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Landscape Optimization Design of King Yu's Terrace Historical Heritage Site Park

Qianqian Zhang[1], Zhaoyu Xia[1], Chenxi Han[1], Linzhe Lu[2]

[1]Academy of Arts and Media, Environmental Design, Shangqiu University Applied Science and Technology College, Kaifeng 475000, Henan, China
[2]Henan Jiangbing Meozi Cultural Media Co., Ltd., Zhengzhou 450000, Henan, China

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Abstract: Against the backdrop of growing global awareness of heritage conservation, increasingly sound and relevant legal and regulatory systems, and continuous iteration of conservation philosophies and technical approaches, substantial progress has been made in heritageconservation practices. Nevertheless, in the context of historic cities, how to reconcile the physical preservation of heritage sites as material cultural heritage with the sustainable development of urban culture, and how to realize the organic integration of historicrelic conservation and contemporary urban functional renewal remain critical issues to be urgently addressed [1]. In recent years, as a comprehensive spatial paradigm integrating conservation, interpretation and revitalization, "heritage site parks" have increasingly become an important approach to coordinate urban development and heritage protection [1]. They not only help strengthen the holistic conservation of heritage sites and their buffer zones, but also facilitate the systematic interpretation and public communication of culturalheritage values. As the renowned "ancient capital of eight dynasties" in Chinese history, Kaifeng boasts profound cultural heritage and abundant historic remains, among which King Yu's Terrace Park serves as a typical representative. Taking urban heritage site parks as the research subject, this paper selects King Yu's Terrace Park as an empirical case to conduct systematic research on landscape optimization and design [2]. The proposed comprehensive renewal scheme balances the authentic conservation of heritage sites, coordination of environmental style and features, and integrity of cultural narratives. It effectively improves heritage recognition and culturalbearing capacity of the ancientrelic conservation zone in the suburbs of Kaifeng. It also carries important practical value and demonstrative significance for furthering the research, dissemination and dynamic inheritance of SongDynasty culture [2].

Keywords: Heritage site park; Landscape optimization; Cultural inheritance; Urban renewal

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1. Overall planning

1.1. Bubble diagram

This project focuses on the central activity area of the park, covering a total land area of 8.2 hectares. Combined with the site conditions and overall design strategy, the site space is reorganized and divided into

11 functional zones. Three original functional zones are retained: the entrance square serves as the gateway space of the park for crowd distribution and image display; the peony garden relies on the existing plant base to create a characteristic specialized botanical garden; the central lawn provides an open venue for outdoor rest and group activities (**Figure 1**).

Eight new functional zones are designed: the flower ornamental area features various flowering plants to form seasonal landscapes; the children's area is equipped with amusement facilities to meet children's game and entertainment needs; the central waterscape is dominated by water features, with wetlands and dry creeks to build an ecological water system; the woodland rest area takes advantage of tree canopies to offer quiet shaded spaces; the cultural display area centers on the history and culture of King Yu for cultural popularization and exhibition; the sports area arranges fitness sites to satisfy residents' daily exercise demands; the parking lot is built to solve visitors' parking problems [3]. All functional zones interact with one another, balancing ecological, cultural, recreational, and service functions [3].

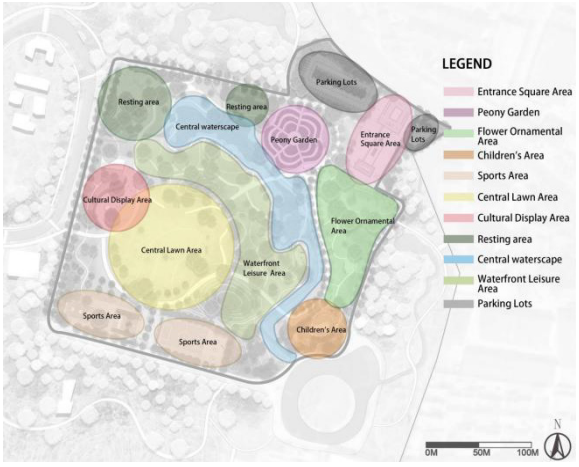


Figure 1. King Yu's Terrace Park Bubble Diagram.

