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Construction strategy of water-saving landscape in urban gardens under sponge city background

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Abstract: *At present, the core problem of urban landscape urgently to be solved is how to use water reasonably and efficiently. Of urban concept sponge core problems, and analysis on the importance of urban water-saving landscape landscape greening plant species reasonable configuration, application of water reuse technology, combined with ecological water use of engineering design, construction of urban landscape, water saving so as to improve the economic benefit, environmental benefit and social benefit.*

Keywords: *Sponge city; Urban landscape; Water-saving landscape; Green plants; Water pollution; Water shortage*

1. Introduction

Sponge city was first proposed by Australian scholars as a metaphor for the adsorption of rural population reflected by the migration of rural population to cities. After that, some scholars gradually linked sponge city with storm flood, hydrology and other issues. For example, Ignacio F.Buster-Ossa used sponge city to describe the elastic function of cities in coping with storm flood, and described relevant coping strategies and landscape expression. Scholars and environmental groups in Taiwan have shown their support for sponge city construction in relevant studies and social activities [1]. In January 2015, The Morning Edition also discussed sponge cities.

Our country is a water resource poor country, the per capita water resource is only 1/4 of the world average level. With the acceleration of economic development and urbanization, the problem of water shortage in cities is becoming increasingly prominent. At present quite a few cities are short of water resources. According to statistics, 400 of the country's 669 cities lack water supply all year round, and 110 of them are seriously short of water. The concept of sponge city was put forward from the speech of General Secretary Xi Jinping at the Central Conference on Urbanization on November 13, 2013 [2]. In October 2014, the Ministry of Housing and Urban-Rural Development issued the document "Sponge City Construction Technical Guide - Low Impact Development Rainwater System Construction (Trial)", and then on January 20, 2015, the Ministry of Finance, the Ministry of Housing and Urban-Rural Development and the Ministry of Water Resources jointly issued the "Notice on Organizing the Application of 2015 Sponge City Construction Pilot Cities". It has greatly promoted the construction of sponge city. Recently, Jinan, Wuhan, Chenzhou and other cities actively declare sponge city, causing the "sponge city fever" in all parts of the country. Sponge city refers to a city that, like a sponge, has good "elasticity" to adapt to the change of environmental factors and cope with natural disasters, absorbs water, stores water, seeps water and purifies water during rainfall, and "releases" the stored water when necessary so that it can be effectively used [3]. Sponge city should be good at coping with rainfall with different return periods, so that the city can not suffer from flood disasters, and can rationally use rain and flood as resources, and maintain a suitable and normal operation of the city's hydrological ecological environment. The core technology of sponge city construction is low impact development (LID) technology, which uses decentralized and small-scale source control measures to control rainwater runoff and pollution caused by heavy rain, so that developed areas can be as close as possible to the original natural hydrological cycle. China is seriously short of fresh water resources, and its per capita share of fresh water is lower than the international standard [4]. Due to the lack of natural water system and low annual rainfall, water shortage is serious in most areas of north China. However, groundwater and tap water are the main sources of urban landscape water in China, which not only costs a lot but also wastes resources. How to collect and utilize rainwater reasonably and develop water treatment technology is the key to water saving in urban landscape.

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2. Analysis on the importance of water-saving landscape construction in urban gardens

Due to the continuous development of urbanization, the expansion of urban areas, the rapid changes in the way of land use, worldwide, 45% of the earth's surface in the 20th century to the 21st century has occurred the huge change: the expansion of urban area is bound to bring numerous cultivated land of land and natural conditions are replaced with impervious underlying surface, with a total area of greatly reduced; Forest resources continue to decrease, countless man-made buildings have replaced the natural landscape dominated by vegetation, and the city has become a "cement forest". According to relevant studies, the urbanization level of developing countries will increase to 83% in the next 15 years [5]. Building buildings, streets, roads and other impervious underlying surface step by step to replace the natural forest, grassland and farmland, which in turn leads to the increase of rainfall runoff, groundwater recharge amount, the rivers and canals erosion is aggravating, impervious underlying surface area of the proportion of high and low has become one of identifying a regional urbanization level gauge.

