

Study on the Practical Experience of Ecological Wisdom of Four Artificial Lakes in Guangzhou

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Abstract: The four artificial lakes in Guangzhou (Liwan Lake, Liuhua Lake, Lu Lake, Dongshan Lake) have maintained a benign relationship with the city for the symbiosis of human, nature and society since the end of the 1950s. Taking the four artificial lakes in Guangzhou as the research object, reviewing the construction process of the four artificial lakes in Guangzhou, and combing the ecological practice experience of the four artificial lakes. It is concluded that siting selection suitable for urban geographic conditions, considering the construction of artificial lakes in urban water systems, designing incorporating cultural, constructing and renovating the park combined with urban development and establishing lake-park symbiosis are the internal cause for the benign interoperability and coordinated development of the four artificial lakes and cities. In order to provide reference for the construction of urban artificial lakes in Guangzhou and the urban ecological environment construction of Guangdong, Hong Kong and Macao Dawan District.

Keywords: Landscape architecture, Ecological practice, Ecological wisdom, Guangzhou four artificial lakes

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1 Introduction

After the Nineteenth National Congress of the Communist party of China, Dawan District of Guangdong, Hong Kong and Macao has become a national strategy. As one of the core cities of Dawan District of Guangdong, Hong Kong and Macao,

Guangzhou has clearly put forward its overall goal to build an eco-city that is livable, suitable for Industry and tourism in terms of urban ecological environment construction^[1]. Artificial lake park which incorporates many functions (such as regulation and storage of rainwater or rainstorm water, improvement of microclimate, landscape upgrading, etc.), has become an important part of water environment construction and urban ecological environment construction in Guangzhou.

“Excavate lake to detain flood” is one of the main ways to solve urban flood in China since ancient time. According to natural law and urban geographical environment, water path/space system is reformed and artificial lakes are built to connect water system. This makes them water conservancy facility with functions of urban flood control and drainage, flood regulation and storage, water diversion and water supplement. On this basis, most artificial lakes also derive functions such as landscape tourism and industrial development, and thus further develop into important cultural landscapes in the region. Construction of such type of water conservancy facility is also an urban ecological practice of symbiosis and harmony between human beings, nature and society, which is full of oriental ecocultural wisdom.

Since the Southern Han Dynasty, Guangzhou has been developing at its original site. It is an ancient city with a long history of more than 2,000 years. The city has an intense water network that relationship between people and water is closely related, it has a profound urban water culture. “Water” is the characteristic of Guangzhou city. As early as the Ming Dynasty, the ancient city pattern of “six rivers are connected to the sea, half of green hills encroach the city” had been formed^[2]. People has been living by

water, forming a series of water-related landscapes such as “shadow of cloud on lake of chrysanthemum”, “spring dawn in Yaozhou”, “fisherman song by Lychee Bay”. Guangzhou’s four artificial lake parks are the earliest artificial lake parks built during modern city construction of Guangzhou. Social, politics, economics and natural environment have undergone tremendous changes during rapid development of modern cities in the past 60 years. Meanwhile, the four major artificial lake parks still preserve their original water conservancy function. Besides, they have been improved constantly and integrate into the city. They have become the representatives of Guangzhou artificial lake park. Looking 60 years back, the four artificial lakes are undoubtedly the successful ecological practice of urban water environment renovation in Guangzhou. Analysis and summarization of ecological practice experience and internal reason of success of the four artificial lakes will play an important guiding role in construction of urban artificial lake for similar cities today. It will be beneficial for urban ecological environment construction in Dawan District of Guangdong, Hong Kong and Macao.

2 Background of construction

Guangzhou is located at southern subtropical

oceanic monsoon season zone. There are often typhoons and rainstorms during summer and autumn, with an average annual rainfall of more than 1700 mm. Geographically, it is divided by Pearl River from the southwest to eastwards into two sides: north bank and south bank. North bank is backed by White Cloud Mountain, with terrain inclines from the north to southwards. South bank is surrounded by water, its terrain is low. Its southwest is in close proximity with tributary of Northwest River, while the east is connected with downstream of East River. At the confluence of East, West and North rivers, there is river network zone of Pearl River Delta. Therefore, Guangzhou is often threatened not only by mountain torrent but also by tide. When rainstorm comes, the city is heavily flooded. In order to resolve flood caused by heavy rain and rainy tide in urban area, Guangzhou Construction Bureau had formulated design scheme to build lakes for flood storage in 1958. The Guangzhou Municipal Government mobilized voluntary work force from people of the entire city to excavate wetlands and marshes, to connect original rivers with Pearl River. Over a year, four artificial Lake Parks Dongshan Lake, Lu Lake, Lihua Lake and Liwan Lake were built.

