

(Recovering) China's Urban Rivers as Public Space

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This article focuses on the revered role rivers in China once held – in cartography, history, mythology, festivals, cities, and everyday life. It begins with a brief review of canonical geography classics and a summary of the ‘hydraulic civilization’ as coined by German Sinologist Karl Wittfogel. The ‘science of wind and waters’ or *feng shui* is also shortly discussed. Thereafter, four historical cases testify to the fact that China’s great cities and settlements were founded on riverbanks and developed in tandem with the dynamics of floodplains. Rivers were important for transportation, defence, and livelihoods; they also imposed respect. Rivers simultaneously represented profits, power, and danger, yet were the centres of public life. Over time, however, a tension developed between the civilizing force of the city and water’s natural energy. As progressive eras of industrialization took hold, organizational abilities allowed, and technology developed, there became a growing disconnection between waterways and settlements. Man tamed, controlled and diverted waterways, constricted the flows, confined the course and canalized rivers. Canalization fundamentally altered the nature of rivers, as they were straightjacketed in concrete linings and in many instances barely resembled rivers anymore. They became physical, cultural, and economic dividers, upset natural habitats and biotopes; open sewers with contamination plumes emptying directly into them. However, there is hope. In the past decade, there has been a rediscovery of Chinese riverscapes, initiated by the Chinese government. The latter half of the article illustrates

in detail the intervention of three case studies that recovered the urban, scenic, cultural, and functional nature of rivers inside the city fabrics of Ningbo, Kunming, and Qian’an by the design firm Turen-scape. It develops the role of riverfronts in the (re-) creation of vibrant public space in the cities overrun by market-driven and privatized spaces.

River川|Water水Mountain山

Water in China once held a privileged position, symbolically and physically. The character for river (川 – *chuan*) represents flowing water, while the character for water (水 – *shui*) is that of a small river with several water drops around it, translating to immobile water. In Chinese cartography, water and specifically rivers are of utmost importance. The first known map of China (1137 CE), from the Song dynasty (960-1279 CE), is engraved in stone and merely shows 80 rivers in the country – those that King Yü (founder of the Xia dynasty) was given credit for being able to tame from flooding, of which he dredged riverbeds and in the watersheds enriched livelihoods by constructing extensive irrigation networks. [fig. 1] Today, Yü the Great, as he has become known, is mythologically idolized by hydraulic engineers, irrigation experts, and water-conservancy workers. Another classic map of China, believed to have appeared before the first century BCE, brings in another important element of ancient Chinese (Asian) cartography, namely that of mountains (山 – *shan*).¹ The *Shan Hai Jing* (classic of Mountains and Rivers), recorded mountains, rivers, animals, vegetation, and legends in different

parts of China. It was considered more representative of ancient tradition, and perhaps magical and ritualistic rather than geographical; 'something of an imagined world concerning man's relationship to mountains, rivers and the sea.'²

Between the third and sixth centuries CE, two classic geography books appeared with maps that specialized on the river systems of China, *Shui Jing* (*Waterways Classic*) and *Shui Jing Zhu* (*Commentary on the Waterways Classic*). The former briefly described 137 rivers, while the latter annotated and substantially expanded the first addition, recording 1,252 rivers. It not only focused on their geography (the book was divided into sections by river, following its source, course, and tributaries), but also its connected history and culture. During the Qing dynasty (1644-1911 CE), an encyclopaedia on rivers, *Xing Shui Jin Jian* (*Golden Mirror of the Flowering Waters*), was completed, which collected historical materials of the source, change, and hydraulic engineering of almost all the rivers in China.

In China, as in all societies, it is evident that the control and appropriation of water was fundamental. Karl Wittfogel, an influential mid-twentieth-century Frankfurt School historian and Sinologist, developed the notion of China as the basis of a 'hydraulic civilization' where social formation was linked to a strong centralized authority and production emerged from water management and control. According to Wittfogel:

Where agriculture required substantial and centralized works of water control, the representatives of government monopolized political power and societal leadership, and they dominated their country's economy. By preventing the growth of strong competitive forces, such as a feudal knighthood, an autonomous church, or self-governing guild cities,

they were able to make themselves the sole masters of their society that constitutes the institutional essence of hydraulic civilization.³

Wittfogel's thesis of the 'hydraulic civilization' identifies an 'intimate link between environmental authority in the form of water control and political power'.⁴ Meanwhile, Chinese geomancy, or *feng shui*, the science of 'wind and waters' (already recognized by the beginning of the Han dynasty in 206 BCE), is the art of adjusting the features of the cultural landscape so as to minimize adverse influences and derive maximum advantage from favourable conjunctions of human settlement.⁵ It emanates from the geomancer's analysis of the morphological and spatial expressions of the *ch'i* (cosmic breath) in the surface features of the earth. [fig. 2]