Landscape water can also be called landscape water. It mainly refers to the water resources consumed to maintain the healthy growth and vitality of the park and to continuously provide high-quality and pleasant landscape for the public. Urban park landscape water mainly includes water landscape water and plant conservation water. The United States and many European countries have changed the concept of simply solving rainwater discharge in the past, and realized the necessity of rainwater for urban development. They have formulated corresponding policies and regulations to limit the direct discharge and loss of rainwater, control the pollution of rainwater runoff, collect rainwater discharge fees, require or encourage rainwater storage, storage or recharge groundwater, and improve the urban water environment and ecological environment.

Since the reform and opening up, China's economic level has made great progress, and the living conditions of urban residents have been greatly improved, especially the living standard of some economically developed areas has been close to that of developed countries [6]. Accordingly, the urban planning and design and the landscape construction of the environment have stepped to a new level. From the founding to the 70 s, when is the state of the new China has just been established, all the ruins, so they can say the city basically with no landscape from the mid - 90 - s, 1980 s after a centered on the public service facilities and open green space, greening simple, environment after the early stages of the design methods of a single, people began to pursue higher living environment, Urban landscape design also gradually began to have a variety of grope and try.

At present, the water has the following characteristics: (1) Water resources are abundant, but the relative content is low. China's total water resources rank 6th in the world, and the average runoff depth is about 284mm, 90% of the world average, ranking 7th in the world. However, due to China's large population and low per capita share of water resources, the annual per capita runoff is only 2260mm, ranking 121st in the world. By comparison, less than a quarter of the world average; (2) The spatial and temporal distribution and geographical distribution of water resources are unbalanced. The distribution of water resources is more in the south and less in the north, and more in the east and less in the west. The rainfall is mainly concentrated in 3-4 months of the year, and the annual rainfall distribution is uneven. (3) Serious pollution of water resources, urban industrial sewage, domestic sewage discharge, domestic major river basins are affected by pesticides, chemical fertilizers and other chemical pollution to varying degrees; (4) Low utilization rate of water resources and widespread waste of water in industry, production and life [7]. Since the late 20th century, yearning and pursuit of the natural environment for people, for the attention of the ecological environment, and the country has also intensified its efforts on construction of sustainable development, and in many parts of the city landscape design pay more attention to human nature and intensification of space, urban landscape is under the management of designers get hot. Especially in residential areas, waterscape has become an important part of the external environment, and many cities have put forward the concept of landscape housing from building by water and living by water to large-scale artificial landscape design of residential area. The direct collection, storage, purification and utilization of natural precipitation is called rainwater utilization.

3. Water-saving landscape construction in urban gardens under the background of sponge city

There are some misunderstandings in the utilization of water resources in urban landscape, and the water-saving consciousness is weak in the construction of urban landscape, and the waste of water resources is serious. At present, the utilization of water resources is not scientific, the utilization

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efficiency of water resources is not high, the city park itself has a certain function of water conservation but become a kind of "water consumption garden". In some cities without severe water shortage, urban landscape can be guaranteed to a certain extent [8]. Therefore, designers and managers do not have a deep sense of the water crisis, and lack of consideration of water saving in the construction and management of landscape. Landscape construction and management pay more attention to landscape effect than construction and maintenance cost, which naturally leads to a lot of waste of water resources. The use of water resources in the landscape is mostly high-quality white water provided by the city, while many places in the park, such as irrigation and road cleaning, can use low-quality water. The water source used by the park is single in structure, and the phenomenon of "high quality and low use" is common. To solve this problem, the following strategies are proposed based on the concept of sponge city.

