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Traditional Water Governance Wisdom from the Perspective of Chinese Character Culture: A Study Centered on Ancient Urban Water Systems

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Abstract: The development of Chinese civilization has long been intertwined with water. Ancient urban water systems provided supply, drainage, flood control, transport, and landscape functions, while also shaping urban order, social governance, and cultural expression. As a carrier of Chinese civilization, Chinese characters preserve early understandings of perceiving, using, and governing water. By examining characters such as shui, shu, xu, ze, gou, han, cheng, and zhi, this paper argues that traditional water-governance wisdom formed an integrated system of natural cognition, spatial planning, engineering practice, and institutional management. Moats, channels, wells, ponds, culverts, water windows, and related facilities enabled water-resource use, stormwater regulation, drainage, flood prevention, and ecological conservation. These practices embodied principles of following natural conditions, guiding water by terrain, combining storage with discharge, and maintaining systems dynamically. They resonate with modern ideas of sponge cities, resilient water systems, and ecological purification, and provide cultural references and practical inspiration for contemporary urban water governance.

Keywords: Chinese character culture; Traditional water governance; Urban water systems; Water culture; Modern water management

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1. Introduction

Chinese civilization prospered through water, and water governance runs through the rise and transformation of cities. Water was never only a natural element; it also shaped social governance, urban space, and intellectual systems. From Yu the Great's flood control to capital-city planning, and from moats and channels to sluices, ancient Chinese urban waterworks displayed systemic wisdom beyond single-purpose engineering.

Chinese characters, as one of the most enduring logographic writing systems in continuous use, constitute a distinctive medium for understanding traditional water-governance wisdom. Their structures are

not only linguistic signs but also cognitive maps. In the character shui (water) and its semantic component 氵, ancient people visually fixed the natural phenomena of flow, convergence, and overflow into graphic form. In concrete characters such as liu (flow) and yan (inundation), as well as governance-related terms such as shu (dredge), dao (guide), and zhi (govern), one can observe a complete logic extending from perception to regulation. Through this image-based mode of cognition, water-governance knowledge was textualized, symbolized, and transmitted through the continuity of civilization.

This paper examines ancient water-system planning, supply and drainage, purification, and management from the perspective of Chinese characters, and discusses their implications for modern urban water governance. The inquiry reveals not only engineering experience but also the cultural logic of interaction between human communities and water.

2. The virtue of water: Philosophical foundations embedded in Chinese characters

The core of traditional Chinese water governance was a form of flexible wisdom grounded in the philosophy of following nature and in the idea that the highest good is like water. This concept was deeply embedded in Chinese characters and guided subsequent engineering practices.

2.1. The highest good is like water: Softness and inclusiveness

The basic pictographic character shui depicts flowing water and symbolizes the source of life. Laozi connected water with the Dao, arguing that water benefits all things without contention. This idea became both an ethical metaphor and a guiding principle for water governance [1].

In practice, this philosophy was expressed as the wisdom of softness and non-contention. The characters rou (softness) and ruo (weakness) refer to gentleness and restraint. Laozi also emphasized that nothing under heaven is softer and weaker than water, yet nothing is better at attacking the hard and strong. Although water appears soft, it can wear away stone, revealing a powerful non-confrontational force that corresponds closely to Yu the Great's method of dredging and guiding. Yu learned from the failure of his father Gun, who attempted to block floodwater, and instead adopted a strategy of dredging: planning channels according to terrain and river location, leading water from small channels to larger rivers and finally to the sea. This approach of following natural conditions and planning as a whole laid the foundation for more than two millennia of Chinese water-governance culture.

2.2. The virtue of deep pools and marshes: Storage and cultivation

Another important virtue of water is reflected in yuan (deep pool) and ze (marsh or moistening land), which signify storage, inclusiveness, and cultivation. The ancient graphic form of yuan depicts a deep pond or backwater and suggests depth and capacity. Ze, formed with the water component, originally referred to a place where water accumulates and later came to mean moisture, nourishment, and benevolence. In urban water engineering, this semantic field was materialized as the strategy of storage.