Ancient Rivers – and Water-Based Cities

Ever since antiquity, cities and settlements in China have had a close relationship with and relied upon rivers. A great number of important Chinese cities were founded on riverbanks, due to ample water supply, ease of transportation, irrigation, and drainage; they developed in tandem with the dynamics of floodplains. Settlement locality statistics shows that almost all historic cities in China were located along or beside water bodies. From Ma's statistics, all the ancient national capitals and provincial capitals were located along main rivers, and it was usually the same case for local cities.⁶ The morphological evolution of cities was inseparable from river systems. Hand-in-hand with urban form, complicated water management systems were developed, thus various water bodies became embedded in cities. There were many different types of urban water systems in different areas of China, which usually adapted to certain geographic contexts, due to their unique water dynamics and demands. Four water-based cities



Fig. 1: *Yü Ji Tu* (map of the Tracks of Yü the Great). By an unknown geographer of the Song dynasty (1137) the engraved-in-stone map at grid scale of 1: 4,500,000 shows 80 rivers.
Source: Wang Chengzu, *History of Geography in China* (Beijing: Shangwu Press, 2005), p. 172.

exemplify the inherent water-human relationship in ancient Chinese cities. The cities below are among numerous case studies, but have been chosen for the clear spatial readings evident in cartography and for the different paradigms of indigenous water management that developed hand-in-hand with urbanism and the definition of the public realm. They exemplify the importance of the water in the city for practical and functional reasons, but also based on scenic landscape ideals, religious Taoist beliefs, as revealed through sacred buildings and in various festivals.

In Xiajin, a city in the floodable downstream region of the North China Plain of the Yellow River, there was ingenious construction of a complicated hydraulic system to survive floods, waterlogging, and incredible amounts of alluvial siltation. [fig. 3] As Yu, Zhang, and Li have documented, cities throughout the region have adopted three main strategies to mitigate the difficulties of the environment: living on highland, building circumvallation and circumvallating levees, conserving and excavating retention ponds.⁷ In Xiajin, the three strategies were combined and large lakes were dug inside the city's high protective walls to serve as temporary reservoirs during floods. Through a method of cut-and-fill, the earth evacuated from the lakes became the high and safe ground for residence. Unique to Xiajin is the fact that approximately 40 per cent of the area inside the walls was occupied by water. The huge lakes became an integrated part of the urban structure and livelihood. The two largest lakes in the south were used for raising bulrush, the two in the north for farmland cultivation, and others for fish farming. Also, a series of sacred temples were built to honour the gods of water, fire, agriculture, the city wall, and Confucius, all of which were located on the watersides.⁸ The sacred buildings made a strong link between the citizens and urban river and water system; the water network was an inseparable component of the economic and socio-cultural life of the city.

Linyi, a city in the hilly area of the northern Shandong province, also has a pond system inside its city walls, not for flood mitigation, but for water supply. [fig. 4] Throughout Shandong province, tank systems were carefully embedded into the topography and along small rivers and streams to collect and store rainwater for various uses, including irrigation and domestic uses. In Linyi, numerous ponds, tanks, and canals were constructed not only in the broad agricultural area, but also inside the city, where waterside public activities were concentrated and colourful. Many important public buildings were situated near the water bodies, such as a temple for Confucius, primary schools, museum, and administrative buildings. The waterside public space was the centre of social activities, particularly during traditional festivals, such as *Yuanxiao* (Lantern Festival, 15 January, the lunar calendar), *Qingming* (Tomb Sweeping Festival, 5 April), *Xima* (Horse-bathing Festival, 6 June), *Qixi* (Magpie Festival, 7 July), *Zhongyuan* (Hungry Ghost Festival, 15 July), etcetera. For example, during the *Zhongyuan* Festival, fishing in the river is forbidden; inhabitants gather at the riverside at night and set all kinds of lit candles adrift in little boats, in memory of their ancestors.⁹ The river waters are simultaneously public, personal, pragmatic, and reflective.

Ningbo (meaning 'serene waves'), Zhejiang Province, is one of China's oldest port and trade cities in the heart of the Yangtze River Delta on China's central eastern coast of Hangzhou Bay. [fig. 5] The historical geography of urban water management in Ningbo reveals a highly complex hydraulic system that has become tightly interwoven with the urban structure. Ningbo is located in the Yong Jiang basin at the confluence of two broad rivers, the Yong Jiang and the Yuyao. Since the relocation of the city in 738 CE as a mountain fortress to the coastal plains during the Tang dynasty (when it was known as Mingzhou) in connection with a great land reclamation project, the city's water system was comprised of 24 small canals and two huge lakes



Fig. 2: *Feng Shui* Idealization. 1) The pole star (northerly direction); 2) the highest mountain in the area; 3) the 'azure dragon' mountain in the east; 4) pagoda and monastery in the north-east to protect the site against evil influences; 5) the 'dragon's head' with a source of fresh water (mineral water, etc.); 6) the Great River; 7) the south mountain; 8) pagoda and monastery; 9) the 'white tiger' mountain in the west; 10) the southern slopes of the north mountain with best locations for graves; 11) a small tributary of the Great River, meandering through the valley; 12) the *yang* position for the city with an abundant water supply from the 'dragon's veins.'

Source: Schinz, A., *The Magic Square: Cities in Ancient China* (Stuggart: Axel Menges, 1996), p. 416.