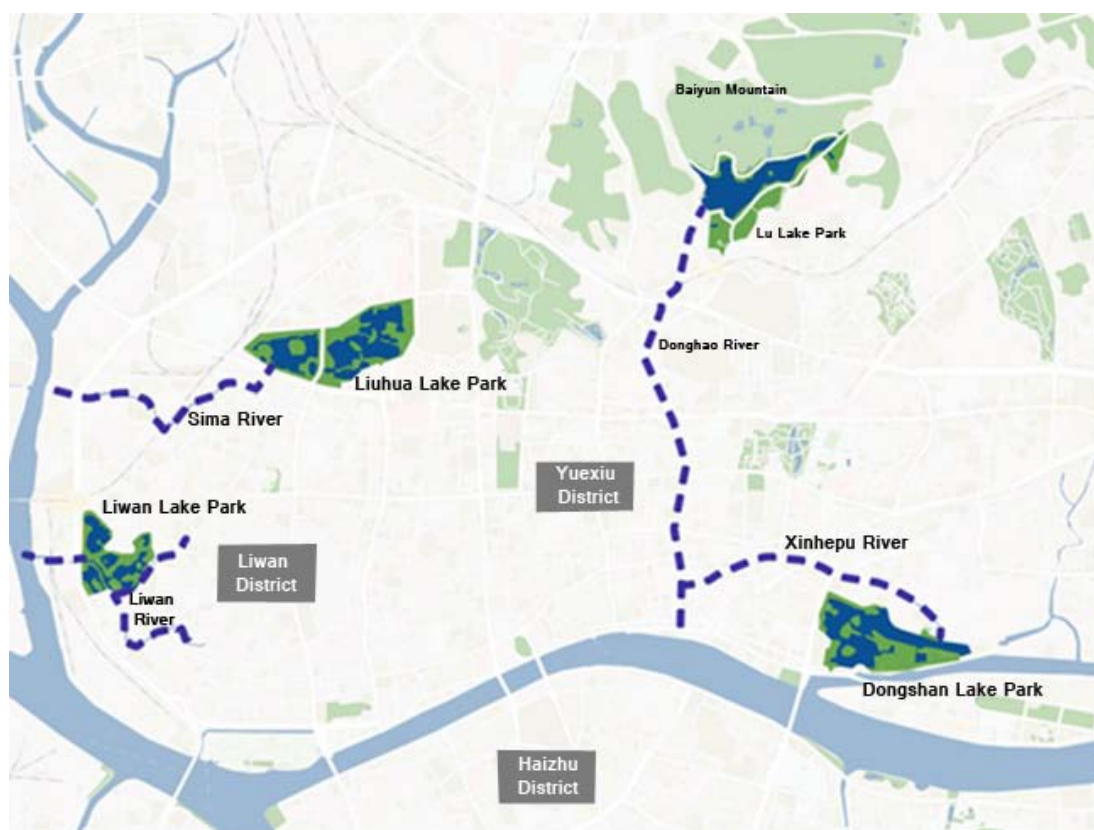


Figure 1. Location of the Four Great Lakes in Guangzhou and their associated water systems (source: self-drawn by the author)

Four artificial lake parks have function of flood storage during rainy season, with a total reservoir capacity of 2.1 million m³^[3], which alleviates waterlogging problem in Donghao River, Baizi River, Xin Hepu River, Chengji River, Sima River and Liwan River. During non-rainy season, several major rivers and some sewers are flushed regularly to reduce accumulation of sewage and dirt. In addition to water conservancy function, artificial lakes are integrated with landscape. Trees and grass are planted along embankment of lake; pavilions are erected; bridges are built above lake surface, forming a park with elegant scenery and pleasant environment. Construction of the four artificial lake parks has also beautified urban space of Guangzhou, transforming swamps which were once spawned by mosquitoes and flies into beautiful public leisure green space. With development, the four artificial lake parks continually improve. Today, they remain to be people's favorite urban parks.