Ancient cities made use of natural low-lying terrain to excavate lakes and ponds for water storage. This practice was not only a means of water-source regulation but also an important component of environmental planning. In the Han Dynasty, Chang'an Kunming Pool was excavated not only for naval training but also as an urban water source and regulating reservoir. Studies indicate that Kunming Pool covered about 320

hectares, comparable to a medium-sized reservoir, and that its integrated system of diversion, storage, and discharge contributed to the reliability of water governance in Chang'an [2]. In Qing-dynasty Beijing, the construction of western suburban gardens created extensive rivers, lakes, and wetlands, which played important roles in water-source conservation, microclimate regulation, and the mitigation of floodwater from the Western Hills. This was a concrete expression of the wisdom of ze in urban planning.

2.3. The wisdom of dredging and guiding: Flow and vitality

Shu (dredging) and dao (guiding) together form the practical core of Chinese water-governance philosophy. Shu means clearing blockages and opening channels, while dao means leading and guiding. The combined idea of dredging and guiding treats the flow of water as a source of urban vitality rather than as a purely destructive force.

This principle was consistently implemented in long-term urban water-management practice. In the Northern Song dynasty, Zhang Junping submitted Eight Proposals on the Benefits and Hazards of Dredging and Drainage to Emperor Renzong, proposing measures such as opening downstream channels and removing sediment, thereby emphasizing the importance of dredging in urban management. Emperor Xuanzong of the Tang dynasty ordered the repair and dredging of old ditches and channels, and Emperor Taizu of the Later Zhou also ordered Kaifeng Prefecture to clear old moats [3]. These examples indicate that dredging was not a temporary response but a regular practice incorporated into long-term state management.

Ancient water governance was therefore a civilizational practice with deep philosophical significance. Through long coexistence with water, early communities translated the abstract idea of the Dao into concrete engineering language, turning water systems into material carriers of philosophical thought. From principle to technique and from idea to work, the character of water, the form of the city, and the dwelling of the people all reflected a wisdom of following nature and guiding action according to circumstances. Many water-related Chinese characters not only recorded the form and function of water but also preserved ancient understandings of governance. **Table 1** summarizes representative water-related characters, their philosophical connotations, and corresponding ancient cases.

Table 1. Water-related philosophical meanings in Chinese characters and representative cases

Character	Etymological and cultural connotation	Ancient water-governance case
水 (shui)	A pictograph depicting the form of flowing water; symbol of the source of all things and of softness with strength.	Yu the Great's method of dredging rather than blocking, using diversion to replace simple embankment-based obstruction.
疏 (shu)	Dredging, diversion, and removal of silt; a core principle of water governance.	The Qin canal system, including the Zhengguo Canal and the Bai Canal, used diversion and distribution to irrigate the Guanzhong Plain.
渊 (yuan)	A deep pool or backwater; symbol of containment, depth, and accumulated potential.	Kunming Pool in Western Han Chang'an stored water and regulated the urban water system.
泽 (ze)	A marsh or water-accumulating place; later extended to nourishment and beneficence.	The Linzi water system of Qi, including Fufu Spring and Juze Marsh, formed a natural wetland flood-control pattern.
弱 (ruo)	Weakness and non-contention; reflects the philosophy that softness overcomes hardness.	In the Spring and Autumn period, Wu shifted from blocking to dredging by opening the Xujiang waterway to guide water into Taihu Lake and reduce flood risk.
润 (run)	Moistening and cultivation; symbol of the life-supporting function of water.	The Zhiquan Spring system of Daming Temple in Tang Yangzhou introduced spring water into the city to support the water supply.

洁 (jie)	Cleanliness and purity; reflects ancient concern for water quality and sanitation.	Song-dynasty Bianliang reportedly used filtered wells and clear-water structures to improve drinking-water quality.
清 (qing)	Clarity and transparency; symbolizes the purity of water and moral brightness.	The Jinshui River in Chengdu used settling facilities to remove sediment and keep the water clear and flowing.