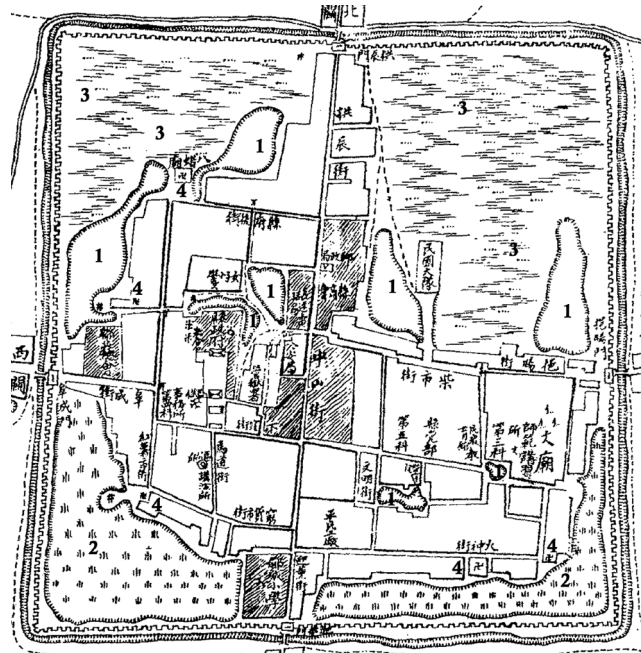


Fig. 3

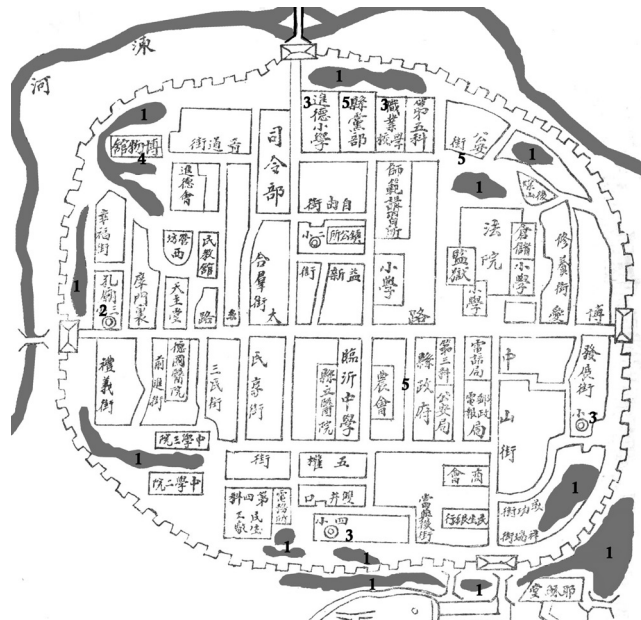


Fig. 4

Fig. 3: Xiajin, Shandong Province. Xiajin is situated in the Yellow River flood plain, with a high wall and several huge lakes inside the wall: 1) fishing pond; 2) bulrush lake; 3) low farmland; 4) sacred temple.

Source: Xie Xiwen and Xu Zonghai, 'Xiajin County Records' in *Collection of Chinese Chorography*, (Taipei: Chengwen Press, 1968), p. 2.

Fig. 4: Linyi, Shandong Province. Linyi is located beside the Yi river, with ponds both inside and outside its wall: 1) pond; 2) Confucius temple; 3) primary school; 4) museum; 5) administrative building.

Source: Shen Zhaohui and Wang Jinyou, 'Linyi County Records' in *Collection of Chinese Chorography*, (Taipei: Chengwen Press, 1968), p. 2.