1.2. Master plan

The master plan for the renewal of the central area of King Yu's Terrace Park includes a total of 26 independent landscape nodes. Under the strict premise of heritage site protection, cultural interpretation and exhibition, the design fully meets visitors' diverse demands for daily recreation, public research and popular science education (**Figure 2**). These landscape nodes cover a wide range of functional types, including entrance squares, themed sculptures, cultural exhibition facilities, waterscape spots, sports venues, children's activity zones, ornamental gardens, rest pavilions and supporting service buildings.

Reasonably arranged according to the site terrain, original spatial texture and constraints of heritage protection, the nodes are connected to form an integrated and interlinked landscape system. The design respects historical relics and minimizes excessive disturbance to the original site. It comprehensively balances ecological benefits, cultural expression and public service. On the basis of preserving the historical context of King Yu's Terrace, the park undertakes the core functions of heritage display and cultural inheritance [4]. Meanwhile, it creates high-quality urban open spaces for groups of all ages, realizing the organic integration of historical heritage conservation, ecological restoration and citizens' leisure activities.



Figure 2. King Yu's Terrace Park Master Plan Diagram.

2. Detail design

2.1. Section of master plan

Two sectional drawings along different directions run through the whole central area of King Yu's Terrace Park, which can intuitively display the complex topographic undulations and layered spatial changes of the site. The longitudinal section mainly demonstrates the morphological characteristics of the open lawn space and the elevation variations around the central lake. It clearly presents the height transition relationship between the water body and the surrounding green space, and reflects the vertical change of terrain from the lawn platform down to the waterfront zone. In contrast, the transverse section shows continuous topographic transformations across three core functional zones, namely the cultural display area, waterfront leisure area and flower ornamental area. It records the gentle terrain reshaping and micro-topography adjustments adopted in the renewal design (**Figure 3**).

These two sectional drawings not only visually interpret the spatial connection and transition between different functional plots, but also fully embody the core design philosophy of respecting the original landform and minimizing site disturbance. Instead of large-scale earthwork, the scheme adopts gentle terrain modification to adapt to the existing relic environment. The sectional analysis provides reliable technical support for subsequent landscape construction, plant layout and detailed implementation of the project, ensuring that the design scheme can be constructed smoothly under the premise of heritage protection [4].

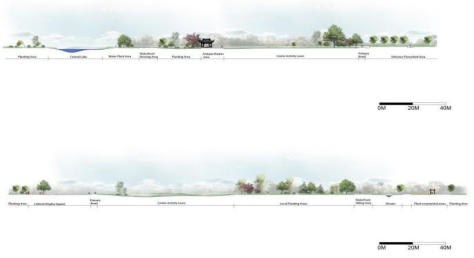


Figure 3. King Yu's Terrace Park Section of Master Plan.

2.2. Road system design

To preserve the integrity of the original spatial pattern of King Yu's Terrace Park, a five-level hierarchical road system is designed to organize visitor circulation and sightseeing routes (**Figure 4**). The design retains the existing main road of 5 meters in width and the 1.4-meter circular runway, respecting the original site texture and avoiding large-scale demolition of the existing road infrastructure. The primary road is 3.5 meters wide and links all park entrances and exits. Its pavement adopts cultural characteristic patterns to deliver heritage display effects. Meanwhile, ecological grass planting ditches are arranged on both sides of the road to collect and filter rainwater, realizing sustainable drainage and reducing pressure on the municipal pipe network.

The secondary road has a width ranging from 2 to 2.4 meters. It extends deeply into the site to connect scattered landscape nodes and guides visitors' sight lines to frame picturesque views. Grass planting ditches are also equipped alongside secondary roads to maintain consistent ecological stormwater management. Tertiary roads are 1 to 1.5 meters wide. Designed with graceful curved lines and strong landscape appeal, they form intimate walking paths and enrich the spatial layers and rhythm of the whole park. This hierarchical road network balances heritage conservation, sightseeing experience and ecological stormwater treatment, creating a gentle and low-disturbance travel system for the heritage park [5].