3 Practical experience of ecological intelligence of four artificial lakes

3.1 “Guided by circumstance, going ahead for advantages and avoiding drawbacks”

The four artificial lakes are in respect to urban geographical environment, and are in integration with urban water system. Guided by advantageous circumstances, deep digging is carried out to build lakes at catchment depression sites in areas with severe flooding disasters. This not only eliminates troubles brought to the city by large-scale flood and stinky water depression, but also beautifies the city and increases public activity space of urban residents. This embodies oriental wisdom of “going ahead for advantages and avoiding drawbacks”.

Liuhua Lake is located at the upstream of Sima River - the drainage ditch in this area, at southwest of Yuexiu mountain. Historically, it was originally Lan Lake in this area. After silting and annihilation, Lan Lake became a depression site where mosquitoes and flies bred. When there were mountain torrents in northwest of White Cloud Mountain and northwest of Yuexiu Mountain while the downstream had slow discharge or being supported by tide level of Pearl River, drainage near Sima River was often poor which led to waterlogging. In April 1958, the municipal government mobilized citizens to excavate artificial lakes for flood storage and drainage. On this basis, Liuhua Lake

Park was built. Liuhua Lake Park covers an area of approximately 590,000 square meters, of which water area is 334,000 square meters^[4]. When rainstorm occurs, Liuhua Lake can store rainwater from upstream of Sima River which greatly improves flood disaster situation in the surrounding areas.



Figure 2. Location of the Four Great Lakes in Guangzhou and their associated water systems (Image Source: Network)

Liwan Lake was built on the basis of excavation and embankment construction at Lychee Bay and its surrounding ponds and depression sites. In the 1940s, with expansion of urban area of Guangzhou, urban population had been gradually increasing while both sides of Lychee Bay River evolved into residence place of vegetable farmers and poor people. Meanwhile, West Village near the former Lychee Bay had become the base of Guangzhou's modern industry. Due to direct discharge of domestic sewage from both sides of river bank and industrial wastewater into Liwan River and large-area encroachment of river, river pollution arised. Water quality continuously deteriorated and drainage capacity sharply decreased. In addition, low-lying terrain here was the outlet of Xiguan Gully. Accumulation of sewage made Lychee Bay a foul-smelling depression land. When there were rainstorms, canals were irrigated and the surrounding areas often suffered from flood and waterlogging. Liwan Lake Park covers an area of 272,000 square meters, of which water area covers 172,000 square meters^[4]. Construction of Liwan Lake Park has made it possible for a large amount of rainwater to be temporarily stored in the lake

during rainstorms, which has greatly alleviated urban waterlogging problem of Xiguan.

Predecessor of Dongshan Lake Park was Dashatou River between Dashatou and Dongshan. Before establishment of New China, outlet of the western section of the river was landfilled. The eastern section of the river became a stinky water depression and vegetation field, where mosquitoes and flies bred and it even became a dung dock. In 1958, due to development of cosmetic renovation project of Guangzhou, this depression land was embanked and built into a lake and Dongshan Lake Park was built. Total area of the park is 330,000 square meters, of which water area is 209,000 square meters. Completion of Dongshan Lake Park, together with Xinhepu River and Donghao River form a flood regulation system with natural geographical advantages: when rainstorm results in raised flood tide of Pearl River crest, rainwater can be stored in the lake, so that flood-stricken areas at Baizi River, east section of Xinhepu River and Chengzi River basins are greatly reduced. During low tide, difference between surface water level of Dongshan Lake and low tide water level Xinhepu River flushes eastern section of Xinhepu River. When there is high tide in open channel, water of the Pearl River is positioned back into the lake to maintain water level of the lake.

Lu Lake is located at the upper valley of Donghao River between Xiaobeishang Pond and Luming Hillock. Donghao River is an ancient river course in Guangzhou and it has long shouldered heavy responsibility of urban drainage in Guangzhou. With the increase of urban population, pressure of sewage discharge increased. Waste accumulation at river bed of Donghao River and large-scale encroachment of the river course had greatly reduced its drainage capacity. When there were rainstorms, mountain torrents occurred at the southeastern base of White Cloud Mountain and exceeded the discharge of Donghao River, causing large-area waterlogging in the surrounding areas. In 1958, the city government mobilized citizens to dig lakes and build dams, to build artificial lakes with water storage capacity of 1.2 million cubic meters. Construction of Lu Lake has blocked mountain torrents during rainstorm, this eliminates the threat of mountain torrents in east and south section of White Cloud Mountain to Guangzhou, and can flush Donghao River regularly.

