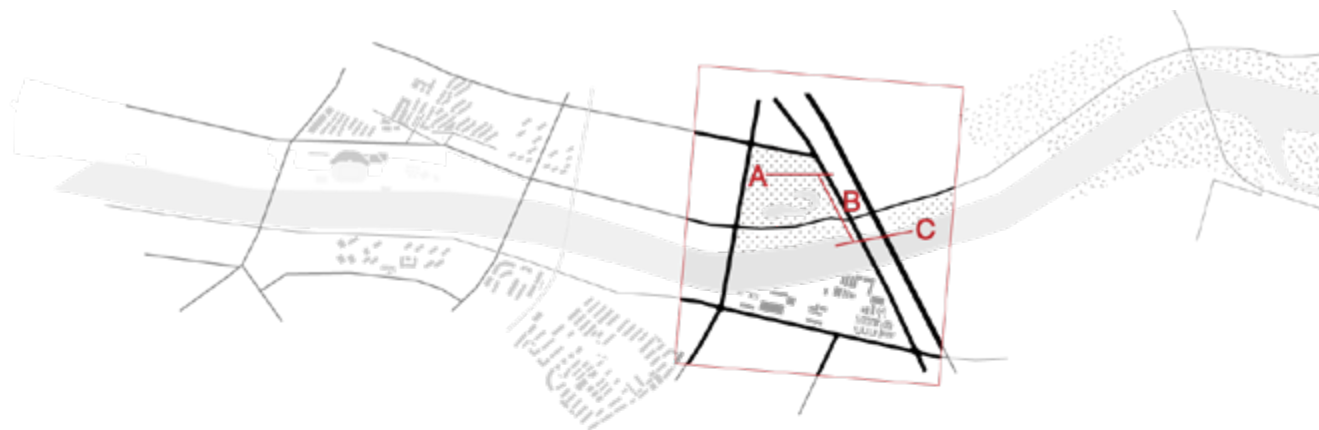
## Community 123

### Rain season



In the rain season, the surface water runoff and rainwater from the community and road flow to the canal through the gradient, with partially retain and infiltrate to the ground water.





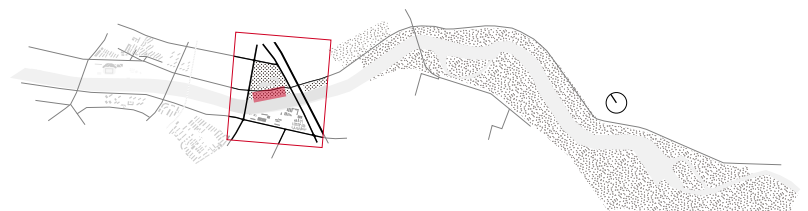
### III /Transition to the ecological paradise

#### i. Proposal



The crucial zone 2 located in between the highways, connects to the forest park in the east side. The goal of this site is to transform the embankment into a natural form for diverse habitat and create a different spatial atmosphere for visitors. Enhance the longitudinal connectivity along the canal.

There are group trees next to the highway to block the noise bring by the highspeed cars, changing terrain for different visual experiences. Use tunnels to break the isolation under the bridge to make longitudinal connection between the site to the forest park.