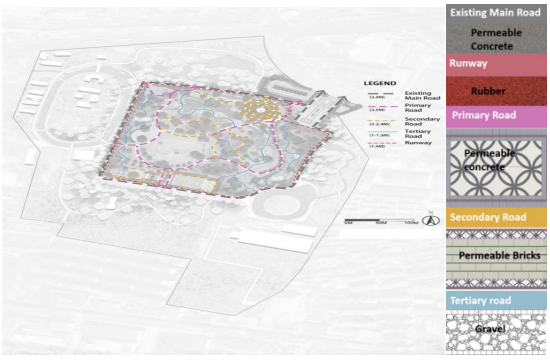


Figure 4. King Yu's Terrace Park Road System Design Diagram.

2.3. Cultural services facilities

The architecture of cultural service facilities takes a four-level hierarchical signage system, in which the information content progressively changes to provide an overview to more detailed interpretation level-by-level, creating a complete and coherent visitor guidance system (**Figure 5**).

The first-level signage is the general map of the park guide. It provides a simple introduction to the entire park and shows the master plan layout. It is placed at the main entrances of the park and assists visitors in quickly getting the overall spatial organization and having a general idea about the functional zones and landscape nodes of the park before they begin sightseeing (**Figure 6**).

The second-level signage combines three fundamental functions: location marking, directional guidance, and introduction of the tour route. It indicates the current locations of visitors and the location of major service facilities such as parking lots, gateways and public restrooms.It also indicates the direction and approximate distance to park buildings, heritage nodes and other scenic spots. Besides, it presents the distribution of featured tour routes and landscape nodes. Such signs are mainly placed at transportation junctions and the entrances of each functional zone to assist visitors in route selection (**Figure 7**).

The third-level signage focuses on the interpretation of relics and scenic attractions. It provides in-depth textual information about heritage sites, landscape features and relevant historical stories, helping visitors understand the cultural connotation behind the scenery. These signs are arranged beside heritage relics and major viewing spots for on-site cultural popularization (**Figure 8**).

The fourth-level signage system belongs to outdoor service furniture, including rest benches, landscape lamps and waste bins for daily use. They are distributed across heritage sites, squares and green spaces according to site conditions and visitor activity rules. In terms of visual style, the whole signage system takes dark red and log wood tones as the main color palette, creating a sedate and elegant visual effect. The design incorporates solid wooden structures, park emblems and other decorative elements, fully embodying the distinctive cultural atmosphere related to King Yu. The four-tier signage system not only satisfies visitors' practical needs for navigation and rest, but also acts as a medium for cultural interpretation, seamlessly combining service function and cultural display (**Figure 9**).

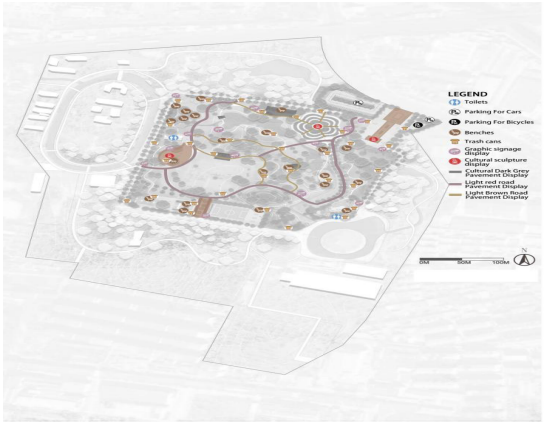


Figure 5. King Yu's Terrace Park Cultural Services Facilities Diagram.