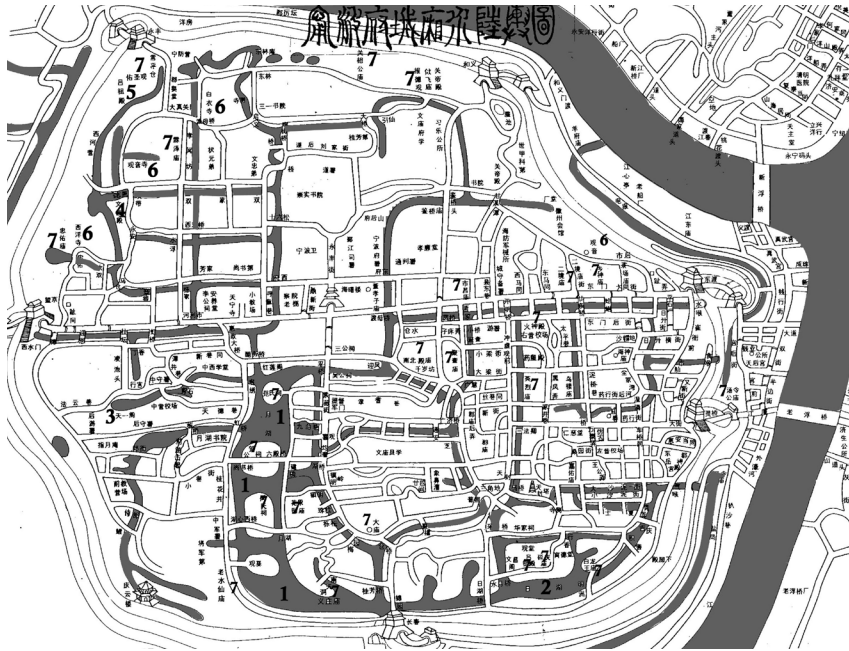


Fig. 5

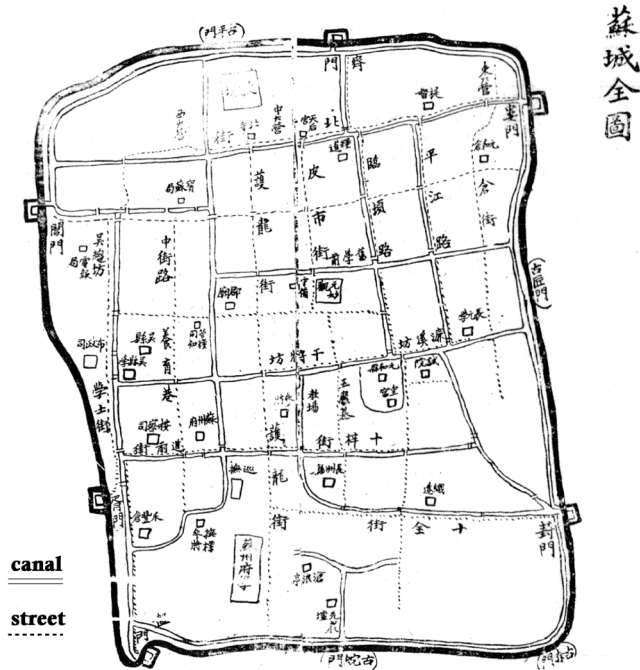


Fig. 6

Fig. 5: Ningbo, Zhejiang Province. Ningbo is located on the confluence of two rivers, with a network of canals and lakes: 1) Moon Lake; 2) Sun Lake; 3) Tianyi Attic; 4) Wenchang Hall; 5) Lüzu Hall; 6) Buddhist temple; 7) Taoist temple. Source: Ningbo Prefecture Records Compiling Committee (NPRCC), *Ningbo Prefecture Records*. (Beijing: Zhonghua Book Company, 1995), p. 50.

Fig. 6: Suzhou, Jiangsu province. The map is of the last imperial dynasty of China, the Qing, revealing Suzhou's intertwined nature of canals and streets. Source: Anon. 'Wu County Records' in *Collection of Chinese Chorography*, (Taipei: Chengwen Press, 1983), p. 10.

(Moon Lake and Sun Lake) inside the city, all of which were connected to one another and linked to the rivers.¹⁰ The total length of the canals was 22.5 km, with a linear river density of 6.44 km/km². Due to its extensive network, Ningbo served as a prosperous business and cultural centre in south-east China; it was connected to the extension of the Grand Canal (which was the main north-south water transportation artery in China). The urban area of Ningbo developed primarily south of the confluence of the rivers:

[...] along the western riverbank where a number of parallel streets connected the landing places on the river with the market street further inland. Since the lower reaches of the Yong Jiang were navigable for ocean-going ships, Ningbo soon became a very important transshipment centre at the southern end of the Grand Canal. Its settlement area increased westward; an administrative centre was established, and residential areas developed around the so-called Moon Lake. At the end of Tang dynasty a wall was built on the west side, connecting the bank of the Yuyao River with the riverbank at the southern end of the harbour area.¹¹

Ningbo's water system was not only the infrastructure network, but also the nerve centre of the urban landscape and public activities. In the 1920s, 70 per cent of the cargo was shipped through the canals and most of the city's streets were extended along the canals, including the main business streets. Eighty-two bridges, in different shapes and sizes, were built over the canals, inspiring a host of literature and tourism about and in Ningbo.¹² The hydraulic system also served as a productive landscape, where fish, chestnut, bulrush, and lotus were cultivated. The productive landscape was always linked to waterside activities such as fishing, lotus gathering, and water chestnut harvesting and everyday citizens were engaged in the production and shared harvests. Today, the inscription of engraved characters on stone tablets along bridges

and quaysides serve as witness to past colourful public activities.¹³ Along the canals were situated some of the city's most famous buildings, including Tianyige, a well-known library; Wenchang Hall, to honour the god of culture; and Lvzu hall, a Taoist temple. In the south of the city, beside Moon Lake and Sun Lake, some 16 temples were built to honour ancestors and various gods, three of which were on islands in the middle of Moon Lake. The lake is bustling with bridges, temples, and gardens and is among the most beautiful and dynamic area in the city; over the centuries a great number of poems, songs, and paintings have been created to depict and celebrate the cultural significance of the lake. However, since the 1860s, rapid urban development has led to the disappearance of the canal system and with it the urban-water interplay. Today, only part of Moon Lake has survived and the city, like so many in China, has largely become road-based.

