Landscape Design of Greenland Park Based on the Concept of "Sponge City"

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Keywords: Greenland Park, Sponge City, Landscape Design, Ecology

Abstract: In order to cope with urban rain and flood problems, this paper will promote the construction of sponge cities and propose to make full use of the landscape design of urban green space parks for stormwater management. Firstly, it analyzes the role of Greenland Park in the construction of sponge city, then proposes the strategy of "sponge city" in green park construction, and finally discusses the landscape design approach of "sponge city" in green park. It is believed that the urban green space park landscape design should be based on the process of catching water-storage-purifying water in rainwater, applying low-impact development technology, designing water collection, water storage and water purification landscape, collecting and infiltrating the rainwater in this process, to achieve efficient management of rainwater and water quality in urban green space parks.

1. "Sponge City" concept and Greenland Park

The concept of "Sponge City" is inspired by sponges, which absorb water and store water, while Sponge City uses the design concept of low-impact development to collect, store and convert rainwater. Mainly through the introduction of ecological engineering technology and landscape technology in urban construction, the effective use of urban buildings, transportation facilities and park green space, etc., to alleviate, save and purify rainwater, to achieve the surface runoff to control rainwater. In this way, the use of engineering technology and natural ecological environment to save and infiltrate rainwater resources.

Greenland Park is a type of park with comprehensive functions in urban ecological environment protection, showing outstanding ecological, social and economic benefits. Greenland Park not only becomes an important activity place for urban residents to live and relax, but also improves the overall ecological environment of the city. Therefore, the application of the "sponge city" concept to the green space park can improve the urban ecological environment and has important practical significance.

2. The role of Greenland Park in the construction of sponge city

2.1 Greenland Park can improve the ecological environment of the city

The wetlands are called the kidneys of the earth, so the green park is the lungs of the city. Greenland Park plays an important role in the development of urban ecological environment.

First, maintain the urban ecosystem. Urban green space parks can improve the local microclimate of the city, reduce the heat island effect of the city and regulate the air humidity to a certain extent, and promote local gas circulation and promote ventilation. Second, maintain biodiversity. Greenland Park can provide a variety of animals and plants with the living environment they need, ensuring the richness and diversity of animal and plant communities, living environment and its ecological functions. Third, it produces an ecological effect. Green plants in urban green space parks can absorb oxygen from photosynthesis to release oxygen, providing cleaner air, and urban green spaces can provide clean water and maintain water and soil.

2.2 Greenland Park can regulate runoff and accumulate rainwater

Greenland Park plays a supporting role in regulating urban runoff. Greenland parks generally have a certain scale of green space, such as ecological wetlands, which can effectively control the

  DOI: 10.25236/issec.2019.017

runoff and peak flow of rainwater and reduce the runoff pollution rate of rainwater. The “water” in the green space park is rational, reasonable and multi-bearing. The runoff and rainwater collected by Greenland Park accumulate on the surface of the green park, in the plant body, and in the peat layer and grass root layer of the soil. The rainwater accumulated in Greenland Park can also provide water for the surrounding industrial and agricultural production, provide greening and watering, improve local humidity and penetrate groundwater. Provide water security for social, economic and environmental sustainability.

2.3 Greenland Park can purify rainwater

With the acceleration of the urbanization process, air pollution and ground pollution have become increasingly serious, leading to increased rainwater runoff pollution. Greenland Park has a powerful rainwater purification function through the synergy of soil, microbes, artificial media and plant roots by physical, chemical and biological functions. The green space in the park allows the suspended solids in the rainwater to be trapped, adsorbed and deposited in the green park system, and the toxic substances and nutrients are degraded and transformed by the wetland plants. The water quality of the rainwater is improved, so that the rainwater can be recycled.

3. The strategy of building a “sponge city” in Greenland Park

3.1 Protect and repair park green spaces and water bodies

In the construction of the “sponge body” of the green park, it is necessary to make full use of the original terrain and protect the original green space ecosystem. Let local vegetation, water, soil and other natural successions create an ecological green landscape that conforms to the local ecological environment.