2020s



2030



2050

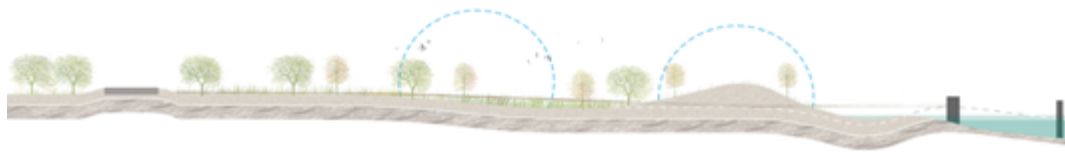


2060

2020 Existing conditions



2030 Place the sediment catching structure



Sediment catching structure

2050 Form the ecological island



Sediment

2060 Introduce visitors to the site

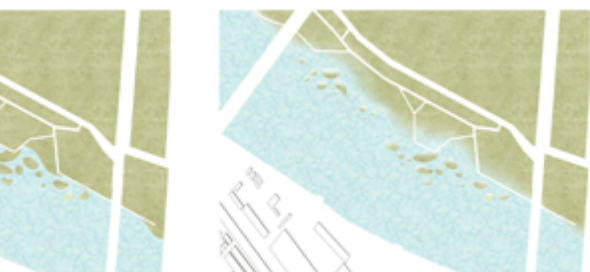


Traffic lane

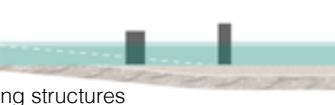
Lookout

View point

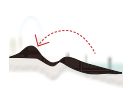




Rain season

Rain season  
Dryseason

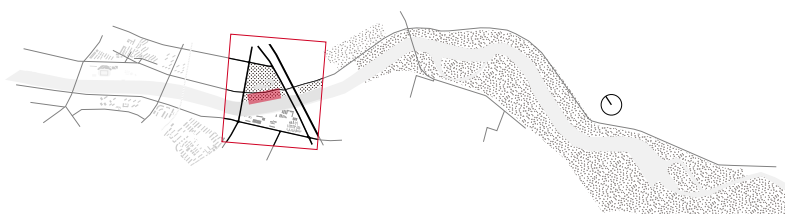
ing structures

Balance between  
digging and fillingForm multiple  
ecological islandsA rich and varied  
habitat environment

Ecological islands

## ii. Developing process

Changing the existing waterline, use the principle of balance between digging and filling, to increase the length of the waterline. Hence to enlarge the gradient space and create more habitat for the species. Simultaneously, there are more space for the water to flow in different seasons, the site will be more adaptive to deal with the extreme weather. By setting the sedimentation catching structure, gradually form ecological islands. Afterwards, animals will be attracted and inhabit in this area. After the stable ecosystem is formed in the site, set up the walkways and lookouts to invite people in the area and form a social-ecological integrated waterfront space. In the rainy season, as the water surface rises, the living environment of the creatures and the recreational environment of people has changed. Thereby creating a rich and varied habitat environment, attracting different species to inhabit it in different seasons, in the meanwhile creating a diverse outdoor experience for people.





京杭

光緒二十六年  
漕糧完全停運  
，通惠河與北  
廣脫，埃里物

新中國成立后  
新政策，使相  
通河北京段  
，并重視營造  
為北京一道靚





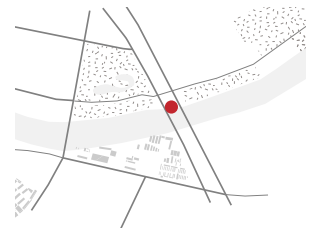
大运河的前世今生

1906年后，京津铁路通车，南北交通大加便利。从清朝末期到解放前，大运河沿岸河道淤积，闸坝失修，一片没落。

1958年，对北运河水系进行了重点治理，通惠河、北运河（大清河）成为首都重要的排水系统。如今，运河风光成为北京的一道风景线。

### iii. Social connectivity 129

Connecting the space under the bridge with the tunnel, creating the possibility of passing from the site to the forest park on the south side. As the water level rise, visitors can experience the different heights of the water through the glass. In the dry season, create the feeling of walking on the water. In the rainy season, create an atmosphere of people walking in the water.





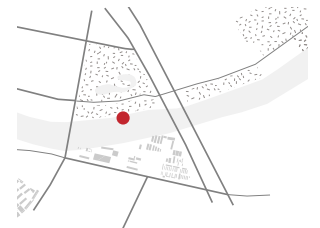




#### iv. Ecological succession 131



If people standing on the wooden path, they can look over the ecological island close by, enjoy the view of dynamic natural landscape and contrast with the distant urban landscape. There is no walkway set between the ecological island and the wooden plank road, thus ensuring that the ecological development will not be disturbed by human activities and become a paradise that only belongs to fauna and flora. Overtime, as plants multiply, the site will attract birds or insects bringing seed, thereby engendering the biodiversity.











This project is looking forward to creating a social-ecological integrated landscape. Through landscape methods, to increase the adaptability of the region to extreme weather. Through the landscape structures and new entertainments applied on the site, recall the historical memory of the Grand Canal.

The objective of this project is exploring the potential of the Grand Canal as a backbone for adaptive and resilient urban development in Tongzhou district. After the research and design, the questions below are answered.

### **1. How does the Grand Canal function as an operative landscape structure?**

By answering this question, it is possible to understand the history of the Grand Canal and the relationship between the city and the Canal, people and the Canal. Moreover, by answering this question, we can understand the potential and strength of the Grand Canal to transform into landscape infrastructure.