3.1. Reasonable allocation of green plant species

In recent years, with the rapid development of urbanization in China, urban greening construction has been greatly improved in terms of scale, quality and benefit. In urban greening, plants are one of the important materials, and the rich plant community and its diversity are not only the standard of urban greening perfection, but also one of the evaluation standards of the quality of the whole city. However, in the application of plant varieties of urban greening in China, there are some mistakes, a large number of exotic plants have been introduced, so that more and more exotic plants have become the protagonist of urban greening, but a large number of native plants have been rarely used. Landscape has shown a trend of project-oriented, commercialized and politicized, and landscape has become a commercial hype or political achievement project of various developers, resulting in a serious phenomenon of seeking quick success and instant profits and extravagance in landscape design [9]. To create high-end of the so-called boutique type landscape, many parks blindly praise highly the west garden in planning and design of "big lawn, color piece, big square, waterscape," such as landscape, artificial and natural light, without considering the characteristics of plant community ecology, abandoned the plant compound structure of arbor, shrub and grass in the configuration of model with natural human knowledge.With the enhancement of the ability to transform nature, the artificial traces of gardens are becoming more and more obvious [10]. This large-scale monoculture mode not only reduces the stability of the community, but also reduces the water holding capacity of green space. In order to maintain the normal landscape effect, irrigation intensity needs to be increased, resulting in the waste of water resources. Some parks ignore the local climate, geography and other natural conditions, blindly introduce exotic trees to create exotic customs, greatly increasing the cost of maintenance. Fountain, pool and other water landscape in the construction of the park is also required to be built, but also to build extremely luxurious, lack of realistic consideration of the local water resources, often increase the burden of water park. These problems are rampant in the construction of urban parks, and such phenomena are still repeated and repeated, allowing the situation to continue to worsen.

This trend has attracted the attention of many experts and relevant personages, and the voices of aquatic plants are rising day by day. Compared with exotic plants, native plants have more ecological water-saving advantages [11]. Because native plants are the result of long-term natural selection, they are the most adaptable to the local natural environment both in terms of their ecological habits and their relationship with environmental conditions. Urban greening environment condition is bad, the air pollution, soil barren, man-made destruction, extensive management, etc., these are the problems we face, to ensure the good growth of plant, to ensure good quality of urban greening, those on the local environment has strong adaptability and resistance of native plants, no doubt will become the first choice, Especially in some greening with special environmental conditions, native plants play an important role that other plants cannot replace [12].

Greening is the main body of the city park, the lush plant community makes the park more full of life. Urban parks have high requirements for greening rate, and the greening area often accounts for 60-90% of the total park area. The park needs a lot of water for plant maintenance. From the beginning of the construction of the park, in order to ensure the survival of new trees and speed up the formation of the park landscape, a lot of artificial maintenance and irrigation water need to be invested. Plant conservation is a long-term process. In order to maintain the healthy growth of plants and maximize the ecological benefits of plants, regular and quantitative watering of plants in the park is necessary even when the park construction is completed and the landscape effect is stable. Therefore, the water demand for plant conservation is quite amazing, accounting for the vast majority of the park's water consumption [13]. Compared with high-cost imported exotic plants, many native plants can reproduce and grow by themselves under natural conditions. Even if artificial propagation is adopted, due to the

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strong adaptability of native plants to the environment, its seedling cost is low, which can greatly reduce the cost of urban greening and reduce the waste of urban water resources. For exotic plants, their poor adaptability to the environment has brought great trouble to the conservation and management work. For example, in the maintenance of lawn, due to the lack of adaptability to the environment, they have to be watered in time in case of drought, resulting in a large demand for water resources, which not only increases the investment. And to the already very tight urban water resources brought more pressure. In urban landscape design, personalized landscape is the pursuit of designers, urban greening landscape design is no exception. The choice of plant materials, especially the application of native plant materials, can play a prominent role in displaying the personalized urban landscape. For example, in areas with a high frequency of rainstorms, 5-10 plant species can be selected, mainly local plants, in consideration of the long-term submerged nature of vegetation. If rainstorm frequency is very low according to the prediction of regional rainfall, the selection of plant species will be more abundant and the species diversity will be better combined with the construction of traditional constructed wetland. The presence of algae is beneficial to the treatment of storm runoff pollution, and the algae layer attached to the sediment surface can effectively remove nutrients. In view of the current wetland park landscape dilapidated, disorderly, lack of service facilities and other conditions to upgrade; To protect and utilize the current vegetation, select local tree species for replanting, in order to avoid damage to the ecological environment; Add wetland basic service facilities, bird watching tower, science popularization education exhibition hall and other facilities, enhance the science popularization function of wetlands; Strengthen the construction of wetland cultural propaganda facilities, enhance the appeal and cultural belonging of citizens; Add artistic landscape, improve the artistic atmosphere and landscape effect of wetland. Finally realize the diversified functions of wetland park under the background of sponge city.