In addition to the need to fully protect the ground and above-ground water, it is necessary to construct a park “green space” to use ecological methods to restore damaged green spaces and water bodies, so that hydrological cycle characteristics and ecological functions are gradually restored. In this way, the greenland park's own resilience is stimulated, and the green park is maintained in a relatively stable balance.

The specific measures for protecting and repairing the “sponge body” of the park green space are: (1) restricting the delineation of the construction area and the prohibited construction area, and dividing the blue-green line by legal means and other means to maintain good flood control capacity and sponge treatment capacity. (2) Restoring natural ecology, repairing and repairing green ecosystems through silt dredging, ecological banks and aquatic plants; (3) Constructing ecological corridors, combining plaque-corridor-matrix theory to construct a construction that is conducive to the construction of “sponge city” Ecological corridors such as rivers, canals and plants. Such an ecological corridor can maintain a good relationship between various ecological patches and create an ecological “sponge body” of the green park system. On the other hand, ecological corridors can form the necessary ecological networks and channels to facilitate the collection and utilization of rainwater.

3.2 Artificial reconstruction of park green space and water body

If the city park lacks natural sponges, it can be built and modified manually. They can effectively improve the static ecology of the city, replenish groundwater, store floods and drains, and collect rainwater.

There are many ways to build a “sponge body” in a green park: (1) construction of artificial park green space, artificial park green space also has good decontamination and sewage discharge effects. It can better improve the city's sponge accumulation in rainwater and improve the elastic adaptability to floods; (2) Build and renovate the park water system. For example, in recent years, Wuhan's “Dadong Lake” and “Six Lakes Unicom” projects are large-scale water network ecological construction and renovation projects, which fully exert the adjustment function of the existing natural water bodies; (3) transform the traditional park green space layout, The centralized green

space construction will be transformed into small and scattered sinking green space, which can better reduce the rainfall discharge and eliminate the impact of surface rainwater runoff; (4) improve the infrastructure and improve the ecological benefits of park green space through LID method, and Greenland landscape resources are combined with rainwater harvesting facilities through subsidence and detention. Effectively increase the permeable area of the green space, and the collected rainwater can also be applied to the entire water cycle of the green space park.

3.3 Construction of bionic artificial green space and water body

The construction of bionic artificial sponges is to construct water-storing, penetrating and rainwater recycling facilities through modern technical means and methods, forming a bionic artificial “sponge body” similar to the function of natural sponges.

Common artificial bionic sponge construction methods are: (1) Bionic sponges based on the green building design concept are mainly used in park buildings and structures. Through the sump, the rainwater collected by the green roof and the permeable roof can be used for domestic water or building landscape water after being treated by the water purification facility; (2) The rainwater of the municipal water circulation system (such as park roads and squares) can be collected to the maximum extent. For example, in a square, the ground can be set up to be permeable to water, and as much as possible, rainwater is leaked underground instead of gathering rainwater to cause a small flood. It can also improve the permeable area and water permeability of park pavements; (3) use modern technology to analyze urban flood disasters through modern information technologies such as cloud computing and big data.

4. Landscape design method for the construction of “sponge city” in Greenland Park

4.1 Water collection landscape design - green space, ground pavement, roof water collection

The watershed landscape design of Greenland Park can be divided into three categories: green space water collection, ground surface water collection and roof water collection.

The water harvesting efficiency of landscape green space is poor. However, due to the large catchment area of green space, the amount of rainwater collected during heavy rain is considerable. The rainwater in the green space is of good quality and easier to handle. In the green space, the landscape elements are mainly trees, shrubs and turf. The natural environment of Greenland Park plays an important role in saving water, maintaining water and soil, reducing surface runoff and promoting atmospheric water circulation. Natural green spaces should be protected as much as possible to maintain their natural ecological characteristics. For artificial green space, reasonable changes and designs can be made according to the development conditions around the site. Such as roads and plaza areas, according to the site conditions, combined with the landscape requirements to design a certain scale of sinking green space. When rainwater enters a sinking green space, sediment, leaves and garbage can be filtered and some pollutants can be absorbed by the plant roots. Rainwater collects and slowly infiltrates into sinking green spaces, reducing surface runoff and replenishing groundwater. Among the sunken green spaces, the most common is the rain garden. Plants can be planted to create a unique wetland landscape. The plant selection of the sinking green space is different from that of the traditional green land plant, and it is necessary to give priority to indigenous plants with strong adsorption and purification ability, drought tolerance and tolerance.