3.2 “Infuse sentiment into object, touch people with object”

Guided by spirit of Chinese philosophy which concords heaven and mankind, ancient China people has been developing complex affection toward land in the process of land utilization. Such sentiment towards land is closely related with people’s appreciation and friendly utilization toward land^[5]. In the construction process of Guangzhou’s four artificial lakes, artificial lake parks are built by integrating regional elements. Building material and spiritual levels of the artificial lake parks resonate with people’s historical sentiment towards land. This exactly represents heritage of people’s complex affection towards land which stimulates aesthetic value and recreational value of the artificial lake sites.

3.2.1 Heritage of water network system and historical memory

Guangzhou has a rich water culture. All the “Eight Sceneries of Yangcheng” which represent style and feature of Guangzhou City at different historical periods have water-related landscapes. However, most of them are lost due to various historical reasons. Construction of artificial lake park preserves original water channel and integrates artistic conception of original water system, which further support and preserve people’s sentiment toward former water sceneries. For example, the area where Liwan Lake is located belongs to Lychee Bay. It was originally a marshland by the Pearl River with low and flat terrain, and dense rivers and ponds. In order to fight for land space, people took efforts to combat flood and dampness. They reinforced base to create pond and planted lychee trees all over embankment base, forming a beautiful scenery of “Green river water at the bay, red lychees on both sides of river bank”. Since ancient time, Lychee Bay has been an important site for people to get away from heat during summer. In Ming Dynasty, it became one of the eight major scenic spots as “fisherman’s song by Lychee Bay” in Yangcheng, Guangzhou. The once beautiful Lychee Bay had gathered numerous rich businessmen, literati, tourists and ordinary people. Lychee Bay at its prime of life condensed the essence of natural and cultural landscapes of Guangzhou^[6]. Regrettably, it became a stinky marsh during Japanese invasion in modern time. The layout of Lychee Bay Lake Park

imitates Spoon Garden by Minister Mi in Haidian Town in Beijing which has a layout of “garden is merely 100 acres but has infinite water sceneries, song is heard from pavilion above long causeway bridge”^[4]. It inherits the original “red lychee at both sides of river bank” artistic conception of Lychee Bay and creates a garden which has rich characteristics of Lingnan water village. Liuhua Lake Park is built on the original site of ancient Lanzhi Lake. In Jin Dynasty, Lanzhi Lake was a natural lake with beautiful scenery. It was one of the two famous lakes in Guangzhou at that time. In Tang Dynasty, it served as a good harbor for ships to arrive at Guangzhou and it became a muddy land in Ming Dynasty^[7]. Name of Liuhua Lake Park originates from the ancient bridge of ‘Liuhua Bridge’ of Southern Han Dynasty. It is said that Fangchun Garden was built at river bank of Lanzhi Lake for emperor and his concubines for banquet and entertainment in Southern Han Dynasty. In morning, maids of palace threw left over flowers into water and they flew through under bridge, it was thus named ‘Liuhua (Flowing Flower) Bridge’^[7]. With historical changes, Fangchun Garden no longer exists. However, name of Liuhua Bridge is deeply imbedded in hearts of people. It becomes the spiritual carrier for people who desire for scenery of ancient Lanzhi Lake at its prime period. On the basis of heritage of original site of Lanzhi Lake water system, Liuhua Lake Park intentionally creates artistic conception of ‘Liuhua (flowing flower)’, and the park preserves the word of ‘Liuhua’ as the name of the park.

3.2.2 Application of traditional garden construction techniques and native plant landscape

Four artificial lake parks in Guangzhou use traditional garden construction method, which combines implementation of native plant landscape with historical landscape feature of river system that further develop four artificial lakes into regional landscapes with their own characteristics. “Touch people through object”, this allow people to feel “connection” between their fancy of long lost scenery and majestic artificial lake parks. From another point of view, this reproduces historical features of original river system to a certain extent, on the basis of heritage of water system and historical culture. For example, Liwan Lake intentionally creates the “green river water at the bay, red lychees on both sides of river bank” characteristic of Lingnan water village. Lychee is planted all over embankment whereas lotus is planted on the lake surface. Five beautiful

flowers such as horseshoe, bamboo shoot and water chestnut are progressively planted according to layout of garden architecture^[8]. Meanwhile, Liuhua Lake mainly consists of local light color flowering trees and palm plants, creating a “flowing flower” sentiment which wraps beauty inside, representing beauty of plain color southern subtropical plants.