3. The veins of water: Macro-layout of urban water systems

Urban water planning was the first step in constructing the overall life system of a city. It determined the relationship between the city and water. Through the use of characters such as cheng (city), hao (moat), qu (channel), and jing (well), ancient communities revealed a macro-layout wisdom characterized by local adaptation and multifunctional integration.

3.1. City walls and moats: Sponge wisdom in urban site selection

The character cheng evokes the combination of a city wall and its surrounding moat. Ancient urban site selection often followed the principle recorded in Guanzi, namely, making use of natural endowments and local advantages. The excavation of moats and the construction of walls were often carried out simultaneously, with earth from the moat used to build the wall. This reflected the practical wisdom of "digging to form a moat and using the excavated earth to build the city." The design served military defense, but it also had multiple water-related functions.

Hao originally referred to a river or ditch encircling a city. In ancient urban systems, it was not only a defensive facility but also a sponge-like system for drainage and water-source conservation. During the construction of Yuan-dynasty Dadu, present-day Beijing, the builders excavated moats and the Jinshui River while making use of the natural north-high and south-low terrain. These water systems and city walls complemented one another and formed an urban flood-control system [4]. The capital sites of Fenghao in the Zhou dynasty, Xianyang in the Qin dynasty, and Chang'an in the Han dynasty all took river locations into consideration, either using natural rivers as moats or introducing water for supply and drainage. This multifunctional concept corresponds closely with contemporary sponge-city objectives such as rainwater regulation, runoff control, and ecological landscape integration.

3.2. Channels and flow: Systematic construction of water-supply networks

Qu originally means an artificial watercourse and, in cities, refers to channels excavated for water supply. Liu describes the morphology of water flowing through channels. One of the principal measures of ancient urban water supply was yin, or water diversion into the city, usually following the principle of gravity flow.

The Kunming Pool diversion channel in Han Chang'an and the Qingming, Yong'an, and Longshou channels of the Sui and Tang periods together formed a relatively complete water-diversion system for ancient Chang'an. This system supplied stable domestic and production water to palaces, markets, and residential wards, while surplus water entered gardens and ponds to form landscape water systems with both ecological and aesthetic value [5]. In the Ming dynasty, the Guangcheng Canal and the Yongji Canal were constructed and connected under the leadership of Xiang Zhong. They effectively addressed urban water-supply problems and also facilitated waterborne transport. These cases demonstrate the high level of ancient water-system planning: urban channels were organized as integrated networks combining water supply, drainage, transportation, and landscape functions.

3.3. Wells and drawing water: Nearby support for domestic water supply

Jing is a pictographic character representing a well opening and well curb, and it reflects ancient exploitation and use of groundwater. Ji, formed with the water component, means drawing water, especially from a well. As an important component of urban water supply, wells provided nearby domestic water in addition to channel-based systems.

In urban water-supply systems, well water long served the functions of terminal security and decentralized provision. Before large diversion channels were completed, or when they became difficult to maintain, wells became a basic source of urban domestic water because they were locally accessible and comparatively easy to maintain. In Sui-Tang Chang'an, as the city expanded to an unprecedented scale, wells and channels were widely installed in palaces, temples, and residential wards, creating a pattern in which channels acted as the main supply and wells as branch sources. Wards commonly contained public wells that met needs for drinking, cooking, firefighting, irrigation, and cleaning [6]. During wars or disasters, wells further demonstrated the resilience of urban water systems. When external diversion works were damaged by warfare, sedimentation, or water-source failure, wells could become the only sustainable support for urban water supply.

Ancient urban planning thus treated the water system as an organic whole. Moats, urban channels, and artificial ponds each assumed different responsibilities while complementing one another and overlapping in function. This "one facility with multiple uses" concept improved the efficiency of land and resource use and revealed a deep understanding of ecological and urban-operational logic. From the perspective of Chinese characters, many terms related to water-system planning also reflect ancient cognition and practice. **Table 2** presents selected characters and cases associated with the planning of ancient urban water systems.