3.2. Application of reclaimed water reuse technology in sponge city

Reclaimed water reuse technology includes biological method and physicochemical method. In conventional treatment process of reclaimed water reuse, biological contact oxidation method and activated sludge method are common at present. The commonly used physical and chemical treatment methods are coagulation precipitation, filtration, activated carbon adsorption, disinfection and other methods. At present, coagulation and filtration are the most widely used in water treatment technology, but with the development of water treatment technology, some new water treatment technology is constantly adopted. In a process centered on physical and chemical methods, California uses ozone and granular activated carbon GAC processes to treat a large number of different secondary effluent. Spanish water treatment plants disinfect filtered secondary effluent with excess ozone doses (greater than 9mg/L) for agricultural irrigation. In the membrane-centred treatment process, Belgium in the US obtained high-quality treated water by microfiltration (MF) followed by reverse osmosis (RO), and Georgia tested ultrafiltration (UF) and nanofiltration (NF) to treat secondary effluent. According to the need to arrange anti-seepage facilities, to avoid sewage pollution to groundwater. Surface flow constructed wetlands are used to purify water by plant absorption, substrate filtration and natural sedimentation. The surface flow wetland has the most similar structure to the natural native wetland, but compared with the subsurface flow type, the pollution removal and pollution control effect is relatively weak but relatively stable. The advantages are simple construction and low investment. However, the surface flow constructed wetland has some disadvantages, such as large area, easy to produce mosquitoes and flies, and is greatly affected by temperature, and the pollutants cannot fully contact with the filler and plant roots in the operation process, resulting in the limited water quality treatment capacity. This type is suitable for relatively good water quality, the water purification efficiency is not high requirements of the region.

Reclaimed water can not be widely used in all parts of our country, the main reasons are outdated ideas, insufficient publicity, imperfect laws and regulations, the price of tap water is too low, reclaimed water utilization project is not matched, reclaimed water quality is unstable, etc. Therefore, it is necessary to increase the publicity of reclaimed water. Long-term and extensive publicity of the use value of reclaimed water, popularization of knowledge about reclaimed water, so that people gradually change the old concept and establish a new concept that reclaimed water is also a water resource [14]. As one of the sources of urban auxiliary water, medium water has a large and stable amount of water and is not restricted by weather and season. Its water quality can fully meet the requirements of landscape water, and the water cost is relatively low, and the development prospect is very broad. However, the amount of domestic wastewater needed for the treatment of reclaimed water is large, which can be satisfied by at least 100,000 square meters of actual living population. The larger the residential area is, the more people live in it, the more conducive to the construction of reclaimed water

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system, and the more economical the cost is. However, China's current real estate development mode is almost piecemeal. Developers circle each piece of land and build each piece in the base. There is no modern development concept of unified coordination, large-scale development and common benefit at all.

At present, the price of tap water in our country is too low, the government should issue new policies, appropriately raise the price of tap water, so that the price of tap water reflects the preferential policy, so as to stimulate the use of tap water units. For the water utilization project, the government should give preferential policies and strong financial support to promote the implementation of water utilization project. At the same time, local water conservation offices should be empowered to supervise the use of water in buildings and promote the construction market to pay more attention to the construction of water facilities by economic means. Strengthen the self-discipline of the industry, add testing stations to ensure that the effluent quality of sewage treatment plants is up to standard, protect the interests of water users. To integrate reclaimed water into the unified management and allocation of water resources, strengthen the utilization of reclaimed water, as soon as possible to use reclaimed water for urban greening, industrial cooling water, environmental water, ground flushing water, farmland irrigation water, etc., in order to achieve the purpose of water conservation and income reduction.