Figure 3. Plant Landscape of Liwan Lake Park (Image Source: Network)



Figure 4. Plant Landscape of Liuhua Lake Park (Image Source: Network)



Figure 5. Plant Landscape of Dongshan Lake Park (Image Source: Network)



Figure 6. Plant landscape of Lu Lake Park (photo source: Internet)

On the other hand, based on the basic characteristics of the artificial lakes and their surrounding environment, construction of characteristic plant landscape endows the sites unique regional landscapes. For example, Dongshan Lake Park is dominated by bright color large flowered trees, shrubs and perennial roots, which fully show the beauty of southern subtropical plants. Scattered islands in the lake are connected and traditional aquatic building elements such as nine-bend wooden bridge and five-hole stone bridge are used to connect the island, this brightens up the lake surface. Lu Lake is surrounded by mountains which are full of green shrubs. Thus it is positioned as a large-scale urban landscape garden which is “surrounded with beautiful mountains, hidden waves can be heard at mountainside”. Combining with abundant native ornamental flowers and foliage plants, a plant landscape of all seasons is created^[9].

3.3 “Keep pace with time, synchronization between water and city”

Since construction of the four artificial lake parks in 1958, modern urbanization of Guangzhou has been developing rapidly in the past 60 years. Four artificial lake parks keep pace with changes of time. They actively interact with the city in the aspects of park landscape upgrading, service function improvement and tourism. From 1970s to 1990s, with further development of China’s reforming and opening-up policy, Guangzhou became the frontier of reforming and opening-up. On one hand, the four artificial lake parks further improve their own water landscape resources. Meanwhile, restaurants, wharfs and other service facilities are built. During this period, Donghu Hotel of Dongshan Lake, Luming Restaurant in Lu Lake and Panxi Restaurant in Liwan Lake incorporate Guangfu

tea drinking culture into the parks. On the other hand, in order to enrich landscape of the parks, “garden in a garden” are built based on original natural landscape, historical resource or adoption of characteristics of adjacent gardens. In addition, cultural activities are actively organized in combination with culture of respective park. After 2000, four artificial lake parks continually improve park’s peripheral landscape and hold a variety of attractive cultural activities in the park, in incorporation with city project of “remove fences and reveal the greens”. For example, Liuhua Lake Park has hold Guangzhou Garden Exposition for several times. Liwan Lake also organize flower floating market during spring festival, in that exquisite flower boats carry flowers and enter the park through Lychee Bay. In which, this at the same time combines local “Old Guang” tradition to celebrate spring festival, presenting Lingnan water city feature^[8]. Due to this series of perfection processes which keep pace with time, parks and city have developed a closer relations ever since.

3.4 “Garden exists due to water, water is thriving due to garden.”

After completion, water facilities will be gradually worn-out and they need regular maintenance to ensure their long-term use. Historically, many water facilities decay and be abandoned due to various reasons^[10]. The four artificial lakes are located at the central urban area of Guangzhou (Yuexiu District and Liwan District). If their solely serve as water conservancy facilities for urban flood diversion and water storage, their sole function will be in opposition to demand for land utilization in Guangzhou which advances the process of urbanization. This will hinder sustainable development of artificial lakes and construction of modern cities in Guangzhou. Therefore, at the beginning of construction of the four artificial lakes, they were already considered as in scope of urban construction in Guangzhou. At the same time, safety and living needs of residents are taken into consideration. During building of artificial lake parks, artificial lakes are combined with parks. Depression lands in the city are artificially transformed in line with natural law. Artificial lakes are constructed according to geological terrain and water system. This establishes a relatively stable landscape structure for the artificial lake parks. On this basis, construction of artificial lake parks preserves urban water system and historical culture, and combines traditional garden construction method and native ornamental plant landscape. Integration of regional elements makes the

artificial lake parks closely related to city in the aspects material and spiritual feature. With the development along time, artificial lake parks have continuous landscape improvement and their functions increase, so that artificial lake parks can achieve concurrent development with cities. As the result, there arise a symbiotic relationship of “garden exists due to water,

and water is thriving due to garden” between artificial lakes and parks. In addition, they form a benevolent interaction with cities, that the nature of artificial transformation is incorporated into city and meets the living needs of residents, thus actualizing the symbiotic integration of human, nature and society in modern cities.