Table 2. Chinese characters and cases in ancient urban water-system planning

Character	Etymological and cultural connotation	Ancient water-governance case
城 (cheng)	A pictorial idea of earth enclosure, expressing a spatial order in which earth forms the frame and water provides support.	Liangzhu Ancient City used earthen city structures together with water systems to form flood-control and defensive functions.
濠 (hao)	A moat or ditch; both defensive and drainage-related, embodying the idea of water as support for the city.	The moat of the Ming imperial city in Nanjing combined drainage, water storage, and urban defense.
渠 (qu)	An artificial channel, the artery of urban water diversion and drainage; reflects dredging rather than interception.	Qingqu Canal in Qin Xianyang introduced water into the city for drinking and irrigation.
井 (jing)	A pictograph of well construction and groundwater use; reflects storage without overflow and decentralized supply.	The ward wells of Tang Chang'an were widely used for residential drinking water and daily use.
引 (yin)	Water diversion into the city to balance supply and demand; reflects the idea of taking water according to terrain.	Eastern Han Luoyang introduced Luo River water to improve the water supply and reduce flood risk.
蓄 (xu)	Storage and regulation of rainwater and river water; embodies the strategy of mitigating floods through retention.	The Taiziwan storage system around Song-dynasty West Lake, Hangzhou, stored water, regulated floods, and maintained landscape ecology.

4. Strategies of water: Cyclical systems of supply, drainage, and purification

Urban water affairs formed one of the most dynamic components of the urban life system. From drainage-network layout and water-quality purification to waterborne transportation, ancient waterworks displayed

both systemic coordination and refined technical skill, revealing a subtle logic of coexistence between human communities and water.

4.1. Ditches and culverts: The underground veins of urban drainage

Gou originally means a watercourse or drainage ditch, and ancient cities used both open ditches and underground channels. Han refers to culverts passing under roads or city walls, while lou can mean drains, seepage structures, or drainage openings. Behind these characters stood highly developed urban drainage networks.

At Pingliangtai Ancient City in Huaiyang, Henan Province, dated to more than 4,300 years ago, ceramic drainage pipes were installed as some of the earliest planned public drainage facilities in China. In Ganzhou, Jiangxi Province, the Northern Song Fu-Shou Ditch system connected ditches and culverts with urban ponds. Its most ingenious component was the water window. When the river level outside the city rose above the window, hydraulic pressure automatically pressed the window shut to prevent backflow; when the river level fell below the outlet, accumulated water inside the ditch pushed the window open and drained out of the city [7]. In Yuan Dadu, drainage culverts were paved with stone slabs on the bottom and sides, covered by brick arches, and fitted with iron grilles in the middle. Their craft was consistent with the arched water-window records in the Song architectural manual Yingzao Fashi. These examples show that ancient public drainage management had already reached a high technical level.

4.2. Washing, settling, and filtration: Refined techniques of water-quality purification

Di means washing and removing impurities; cheng means making water clear through settling; and lü means filtering. These characters reveal a variety of ancient water-quality purification techniques.

The first category was physical purification. The underground drainage channels of the western inner garden of Tang Chang'an were equipped with several gates. The first consisted of iron bars that intercepted large debris, while the second was an iron plate with diamond-shaped openings that filtered smaller impurities. This is one of the clearest records of a staged water-treatment device in ancient China. During the Northern Song renovation of Chengdu's Jinshui River, settling basins or chengcao were built so that water could deposit sediment before entering the city, representing the mature application of physical sedimentation.