Suzhou, long regarded as the 'Venice of the East' on the shores of Lake Taihu (the great drainage basin of the southeast region) and the lower reaches of the Yangtze River in the southeast of Jiangsu province, was a paragon of urban sophistication and elite classical culture – famed by Marco Polo and early Jesuit missionaries to China. [fig. 6] Originally founded in 514 BCE and called Helü Dacheng, capital of the state of Wu, the city was located in the richest rice-growing region of China and an area of great scenic beauty. Suzhou is located at a highland to the east of Taihu Lake, with an average altitude of 4.2-4.5 m above sea level. Mostly, the water level is below 4 m, while the highest water level ever recorded was 4.37 m on 28 July 1954; the city has seldom been flooded during its 2,500-year history.¹⁴ The city was 'laid out according to dictates of classical ritual and historical texts, the square walled city emulated the shape of the universe, in order that the movement of people and goods might mirror the natural flow of primal energies and ensure accord with the cosmos'.¹⁵ Crossing the city wall were eight

overland gates and eight water gates, symbolizing the eight *feng* (wind) of the heaven and eight *cong* (earth).¹⁶ A complicated urban canal system structured the urban form, with eight transversal and eight longitudinal canals and a huge moat, all interconnected to Lake Taihu and later connected with the Grand Canal. In Suzhou, besides the usual moat around the city wall, there is also a canal along the city wall inside the city; the city is truly a water city with canals measuring 82 km in length and with a density of 5.8 km/km².¹⁷

Suzhou thrived when China's imperial capital was shifted from Nanjing to Beijing in 1421 and particularly when it was connected to the Grand Canal. Its highly developed waterway system propelled it to become China's production centre for luxury goods and textiles (silk) and during the sixteenth century it was the economic and cultural centre of the country's most urbanized and advanced region. The cheap and efficient transport of its waterways was enhanced by a lively urban environment and along the watersides a rich fabric of private gardens, sacred temples, palaces, Buddhist towers, and commercial, residential, and public buildings were developed. The pragmatic function of the city's waterways was married with an aesthetic relation with water (representing the spiritual entity of Tao) and Suzhou has become world-renowned for its venerated urban gardens of literati, inside the tissue's urban dwellings.

Hundreds of bridges, built during several dynasties, spanned the canals and created a warp-and-woof, water-and-pedestrian system as expounded in one verse of a famous poem by Bai Juyi

Green waters surge in all directions of watercourses,
Vermilion painted balustrades stand on three hundred
and ninety bridges.

[...]

Waterways scatter like veins and boats like scales,

Lanes dot like pieces on the checkerboard in this square city.¹⁸

It was also famously depicted by the Qing dynasty Suzhou court painter and to this day is memorialized in the '*Shengshizisheng* Map', also known as the '*Gusu* lively map', presented to emperor Qianlong to commend prosperity of the country during his rule. [fig. 7] The painting depicts Southern China's landscape, idyllic cottage's officer's houses, ancient boats, small towns along the river, and bustling market scene.

The navigable waterways, fresh water, and location in a region with abundant natural resources, raw materials, and a large market and labour force placed *Suzhou* in the centre of an intensely urban centre of a vast agrarian empire. It was one of the world's most populated cities in the early nineteenth century and only started its decline in the 1860s during the Taiping Rebellion when it was laid to ruin and economically overtaken by nearby Shanghai.

Despite the incredibly rich legacy of China's water-based cities, during successive waves of industrialization and modernization, beginning with the pre-Mao era to Chairman Mao's Period, to Deng Xiaoping's economic reforms, water progressively disappeared from urbanism. As the contemporary global social-capitalism models took hold, organizational abilities allowed, and technology developed, there became both a further disconnection between waterways and settlements, and a new beautified relationship of urban waterfronts and waterside residential districts. As cities became more and more road-based, boats and ships and the everyday commotion of living with the water disappeared, as did a great deal of waterside recreation. Rivers once again became channels for sanitary waste and foul industrial waters until they were eventually polluted, abandoned, or filled in. The great technical progress of civil engineers and hydraulic engineers was able to tame the 'bacteriological city' of sewage

and water supply.¹⁹ Sewage was piped, rivers were covered and/or channelized, and water was quickly flushed from the city. On the whole (but thankfully with a few wonderful exceptions to the rule), health and sanitation regulations led to the bureaucratic pigeonholing of the urban water sector and hydraulic engineers systematically undermined the interplay of water and the city.

Throughout the contemporary world of increased specialization and technological innovation, the infrastructure of urban environments is planned and designed as linear flow systems and the focus is on the transportation of rainwater, nutrients, and wastes out of the city, accompanied by an inefficient use of energy, mineral, and other resources. As one looks back on urban history, water has disappeared from the urban realm, visually and as a collective conscious of urbanites, whether it be in the West or the East.²⁰ The nineteenth-century epoch of 'clean urbanism' began with the visual banishment of water.²¹ From that moment onwards, water became an absent presence in modern urbanism, an engineering trick – out of sight and, consequently, out of mind.

Three River-Recovery Projects by Turenscape

Over the past decade, landscape architect Kongjian Yu and his firm Turenscape have been tackling the overwhelming challenge of China's river channelization of concrete and other hard materials that has become an ubiquitous phenomenon in urbanized areas. Three projects in quite different contexts and with correspondingly varied responses reveal the possibilities to not only ecologically restore, but also imbue a rich public realm into urban cores of urban riverfronts.