In addition to the green space, there are various floor coverings covering the ground of the park. Various floor coverings include paving of roads and platforms, as well as all natural paving or covering. The traditional hard pavement severely blocks the natural penetration of rain and affects the natural hydrological cycle. In order to restore the ecology of the green park as much as possible and increase the penetration rate of rainwater, the permeable paving materials can be used according to different needs. For example, various permeable bricks, permeable asphalt, permeable concrete and pebbles, gravel, lawn bricks, etc. (Fig. 1) According to site characteristics, various paving materials are used for plazas, parking lots, sidewalks (roads, trails), and roads with small traffic and loads. In the form of material combinations and colors, various design changes can be made by art,

so that paving can collect water and seepage, and can also form a unique landscape effect. (Fig. 2) Such a permeable pavement not only reduces the heat reflection on the ground, but also maintains the ecological efficiency of the soil. The permeable pavement can quickly eliminate the water on the park roads and squares; when the rainfall is concentrated, it can reduce the burden of urban drainage facilities and effectively prevent river flooding and water pollution.

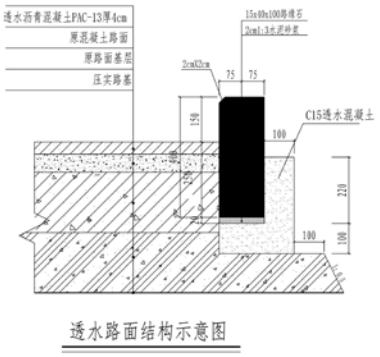

Figure 1 Schematic diagram of permeable pavement structure

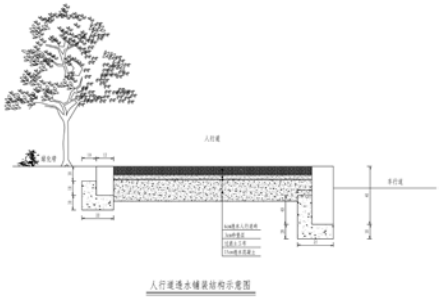

Figure 2 Schematic diagram of pavement penetration structure

The water collection in the Greenland Park can also be carried out through the green park structure and the impervious roof of the building, increasing the amount of rainwater collected and increasing the catchment rate of the green land. Therefore, it is possible to make full use of the green space, the ground paving, and the roof collecting water to collect more water resources.

Take Beijing Olympic Park as an example. The park includes various landscape engineering facilities and has built effective landscape sponges, including recreational green spaces, permeable pavements, sunken rain gardens, roof water collection, rainwater harvesting, reclaimed water use, rainwater filtration purification and wetland purification. . The total water area is 842 hm^2 and the total water storage capacity is 130 m^3. These measures not only save water, but also create a series of beautiful landscape belts.

4.2 Water storage landscape design - plant grass ditch, underground water storage system, ecological lake

The grass grass ditch is a drainage system, which is characterized by a landscape ditch with rich planting. In the process of transporting rainwater, grassing ditch can slow down the flow rate of rainwater runoff, purify and infiltrate rainwater, and create good landscape effects through plant plants. The design of the grass ditch should be combined with the natural topography and overall layout of the park green space to design the plane and vertical vertical of the shallow ditch of the plant. Ensure that the gravity of the rainwater flows smoothly, so that the rainfall runoff in the grassland can be distributed as evenly as possible to avoid erosion on the slope. At the same time, it is necessary to coordinate with the natural environment in the green park to give full play to the landscape effect. (Fig. 3)