The second category included chemical and biological purification. As early as the pre-Qin period, people had accumulated experience in using natural materials to improve water quality. Tiangong Kaiwu records that people living along the Yellow River during the Chongzhen reign of the Ming dynasty used alum to clarify muddy water, relying on coagulation to settle suspended impurities. This mechanism is similar to modern coagulation and sedimentation. Qimin Yaoshu and Bencao Gangmu also mention the use of plant ash, bamboo charcoal, and lime to purify well water. Through adsorption and alkaline reactions, these materials removed impurities and reflected an experiential form of chemical purification. Ancient people also used plants and organisms for ecological purification. Ritual practices used bundles of baomao grass to filter liquids [8], and folk devices used bamboo strips, palm fiber, and grass roots as simple filtering layers for well water. In Tang-Song gardens and palace water systems in the Jiangnan region, lotus planting and fish culture were often used to maintain water cleanliness. Lotus leaves, aquatic roots, photosynthesis, and the feeding behavior of fish and shrimp jointly supported water self-purification. West Lake in Hangzhou, Slender West

Lake in Yangzhou, and Shangqing Pool in Luoyang all practiced forms of plant-water-fish coexistence that combined landscape with function. Such multilevel water-quality safeguards show ancient concern for water safety and public health, as well as the integration of engineering rationality, ecological wisdom, and economic efficiency.

4.3. Canal transport and navigation: The traffic and economic functions of water routes

In addition to supply and drainage, urban water systems also performed important transportation and economic functions. Cao originally referred to grain transport by boat, yun means carriage or transport, hang means sailing, and gang denotes harbors or transfer points. Together, these characters outline the spatial and economic role of ancient water transport.

The Grand Canal became the main artery of ancient waterborne transport, connecting political centers, agricultural regions, and military strongholds. In the Yuan dynasty, dredging the Tonghui River and Lu Canal shortened the Beijing-Hangzhou grain-transport route by nearly 900 km [9]. In Southern Song Lin'an, granaries, streets, and commercial spaces developed around canal transport.

The drainage and purification technologies of ancient cities were grounded in practical understandings of hydraulics, physical chemistry, and even biology. These techniques formed a linked and layered system. From hydraulic pressure regulation and flow-velocity control to sedimentation, filtration, and biological purification, ancient communities built a waterworks system that approached modern systems in functional logic. Their practices demonstrate that they had already recognized the complexity of water governance: it was simultaneously a technical, managerial, ecological, and philosophical issue (**Table 3**).

Table 3. Chinese characters and cases in ancient waterworks practice

Character	Etymological and cultural connotation	Ancient water-governance case
蓄 (xu)	Water storage and energy accumulation; reflects the strategy of using retention to mitigate emergencies and floods.	Kunming Pool in Western Han Chang'an stored floodwater, supported drainage, and served water-supply and landscape functions.
沟 (gou)	A watercourse or ditch; symbol of the capillary network of urban drainage.	Drainage ditches along Tang Chang'an streets supported rainwater and wastewater diversion and street-level flood relief.
涵 (han)	A culvert or the act of containing and connecting; symbol of hidden underground drainage linkage.	Drainage culverts in Yuan Dadu used brick arches to guide water into rivers and improve flood resilience.
澄 (cheng)	Clarification and sedimentation; represents artificial purification and water-quality conditioning.	The chengcao settling facilities of Chengdu's Jinshui River used sedimentation for natural purification.
滤 (lü)	Filtration and percolation; indicates removal of impurities from water.	Lu Yu, the Tea Sage of the Tang dynasty, designed a water-filtering bag for tea water, inspiring later simple filtration methods.
漏 (lou)	Leakage, seepage and drainage; reflects the use of underground channels and seepage wells.	The seepage-well system of Qin Xianyang combined underground infiltration with open ditches to prevent street ponding.

5. Governance of water: Long-term institutional mechanisms

No major waterworks system can remain effective without institutional support. Ancient water management gradually evolved from reliance on individual wisdom to a dynamic long-term mechanism based on law and official institutions. This development can also be traced through Chinese characters.

5.1. Law and punishment: The regulatory role of water-related institutions

Lü means law, rule, and standard, while cheng means punishment or correction. These characters record the transition of water management from personal rule to institutional governance.