Yingzhou Central River Transportation Project in Ningbo

In Ningbo, previously mentioned as a thriving port city, Turenscape's Yingzhou Central River Transformation (2006-2010) project showcases an alternative solution to today's urbanized waterfronts, addressing the challenges of minimum available land and flood control. It successfully transformed a channelized, concrete, rigid, and lifeless river into an eco-friendly, aesthetically pleasant, and productive landscape, harmonizing the relationship between nature and city. The project is located in the centre of the newly developed dense urban Yingzhou District of Ningbo. The rapid urbanization of the region left its rich irrigation, drainage, and transportation network largely filled or channelized using concrete, resulting in rigid and lifeless concrete ditches, which only function for drainage. At the same time, other ecosystems services have been completely ignored. By transforming the former channelized river into an eco-friendly, productive and pleasant water feature, the project proves the possibility of the recovery of the region's water courses as a living ecosystem with the capacity of providing multiple ecosystem services. [fig. 8] The project had to deal with a number of constraints, first of which was limited land use; the central district occupies an area of one square kilometre and its surrounding rivers had all been channelized. The waterfront space is only 50 to 80 m wide between the street and the water line. Along the water's edge is a bend of 10 to 20 m of hard surface pavement rendered in concrete and granite. Beyond this narrow bend is a green strip, which had been planted with trees. Secondly was the problem of flood control. The flood control regulation required that the drainage capacity of the channel could not be reduced. Thirdly, budget was very limited and no massive earthwork was possible. Therefore, the design strategy followed a few key principles: 1) maintain newly planted trees on site as much as possible, so that the cost of tree planting could be reduced; 2) remove the upper part of the concrete embankment, but utilize the base for



Fig. 7



Fig. 8

Fig. 7: 'Shengshizisheng Map' ('Gusu lively map'). A part of the map of the Qing dynasty painting that shows the bustling waterside activity in Suzhou as well as the active street-life in the prosperous commercial centre of the 'Venice of the East.'

Fig. 8: Yingzhou Central River Transportation Project. The former canelized river is transformed into an eco-friendly, productive and pleasant water feature. Source: Turenscape

erosion control of the new earthen bank; 3) reduce the elevation of the riverbank so that a riparian wetland zone could be created (productive lotus flowers are grown and lotus tube can be harvested in the fall); 4) install a boardwalk (as seating and fence) in the middle of the wetland surrounded with rush lotus flowers; 5) create semi-enclosed courtyards (30 x 30 m at intervals of 150 m) to create meeting places and rhythm along the route. The courtyards were inspired by the vernacular typology of the local villages and local materials of tile and granite slates are used for paving. A wood shelter is nestled among the background trees for people to rest, native grasses are grown inside the courtyards, and double steel panels, filled with bamboo, frame the courtyard. In this way, a contemporary new-vernacular experience has been created.

Pan Long River Rejuvenation Project in Kunming

It is clear that China's development pressures are tremendous and environmental and sociocultural consequences are devastating. Throughout China, rivers are hardly recognizable as the cultural gathering and social centres they once were. In Kunming, the Pan Long River (Kunming's 'mother river') has become a hardened landscape (with no natural edges) and a sewer for parts of the city. Here, Turenscape (re)developed the landscape structure in tandem with new urbanization and urban/rural requalification across scales. Kunming (population 5.7 million) is the capital and the largest city in Yunnan Province in southwest China. It lies in the fertile lake basin of the Yungui Plateau at 1900 m above sea level and is surrounded by lakes and limestone hills. It is located near the border with Southeast Asian countries and has always had a special link to that region, as well as to India and Burma. Kunming is known for having one of the mildest climates in China and for its Dianchi Lake ('the pearl of the plateau') – China's sixth-largest fresh-water lake. The city is a huge horticultural centre, the largest flower export base in Asia, and is

a growing tourist destination. Its scenic landscape is a quality of the region that requires safeguarding and land stewardship.

Kunming's Pan Long River stretches 23 km through the city's central business district between the Song Hua Ba Reservoir in the north and the Dianchi Lake in the south. The river is quite narrow (between 10-20 m wide) and over the years has become channelized and embanked with 100-year-flood concrete steep slopes. At the same time, over the most recent decades, urban development has been proceeding at breakneck speed and, as the permeable surface areas of the city decreases, the general risks of flooding in Kunming are increasing (during the summer, as the city has a subtropical highland climate). In addition, pollution in the river is getting worse, due to, on the one hand, the fact that the city has an incomplete sewer network and a great deal of raw sewage that discharges directly into the region's waterways and, on the other hand, the fact that there are a number of inappropriate land uses along the riverfront (including industry and warehouses). Also, the river was once the cultural and social centre of the city, and although there are number of important relics remaining, they are mostly neglected and need re-linking to the 'mother river'. Today there is no convenient access to the riverfront and there are no natural buffers between the cityscape and the water.