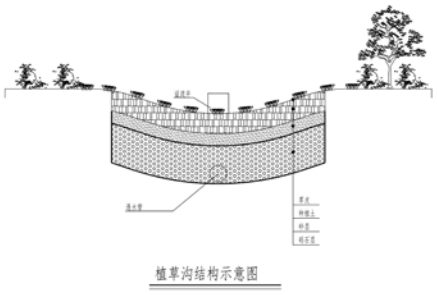

Figure 3 Schematic diagram of planting grass ditch

The underground water storage system is an engineering device that has the function of temporarily storing rainwater, which can guide the rainwater retention and slow penetration before entering the pipeline. When the underlying soil of the park green space has good permeability, the water storage system can slowly release the stored rainwater into the sponge urban facility network. Underground storage facilities can be used where there is no available storage space on the ground. Based on surveys of on-site permeability and rainfall in these locations, water storage facilities with storage potential and permeable potential are designed. This kind of landscape engineering facility has a high initial investment, but the maintenance method is simple and has a long service life.

Ecological lakes are also a water storage landscape that allows green parks to change their ecological landscape. When heavy rain arrives, rainwater can be introduced into the lake to reduce the amount of rain around the park; during the dry season and early season, the water vapor evaporated from the lake will freshen and dry the dry air; the water infiltrated from the bottom of the lake can effectively replenish the groundwater resources; At the same time, ecological lakes can beautify the environment in green parks, provide waterscapes for people, create a good landscape atmosphere, and reduce the heat island effect of the city.

4.3 Water purification landscape design - ecological wetland

Rainwater collected from green spaces or permeable pavements or from impervious roofs should be purified prior to secondary use to improve water quality and reduce pollution rates. The filtered rainwater function of the clean water landscape has a good effect in regulating flooding in the green park area and maintaining biodiversity.

The use of ecological wetlands to store and purify rainwater, and integrate with landscape facilities, relying on the natural purification capacity of water bodies to treat and use rainwater. Ecological wetlands can decompose, absorb, transform and utilize pollutants entering the wetland system for purification purposes. In the green water park rainwater purification process, natural wetlands and constructed wetlands can be combined, so that not only the role of landscape viewing, but also a multi-faceted comprehensive effect, reflecting the perfect combination of landscape design and ecological sustainable development.

In the ecological wetland, we need to convert the hard reinforced concrete dyke into an ecological river floodplain; restore the straightened river into a curved natural state; allow temporary flooding; the revetment design becomes an ecological revetment, such as wooden stakes. Stone cages, ecological bags, ecological bricks and pebbles. (Fig. 4) Through the connection of water system and the restoration of water ecosystem, a complete sponge system of surrounding hydrological system is formed to alleviate flood disasters and use water resources to promote urban wetland stability.

For example, in Harbin Qunli Yuhong Park, Tujia Landscape Design Company uses urban rainwater resources to solve urban problems. The park was built as a city rain and flood park, providing the city with a variety of ecosystem services. In its special design, most areas of the original wetland are protected, and natural succession areas are used to cultivate native natural landscapes; rainwater inlet pipes are placed around the wetlands to collect rainwater from the new urban areas. Puddles and mounds of different depths are like a blue-green gemstone necklace, providing habitat for a variety of original flora and fauna, providing visitors with natural beauty.

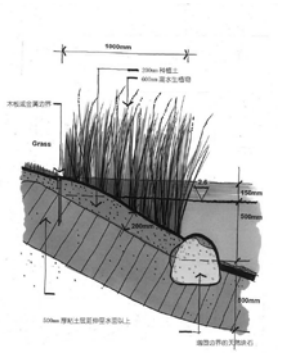

Figure 4 Schematic diagram of ecological revetment

5. Conclusion

The application of “Sponge City” in green parks will inevitably face landscape needs. Therefore, in the green park, the embodiment of natural beauty and ecological beauty is the combination of the “sponge city” system and landscape design, and it is also the new direction of the green space park water environment construction. When designing landscapes for the park's “sponge city” system, natural ecology is always an important design premise. As a landscape project, it needs to have a cultural heritage, full of humanistic care and aesthetic principles; as an ecological engineering project, it also needs to follow the principles and design principles of ecological engineering. In the construction of green space parks, the landscape architect's responsibility is to combine landscape design with the construction of “sponge city”. Realizing aesthetics and ecology, improving the natural and human living environment, and making people and nature develop harmoniously.

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