Figure 26. General guide map model

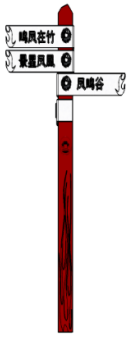


Figure 27. Directional sign model

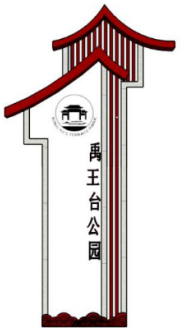


Figure 8. Information introduction to attractions model

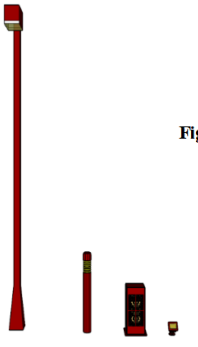


Figure 9. (a) Park lighting model

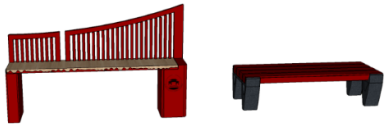


Figure 9. (b) Bench model

2.4. Water system ecological design

Firstly, three types of waterscape design are adopted to restore the water system pattern based on the overall site conditions of King Yu's Terrace Park. The first measure is to construct shallow lakes with natural revetments to replace the existing artificial lake. Unlike rigid concrete lake banks, natural revetments adopt native plants and stone stacking to soften the water boundary. This practice enhances the connection between water and land, creates habitats for aquatic organisms, and improves the landscape naturalness of the lake area. The second measure is to use constructed wetlands to substitute the existing artificial channels. The wetland system is planted with purification plants, which can intercept suspended solids and degrade pollutants, turning the originally single drainage channel into an ecological purification corridor. The third measure is to apply dry creeks to replace the open channels. Dry creeks are paved with gravel and pebbles. In dry seasons, they serve as landscape trails; in rainy periods, they temporarily store and guide rainwater to reduce surface runoff (**Figure 10**).

To establish a sound water circulation system, water is diverted into the park from the urban river at a higher elevation. After multi-stage purification by wetlands and dry creeks, the treated water flows into the urban river at a lower elevation. This ecological circulation strategy not only rehabilitates the original water system layout within the park and reconstructs the hydrological connection of the site, but also effectively improves the regional water quality [6]. The integrated waterscape scheme combines ecological purification, stormwater management and landscape appreciation, realizing the coordinated development of water environment restoration and park recreation function.

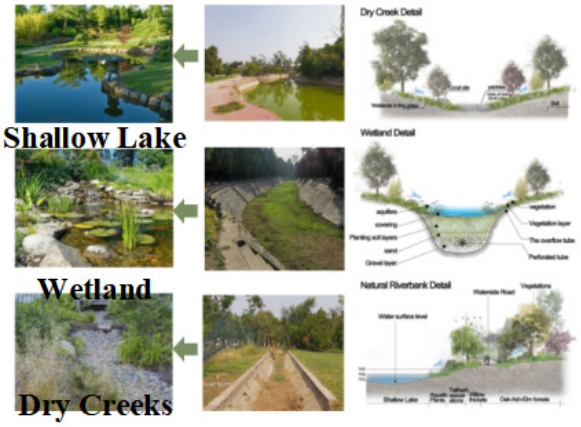


Figure 10. 3 Different Forms of Waterscape Diagram.

2.5. Plant community ecological design

2.5.1. Planting principles

(1) Protect and display the site as the fundamental principle

The planning and design of plants should respect the site itself and its characteristics. In the site area, shallow-rooted trees and shrubs Herbaceous plants are used in the site area to prevent the damage of deep-rooted trees to the soil of the site. Choose plants that are more resistant to drought to ensure less watering and protect the site. Because the depth of the planting soil covered above the site is limited, poor-tolerant species should be selected [6].

(2) Conform to site chronological properties principle

Select historical plants recorded in the literature to create a plant landscape with a historical atmosphere. The main selection is the Poetic Edda to create a historical plant landscape.

(3) Ecological principles

Follow the principle of suitable trees for the site, mainly deciduous broad-leaved trees and evergreen coniferous plants, and consider the planting of native plants; respect the current plants of the site and make use of them [7].

(4) Ornamental principle

The combination of natural and regular planting, the configuration of flowers, fruits, leaves, shapes, tastes and other ornamental characteristics, focusing on the seasonal changes of the site. The vegetation system is also used to create a spatial pattern and create axes and view corridors.

2.5.2. Overall plant combination

Ecological artificial vegetation design can influence carbon stabilization of the land positively and increase the concentration of organic carbon in the soil. The combination of trees, shrubs, ground cover and herbaceous plants has a more significant effect on the stabilization of soil plant organic matter. So, in this scenario, based on the above findings, the plant community is combined with trees, shrubs, ground covers, and herbs to maximize the ecological benefits of the plants (**Figure 11**).