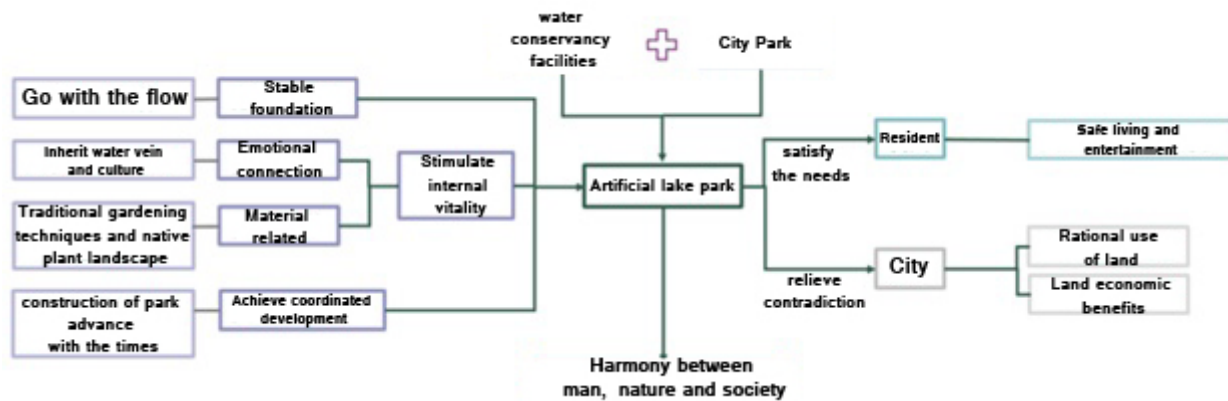


Figure 7. Development Model of Artificial Lake Park (photo source: self-drawn by the author)

4 Discussion and summary

The four artificial lakes in Guangzhou are constructed during the modern city construction in 1950s of the 20th century. They are the first artificial lake park building attempt to mitigate urban flood. Construction of the four artificial lake parks modifies natural environment by fully utilizing urban water system, that the construction employs water system technique which “going ahead for advantages and avoiding drawbacks” and in line with geographical environment of the city. Through construction method that “infuses sentiments into object, touches people by object” and integrates with regional elements of the city, close relationship between artificial lakes and cities well established in the perspective of material and spirit. Adopting development strategy of “advancing with time, synchronization between water and city”, construction of lake parks is in actively integrateion with urban development, maintaining the close relationship between artificial lakes and cities.

By establishment of symbiotic relationship of “garden exists due to water, and water is thriving due to garden” between artificial lakes and parks, human, nature and society coexist and co-develop. This is the internal reason for the four artificial lakes in Guangzhou to serve as natural space in the city and actualize good interaction with city in coordination of urban

modernization. It encompasses abundant ecological wisdom to actualize the synergy between modern city construction and water environment construction. Ecological experiential learning of Guangzhou’s four artificial lakes is in parallel to demand of building a sustainable, livable, industrialize and touristy city under the background of construction of Dawan District in Guangdong, Hong Kong and Macao. They deserve to be the highlights and serve as reference for urban water environment planning and construction today. Nowadays, construction of artificial lake parks in cities has entered stage of popularization. However, with the development of cities, new problems continue to emerge. For example, rapid growth of urban population and lagging development of sewage disposal system lead to sharp increase of sewage discharge and encroachment of river channel space by urban development. This leads to eutrophication of water body at early stage of artificial lakes construction, in which the artificial lakes have slow exchange with outside of water body. Some of the new artificial lakes are built without distinctive characteristics, they further deteriorate and are lack of maintenance, so they are unable to form symbiosis relationship with city development. Therefore, exploring and developing practical experience of artificial lake ecology will be an indispensable research direction for urban water environment planning and construction. It will play

an immeasurable role in urban water environment protection, urban ecological environment improvement and urban sustainable development. This paper serves as a preliminary attempt to explore and summarize ecological practice experience of artificial lakes.

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