One of the earliest relevant legal provisions appears in the Qin laws: those who discarded ash on roads were subject to punishment. This reflected Qin's concern for maintaining drainage systems by preventing ash and refuse from blocking ditches. In the Tang dynasty, legal provisions became more detailed. The Tang Code and its commentaries stipulated penalties for pouring wastewater or dumping refuse onto streets. Such institutional constraints integrated the daily maintenance of water facilities with public sanitation management. Strict regulations provided legal support for urban waterworks and constructed an institutional safeguard for the urban water environment.

5.2. Governance and officials: Organization and practice of water management

Zhi means governance, ordering, and regulation, while guan denotes officials and the institutions that implement governance. The shift from heroic water control by individuals to official water management reflects the evolution of ancient water administration from experience to institution.

From Yu the Great to Li Bing, individual wisdom and technical skill opened important paths for water governance. However, as city size expanded and water systems became more complex, the long-term operation of such systems could not be sustained solely by individuals. In the Song dynasty, specialized agencies such as Hequsi and Dushuijian were established to manage rivers, channels, and urban drainage [10]. In Ming Beijing, the Five-City Military and Patrol Office undertook responsibilities for street and ditch maintenance, ensuring that drainage and cleanliness were jointly managed.

Ancient water management thus formed a collaborative mechanism of official supervision and public maintenance. This model extended the service life of facilities and supported dynamic balance in urban water governance. **Table 4** summarizes the institutional logic.

Table 4. Chinese characters and cases in long-term water-management mechanisms

Character	Etymological and cultural connotation	Ancient water-governance case
律 (lü)	Law, rule, and institutional order; used to regulate water-management behavior.	Qin legal provisions punished the act of discarding ash on roads to prevent blockage of drainage channels.
治 (zhi)	Governance and ordering; refers to the coordinated management of water systems.	The Song dynasty established Hequsi and Dushuijian as specialized offices for water management.
浚 (jun)	Dredging and clearing; reflects mechanisms of periodic maintenance and renewal.	The Song dynasty implemented organized labor for channel opening and regular river dredging.

6. Conclusion

The development of Chinese civilization has always been closely connected with water. Water governance shaped the spatial structure of ancient cities and profoundly influenced social governance, intellectual systems, and cultural expression. From the perspective of Chinese characters, shui and its related graphic forms functioned as cognitive carriers that reflected a complete logic from observation to planning and practice. The softness and inclusiveness, movement and storage, dredging and purification of water were embodied not only in engineering practices such as rivers, channels, ponds, and wells, but also in legal systems and administrative management. Together, they formed a water civilization in which philosophy,

engineering, and institutions were deeply integrated.

From the character shu, which represents governing water by following and opening its course, to xu, ze, and han, which imply flood retention and ecological cultivation, and further to di, cheng, lü, and lou, which reveal water-quality purification, each character reflects both cultural depth and technical rationality. Meanwhile, the organization of urban water-system planning, water-supply and drainage networks, and waterborne transportation shows that cities and water formed an organic relationship. Ancient urban water systems integrated ecological, economic, social, and aesthetic functions.

This wisdom is not only a historical accumulation but also a source of insight for contemporary urban water governance. Modern concepts such as sponge cities, stormwater regulation, and ecological purification are highly consistent with ancient principles such as dredging rather than blocking and guiding action according to terrain. Water governance is therefore more than an engineering problem; it is also a manifestation of culture and wisdom. The water-governance philosophy and practical experience carried by Chinese characters provide a millennia-long cognitive reference for modern urban water systems. They also remind us that, when responding to complex water-environment challenges, we should uphold the principles of following nature, planning systemically, and managing dynamically, so as to construct urban water systems that are sustainable, resilient, and capable of serving both ecological and social functions. This inheritance of wisdom across time demonstrates the enduring value of Chinese civilization: prospering through water, establishing order through water, and reaching toward the future through water.

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Author contributions

Jiaxuan Zhang conceived the study framework and drafted the manuscript. Bin Wang supervised the study and revised the manuscript. Kegang Lei, Xiaolei Ma, Haimei Wang, Jian Li, and Xujun Shi contributed to the literature review, case analysis, and technical discussion. All authors reviewed and approved the final manuscript.

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