The Pan Long River Rejuvenation project, the planning of which was developed in 2008-2009, works across multiple scales (region, city, and district) as well as in a realized stretch of the riverfront. In a most general sense it has four major objectives as follows: 1) to reconfigure the river as a channel to mitigate the city's floods (100-year flood) and (purified) storm water, while, at the same time, giving public access to the riverfront in a friendly and landscape/soft-engineered manner (requiring demolition of the hard concrete embankments); 2) to upgrade the river and thereby rejuvenate

the economy of the inner city and to more specifically increase the land values of the properties immediately adjacent to the riverfront itself; 3) to pay particular attention to the upper and lower reaches of the river, where the farmland and rural land use is dominant. It is evident that the territory is one in transformation, but the project seeks to build upon the inherent qualities of the particular landscape features adjacent to the northern reservoir and the southern lake; 4) to initiate ecological restoration along the river and the region as a larger system to increase biodiversity (including to collect water in the wet season and to release it in the dry season), to strengthen the link between the natural and cultural heritage, and to create new systems for recreational and public space uses for the city and province.

At the scale of the region, 'ecological infrastructure' and 'security patterns' were developed following an analysis of the existing conditions. Ecological infrastructure is intended to secure the integrity and identity of the landscape by identifying and working with essential natural, biological, and cultural processes. Ecological infrastructure includes both 'defensive measures' (protecting threatened ecological networks) and 'opportunistic' interventions to restore, complete, and integrate the damaged water network into the urban fabric. 'Security patterns' identify the natural capital of ecology and stresses its non-renewable process-embedded value. The ecological infrastructure for Kunming, as a powerful tool for open public space conservation, focused on three categories of processes: abiotic (mainly water management), biotic (native species/biodiversity conservation), and cultural (heritage protection and recreation).

The strong analytical base for the project was provided by natural, cultural, and socioeconomic data from GIS, and interpretative maps led to projective design cartographies that were used to safeguard the three different processes in the landscape.

The flood-security patterns at the regional scale sought alternative solutions to the usual engineered flood mitigation by capitalizing on the assets of the natural landscape and low-, medium-, and high-security patterns were developed for 20-, 50-, and 100-year floods respectively. Landscape security patterns were set up to provide maximum natural water-retaining capacity. Storm water management and flood protection depend on these interconnected networks of wetlands, low-lying grounds, waterways, and lakes – providing a sound substitute for concrete dams and riverbanks. The strategy for biodiversity conservation was built on analytical maps of land use and vegetation, combined with an analysis of habitat suitability (based on the spatial relationships between habitats and landscape ecological principles). Strategic points and critical areas were identified as the primary concerns for the management and design of interconnected ecological corridors. At the intersections of roads and the natural corridors, the proposed design interventions include underpasses for certain wildlife species and for water flows, plus bridges for animals. Security patterns for cultural heritage protection and recreation are also included, and these are based on careful analysis of the existing heritage site and potential linkages to it.

At the scale of the river itself, the 23-km trajectory was analysed very carefully and recognized to have a number of very different inherent qualities. The north and south are presently rural, agricultural areas and this was considered a quality that could be respected in the new densification and development that would inevitably take place as urbanization continues its unstoppable advance. In a development plan for the area adjacent to the Song Hua Ba Reservoir, new housing clusters were developed together with constructed wetlands and swales (in addition to protecting as many existing rural fish ponds and villages as possible) to create a new urban/rural morphology and housing typologies. In the area just north of Dianchi Lake, existing

villages were also maintained; the rice fields were converted into a wetland park to (re)purify water that was cleaned in a mechanical sewage treatment plant before releasing it into the Pan Long River. New urban development would complement the existing settlement structure, again creating a marriage of tradition and modernity and a host of new mixed-use morphologies and typologies. In the central stretch of the river – particularly through the central business district of Kunming – the river was upgraded and developed as a system of parks and gardens to link cultural amenities and create public promenades and a low-speed traffic system for Kunming. A modification and adjustment of the existing morphologies and typologies along the greatest length of the river's trajectory would significantly change the quality of life in the city and shallow slopes along the banks would give citizens accessibility to the riverfront once again and bring Kunming back to the Pan Long River.

The first phase of the project was constructed between September 2009 and March 2010, and realized 8.3 km of the riverfront restoration of the downstream section of the river, from Guannan Bridge to the mouth of Dianchi Lake. The project included riverbank stabilization using ecological engineering (live-staking and riprap) to strengthen the structure of the soil and provide added resistance to the erosive forces of the water flows; newly placed porous-paving bicycle and pedestrian trails along the river; native hydrology-based planting to restore the riparian system; and the inclusion of wooden platforms and urban furniture to create new social spaces along the riverfront. [fig. 9] The dilapidated riverside has been transformed into a highly used public green space and the river has been returned to the city as its central spine.

Finally, the Pan Long River (as the mother river of Kunming) project is an important step for the recovery of the region's 35 rivers (which are the source of Dianchi Lake's pollution). The Mayor of

Kunming has himself taken personal responsibility and supervised projects on the Pan Long River and assigned each of his deputy mayors to be responsible for a similar ecological rebalancing of other rivers in the province. The political will of the local government is recorded in the city's Communist Party record of 18 July 2008.