Rivers have historically been regarded as a kind of natural landscape. With the urbanization and the needs of human activities, rivers have been artificially excavated and built into an infrastructure serving the society. Thus, it has better navigation function.

Whether in history or now, the Beijing-Hangzhou Grand Canal constitutes a different type of landscape in the city. In history, the Grand Canal is closely related to people's lives. Through the study of historical scrolls and the study of literature, it is found that the Grand Canal has not only served as a navigation channel in history but also has multiple values. Such as promoting the economic development and cultural spread of cities along the canal, the treatment of rain and flood, providing water sources for agricultural production, and also promoting people's aesthetic level, drove the development of architecture. Today, the Grand Canal in the Tongzhou section serves as an infrastructure for the city. It is an important drainage channel of the city, and also has the function of recreation by boat. From a landscape perspective, the wide waters of the Grand Canal have shaped a different landscape atmosphere in the city. However, other than functioning for drainage and recreation as a line, the canal also has the potential to serve society and ecology as a



zone. Today, the landscape along the Grand Canal does not form as a coherent system. As an urban infrastructure, it has the potential to promote the social-ecological value by turning to a landscape infrastructure.

It has the potential to establish a closer connection with the city and people as in history. In addition to accommodating and draining, it also has the potential to accelerate rainwater infiltration, water retention and reuse of rainwater.

## **2. How to transform the canal to a landscape infrastructure?**

The difference between landscape infrastructure and infrastructure is that landscape infrastructure has more local identity that has tangible relationships to the region (Nijhuis, 2015). By studying from historical cases, worldwide cases, and theories, there are toolkits concluded by social, ecological, spatial and technical aspects of landscape infrastructure mentioned in the methodology chapter.

The social toolkit is based on the study of Kondolf's literature (2017), combining the content, the author's own experience, the study of historical cases, and the observation in the historical scroll of the summer palace in Beijing. The interactive behaviour between people and water can be divided into instream, banks to the upland trail, from active to passive. This concludes the different behaviour patterns of human-water interaction. The ecological toolkit mainly summarizes the form of an ecological network. The spatial toolkit mainly summarizes the form of the embankment, from the soft or hard of the embankment to the scale between the embankment and the adjacent city buildings or roads. Based on the study and observation of different cases, the types of man-made structures on the waterfront are separately summarized to facilitate the application of detailed design in the future. The technical toolkit contains a summary of rainwater collection and purification methods in cities.

Finally, select a part of all types of toolkits for testing, showing social-ecological integrated design reflection on the city and neighbourhood.

### **3. How to use the water source in Tongzhou as part of the urban infrastructure?**

The Grand Canal, as the main water source in Tongzhou, is also a historical infrastructure. The purpose of this project is to transfer the Grand Canal from a line to a zone and turn the role back as the lifeline in the city. Therefore, in the design thinking process, we discussed how to achieve the assignment in four discourses, social, ecological, technical and spatial. And the test and application worked through scale to discuss the relationship between city and water, people and water.

The basis for guiding the design is to test the principles through scale and work on a different scale in parallel. Ultimately, enhancing the public accessibility to the canal zone and ecological performance along the canal zone.

By answering the above questions, the objective of this project 'exploring the potential of the Grand Canal as a backbone for adaptive and resilient urban development in Tongzhou district' can be achieved.

#### **Restriction of this project**

Due to political and social reasons, Beijing has developed rapidly since 1950. Many historical maps and development statuses cannot be traced to the source. And because of the rapid development of China, the historical appearance of Tongzhou district is completely gone. It is difficult to learn from historical cases when designing. More is to understand the possible relationship between water and people, water and society from history. At the same time, because the exact information of Tongzhou is difficult to obtain, some analysis is based on the author's speculation based on the existing situation, which inevitably exists misjudgment and affects the specific design. Moreover, because Tongzhou is a city that is undergoing rapid construction, the information obtained is not completely accurate. From the city map, it is easy to see that many lands are under construction since it is on the process of transforming to the future subcenter. Most of the designs are completed in the ideal state through the author's speculation based on the satellite map and other sources. Therefore, there may be a deviation from reality.