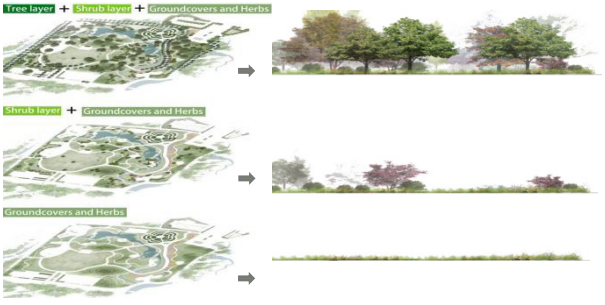


Figure 11. Ecological Plant Design Diagram.

3. Node design

3.1. Zoom in culture square area design

3.1.1. Zoom in master plan - culture square area

This section is the main cultural exhibition area of the Terrace Park of King Yu, which has the important role of decoding local historical heritage. Combined with artistic sculptures, multi-group historical and cultural walls and typical cultural paving, the space is a systematic interpretation and presentation of the deep history and culture of the park. The sculpture in the middle of the cultural square is called Shi Kuang Fondling the Qin, which serves as the cultural icon of the entire park. It recreates the historical scene of the site (classic), makes visitors stop, look and reflect, and makes tourists enter the historical ambiance of the Terrace of King Yu quickly (**Figure 12**).

The historical and cultural wall is behind the sculpture and is composed of three wall segments of different heights to create a layered and rhythmic interface of cultural exhibition. The former two walls are 2.3 meters high, depicting common architectural elements and touching upon the history of various periods. They

organize the chronological development context of the site and assist visitors in comprehending the evolution of the relic site. On the back 3-meter cultural wall, there is the park logo and traditional poems relating to King Yu, which brings out the special literary and cultural background of Kaifeng. Benches are placed on either side of the square to allow visitors to relax, socialize and enjoy the cultural environment around them (**Figure 13**).

Instead of being demolished, an abandoned building next to the cultural square is completely renovated and repurposed as a cultural experience hall. This regeneration mode is low-impact and fits into the idea of heritage conservation. Within the hall, various interactive display formats are installed, including panels introducing culture and scene displays, in order to enhance the immersive cultural experience of visitors. Together with the outdoor square landscape, it creates a complete chain of cultural experience that combines viewing, reading, and participatory interaction [8]. The general architecture of the cultural square integrates the beauty of landscapes, cultural communication and public service. It turns abstract historical data into concrete landscape images, achieving the organic combination of landscape space construction and cultural legacy of the Terrace of King Yu.

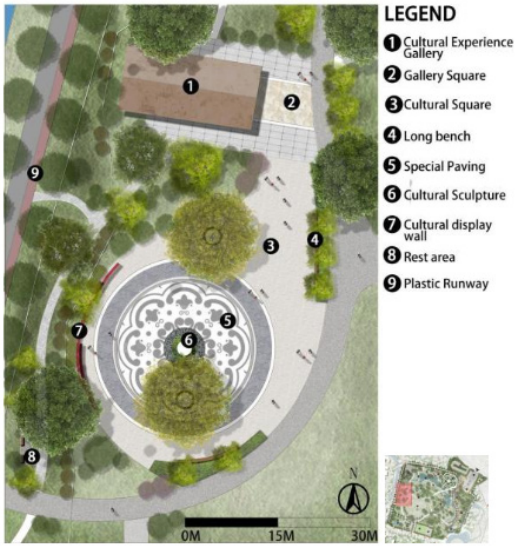


Figure 12. Zoom-in Master Plan - Culture Square Area Diagram.