The last Turenscape river restoration project is perhaps the most radical in terms of renaturalization. Qian'an City is located at the south foot of the Yanshan Mountain, at the right bank of Luan River, northeast of Hebei Province. Although the city developed along the Luan River, one cannot see the water as Qian'an's topography is situated below the riverbed; the river is notorious for its unpredictable flooding, and has thus been kept outside of the city for decades through a high embankment. The life source of Qian'an has been a tributary of the Luan, the Sanlihe River, a more calmly flowing river, which has shouldered the long history of the city and carried the collective memory of the inhabitants. Before 1973, the Sanlihe had crystal-clear water from the groundwater recharge of Luan River. Although frequented by storms and heavy rain, the Sanlihe River was never a source of either drought or flood; on the contrary, it provided rich water resources for nearby industries and agriculture. However, as industrialization and urbanization progressed, the Sanlihe suffered the same fate as rivers throughout China. It became the city's backside – neglected, a sewer, used only for waste disposal.

Sanlihe River Project in Qian'an

In 2007, Turenscape was commissioned to recover the Sanlihe River and a greenway of 13.4 km in length and 100 to 300 m in width now serves as an exemplary project of how a neglected landscape can be recovered as an ecological infrastructure and everyday landscape with restored ecosystem capacity in providing multiple services, mediating flood and drought, providing habitats for native



Fig. 9



Fig. 10

Fig. 9: Pan Long River Rejuvenation Project. Reconfiguration of 8.3 kilometres of the downstream river section created a vibrant new public realm with platforms for locals along a river pathway. Source: Turenscape
Fig. 10: Sanlihe River Project. Restored ecosystems restored a public realm and all was done with relatively inexpensive means and using many of the existing elements, as here with 'tree islands'—created from the desire to keep existing trees that would be inundated with the restoration of the river.

biodiversity, integrating pedestrian and bicycle paths for commuting and recreational uses, creating spiritual and aesthetic benefits, and catalysing urban development. The linear park covers approximately 135 hectares and benefits a population of approximately 700,000. The existing trees on the site were saved and the riverbanks were transformed into a number of tree islands connected by boardwalks. [fig. 10] The project used low-maintenance native vegetation, lush water grasses, and wildflowers. Along the greenbelt, the pedestrian and bicycle routes are fully accessible to communities along the channel; these routes integrate with the urban slow-transportation network and create harmony between man and nature in the city of a new era.

The water management of the project is noteworthy. The design for the greenway took full advantage of the existing natural elevation change between the Luan River bed and the city. A fountain was made through a pipe that goes under the high embankment, so that a constant controlled amount of water will make its way through the city before running back to the Luan River at the lower reach. This strategy turns the Sanlihe into a 'scenic byway' of the larger Luan River and transforms the dangerous natural force into a pleasant amenity. Secondly, the existing concrete channel of the river was removed and a multiple watercourse riparian wetland system was created, including the creation of emerald-like wetland bubble chains at the edge of the main watercourse, which regulates floods and collects and dissipates urban storm-water runoff. When the river's water level drops to its lowest point, pools of water remain in the emeralds as wetlands, creating a 'green river'. Furthermore, the wetlands work as an ecological purification buffer for urban storm-water runoff from both banks and the meandering natural waterways, at various surface levels, become diverse habitats for wildlife.

China's Urban Rivers as Public Space

In China, as elsewhere, 'the struggle to control water is a struggle without end'.²² Man's apparent mastery over nature and taming of rivers has proven futile. In recent years, water management projects by Turenscape and others have deviated from business as usual and made the necessary shift from hard engineering to soft engineering, where slogans such as 'room for water' and 'space to the river' have taken precedence at the territorial scale and in which terms such as SUDS (sustainable urban drainage systems) and eco-swales have become part of the urban design vocabulary. Reconstructed wetlands, aerated lagoons, flood adaptive landscapes, and rainwater gardens are all concepts that work with natural forces in the development of a resilient water (-based) urbanism – in many instances they are experimental terrains to simultaneously accommodate development pressures and ecological concerns. They are working within a larger paradigm shift that is occurring throughout the world²³ and where to date a number of offices, primarily in Europe and North America are working at such scales and with similar issues (firms such as Georges Hargreaves, Agence Ter, H+N+S Landscape Architects, PROAP, SWA, and so forth).

Clearly, if even marginally, there has been a rediscovery of riverscapes in China. Rivers are, once again, becoming distinguishing attributes of cities and towns. The times and characteristics of Imperial China and the imagery are irrecoverable, as history is an evolutionary flow, however new roles and with them spatial forms of rivers are taking shape. Not only the environmental (compounded by the predictions of climate change), but also the social aspects of rivers are now seen as advantageous as cities are beginning to market themselves in the post-industrial era. There has been an increasing level of scepticism in the universal faith of technology and a return to respecting the river as an entity defined by its natural laws. As seen particularly in the Sanlihe project, floodplains are being (re)seen as spaces

of negotiation between nature and the demands of civilized society. Ecological awareness, coupled with an increase in leisure time, has led to massive investments in new strategies for de-channelling and giving a greater degree of freedom back to rivers. The change from a controlled object to an active subject (that is at least partially beyond control) affords new forms of living, recreation, and land use.

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Biographies

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