## Theory learned

This project aims to transfer the infrastructure to landscape infrastructure and provide alternative ways for the canal zone development. Therefore it strongly needs the understanding of landscape infrastructure and how to benefit the urban development and residents. Thus, the design is mainly focused on the social-ecological integrated design to achieve an adaptive and resilient urban development.

By studying the literature about “Landscape urbanism”, the “Infrastructure as landscape”, “Landscape structure”, “Landscape infrastructure” the essential focus of the transformation is on the lens of social, ecological, technical and spatial adaptability. These four discourses are partly overlaid with each other, but it helped to develop clear thinking over the research and design thinking process. The social aspect is mainly focused on the public space and the diverse entertainments in the canal zone, the ecological aspect is focused on the green connection over the region and the diverse habitats along the canal zone, the technical aspect is focused on the water retention, purification and reuse of the rainwater, the spatial aspect is mainly focused on diverse spatial context made by different material and multifunctionality of each space.

Other than transforming, social connectivity cannot be neglect. Since there are projects only focused on green the zone along the waterway and bring in multiple functions but ignored the connection of the waterfront to the nearby neighbourhoods and the interaction between people and water. Thus, there are 3 dimensions need to pay attention to in parallel to the research and design of the four discourses. The 3 dimensions are longitudinal, lateral and vertical. In this project, the longitudinal dimension means the amount of water the system can retain and the water connection. The lateral dimension focus on the connection between water and city, the accessibility of neighbourhoods to the canal zone, ecological connection from neighbourhoods to the canal zone. The vertical dimension focus on the connection and possible interaction between people and water, ecological connection from the instream of water to the up-trail land.

As a result, by designing though scale on the 4 discourses and 3 dimensions mentioned

above, the overall system achieved a more adaptive and resilient urban development. Turning the Grand Canal from a separate infrastructure to a landscape infrastructure by the social-ecological integrated design, connecting the neighbourhood with water, people and water. In another aspect, the canal and the nearby ecological system can benefit the city from infiltrating, retaining and reusing the rainwater, leave the space to nature to cope with the changes in the future.

### **The design and research process**

#### **Research and design:**

The research helped to clarify the objective of this project and give the idea of the main focus of the design. It also helped to limit the scope of the analysis. In this project, the design comes after the research. However, it took too much time to do historical research in the early stage, but many of them cannot be converted into tools for later design. In the process of research, it is important to know how to convert the acquired information into usable data. The method is to record and integrate the information while looking at the data. However, not all research can be transformed into a useful tool for design

#### **Design across scales:**

During the research process, there are ideas of design on a different scale. Through the understanding of the context and the collecting of design concepts, select the appropriate site to apply the design idea. It is very important that the design is not completed gradually from large to small scale. During the design process, design concepts of different scales will be tested at the same time, and the final design will be formed through repeated considerations.

### **Flowscape studio**

The theme of this graduation studio is "Flowscape", which mainly discusses the concepts "Infrastructure as landscape" and "Landscape as infrastructure". It reflects from four



perspectives: Landscape as spatial-visual perception, Landscape as a palimpsest, Landscape as scale-continuum, Landscape as an ecologic, economic and social process. Here, research exploration and design thinking are systematically combined in the discovery journey, and design is a tool for formulating possible spatial future assumptions. In this project, the principles acquired by the case study and theory are translated into design practice. Including strengthening the social connectivity of the canal zone, how canal and surrounding space deal with urban rainstorm problems, uneven drought and flood problems as a changing system.

## Outlook

The goal of this project is to summarize a series of toolkits that can be used to transform urban water spaces into urban landscape infrastructure and test them in the Tongzhou section of the Beijing-Hangzhou Grand Canal. The project not only designed the small-scale waterfront space but also discussed how to develop the water and surrounding environment into a system that is conducive to the sustainable development of the city and became an urban landscape infrastructure. This project has combined the knowledge of multidisciplinary. Despite this, the project ignores the political aspect. For example, in Beijing, the water area and riparian space are in charge of different institutions. There are many regional restrictions in the actual practice.

This project considered how to transform the historical infrastructure into urban landscape infrastructure and provided a complete set of research ideas and design toolbox. However, despite the field trip which offered the chance to understand the spatial context, to observe the interaction between people and space, there are still information not collectable. If can practice the participatory design in this project, may help to make the type of space more abundant and provide a more solid social strategy. Also, the questionnaire survey can help to understand the changes in the canal and its impact on people's lives, which can benefit the design to meet the needs of users better.

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