3.3. Engineering design of water ecological utilization under sponge city background

Rainwater is the natural water resource with the fastest purification speed in nature. It is an important link in the natural water circulation system, and plays an extremely important role in supplementing regional water resources and improving and protecting the ecological environment. But for a long time, our country has been the rainwater as wastewater directly discharged into the sewer. In the shortage of fresh water resources today, we should recognize its value and use it again. Rainwater does not contain chlorine and is closer to the water needed for the survival of animals and plants in waterscape. Therefore, in this regard, rainwater is even more suitable for landscape water than tap water flowing from pipes [15].

The purpose of the construction of sponge city is to build a low impact development rainwater system to realize the "infiltration, stagnation, storage, net, use and discharge" of rainwater. In the traditional sense, the design concept of urban drainage system is rapid discharge and terminal treatment. Such a single drainage mode will increase the pressure of flood control and drainage of municipal pipe network, and if the initial runoff is directly discharged into the river, it will pollute the receiving water body. In addition, the discharge of rainwater is also a waste of water resources. The construction of sponge city comprehensively controls rainwater from the beginning to the end in the process of runoff flow. Compared with the traditional discharge mode, it pays more attention to the natural accumulation and infiltration of rainwater, which can play a positive role in the healthy and sustainable development of the city. On the one hand, all kinds of indirect measures are adopted to strengthen the infiltration of rain water, so that more rain water infiltration underground, conservation of underground water sources; On the other hand, a reasonable collection system will be used to collect rainwater and reuse it through ecological treatment technology. In the rainy season, rainwater and treated intermediate water enter the ecological treatment facility together. In the dry season, only treated intermediate water enters the ecological treatment system. The technological process of water ecological treatment is shown in the figure below:

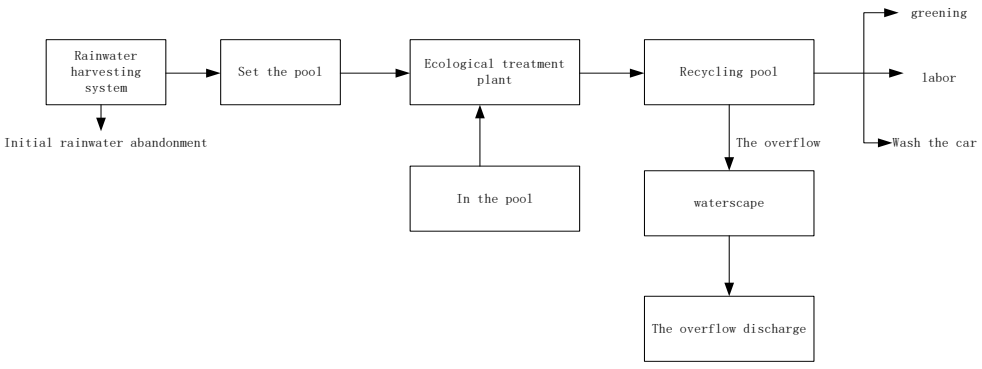

Figure 1: Process flow chart

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From the long-term significance of urban landscape water-saving planning, urban landscape water-saving planning and design is an inevitable requirement of its own sustainable development, and a landscape approach to solve the problem of urban landscape water use. Limited by the shortage of water resources or the economic burden of high water prices, the management departments often make certain compromises in the quality of landscape maintenance, such as reducing the frequency and amount of greening irrigation, and opening fountain water features on a regular basis. The quality of urban landscape can not be fully reflected, the function can not play normally, resulting in the regret of visiting. If these problems cannot be effectively solved, will cause serious influence sustainability of the urban landscape, as a result, only from the perspective of planning and design, the overall control of water saving, indicate in the right direction, the construction of water-saving landscape of the garden, reduce their water consumption, open up a variety of water resource utilization and access to, can alleviate the contradiction of water shortage, Achieve sustainable development.

4. Conclusion

With the rapid development of the city, large areas of impervious pavement cover the urban surface, and the area of the original rivers, lakes and other natural water bodies decreases sharply. At the same time, unreasonable development and construction destroyed the original natural hydrological cycle of land, and reduced the city's adaptability to rain flood, resulting in frequent urban waterlogging. In addition, the city is also faced with the development of water pollution, water shortage and other urban water problems. Under this background, the strategy of constructing water-saving landscape in urban gardens under the background of sponge city is put forward, and the development mode of constructing new and green city is actively discussed.

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