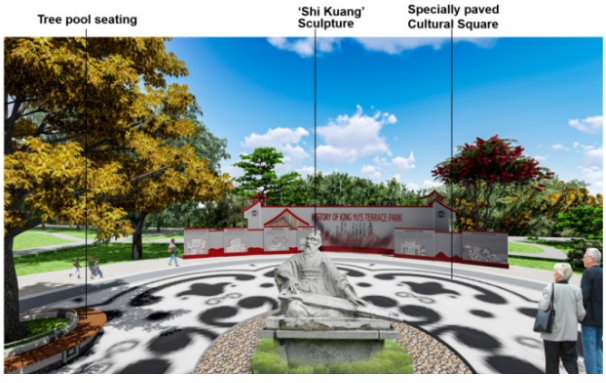


Figure 12. Zoom-in visualization — Culture Square Area Diagram.

3.2. Zoom-in flower ornamental area design

3.2.1. Zoom-in master plan -Flower Ornamental Area

Flower Ornamental Area is one of the fundamental features of the design of Terrace Park by King Yu, which emphasizes the ornamental presentation of flowering plants and restoration of native plant communities (**Figure 13**). The multi-level trails meander through the entire area in a winding path to slow down the pace of walking visitors and allow them to roam around and have an immersive view of the landscape. To offer a comfortable shaded rest area to tourists, a semi-enclosed circular flower pavilion is laid out in the middle of this space. Tourists can also stop here to admire the floral landscapes around and interact with others. With various and stratified plant associations of various heights, colors, and blooming seasons, this area provides informative and entertaining popular science education, combining a relaxing leisure experience with systematic learning of botany and ecological conservation.

At the other end of the main walkway is a composite wetland and dry-creek landscape. This hybrid hydrological system can be used to effectively capture and purify surface runoff in the park through the filtering effect of substrate and wetland plants. Meanwhile, it will form appealing waterfront landscapes, add visual value for visitors, and establish a positive interaction between human activity and the natural plant-water ecosystem. The whole area organically blends flower appreciation, ecological purification, and science popularization into one cohesive multi-functional landscape space [8]. While satisfying visitors' demand for flower viewing, it undertakes the task of stormwater management and ecological restoration. It also conveys ecological knowledge to visitors subtly, realizing the integration of aesthetic value, ecological function, and science popularization value of the heritage park (**Figure 14**).

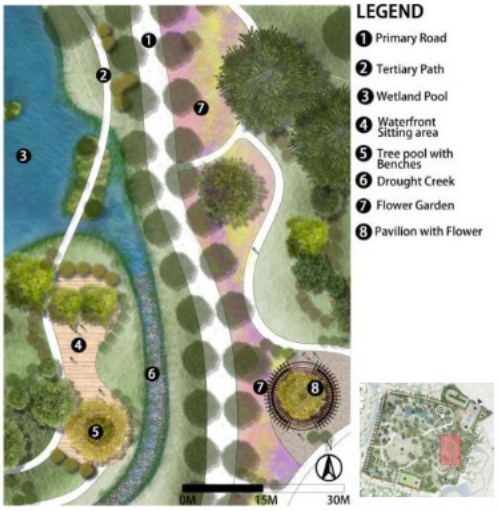


Figure 13. Zoom-in Master Plan — Flower Ornamental Area Diagram.



Figure 14. Zoom-in Visualization — Flower Ornamental Area Diagram.

4. Conclusions and deficiencies

This paper takes King Yu's Terrace Historical Heritage Site Park in Kaifeng as the research object and carries out landscape optimization design for its central activity area of 8.2 hectares. Aiming to resolve conflicts among heritage conservation, urban ecology and public leisure under urban renewal, the study adopts the "two axes, three zones and multiple nodes" framework. The site is divided into 11 functional zones with 26 landscape nodes, forming a coordinated landscape system.

The in-depth design covers a five-level road network, a four-level cultural signage system, an ecological water system, and plant community design. Three types of waterscapes, including natural revetment, shallow lakes, wetlands, and dry creeks, are applied to restore water circulation and purify runoff [9]. Plant design follows four principles to avoid damage to relics and build multi-layered vegetation. Two key areas, the cultural square and the flower ornamental area, are designed to interpret Yu culture and create seasonal flower landscapes.

This scheme integrates heritage protection, ecological restoration and public recreation. Nevertheless, this research lacks post-occupancy evaluation and long-term site monitoring data. It can provide practical references for the regeneration of similar heritage site parks[9].

Disclosure statement

The authors declare no conflict of interest.

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