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Research Article

Practical Research on the Application of Sponge City Reconstruction in Pocket Parks Based on the Analytic Hierarchy Process

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The rainwater system is an important part of the urban infrastructure as well as a key hub for maintaining the dynamic operation of the city and a clear indicator of the level of urban development. With the rapid development of urbanization, the hardened area of roads and residential areas has increased, and the construction of rainwater systems is so far insufficient, causing the urban waterlogging and water pollution problems to become increasingly serious. Accordingly, combined with the "sponge city" construction concept of the six-character policy of "seepage, retention, storage, use, purification, and drainage," we propose to adopt measures for the local conditions and to reasonably select sponge city engineering measures to increase rainwater utilization, effectively reduce rainwater runoff, and alleviate the city waterlogging and water pollution problems. We used the analytic hierarchy process (AHP) to evaluate the effect of a sponge city "pocket park" rainwater system in Chaohu City before and after the transformation. The results showed that the pocket park after the renovation was well controlled, the waterlogging was basically eliminated, the water quality pollution was clearly improved, and the ecological environment was significantly improved.

1. Research Background

With the rapid economic development of the city's urbanized area increasing year by year, the green area has been decreasing, resulting in the city park feature not being fully functional, and urban infrastructure has increasingly exposed shortcomings that have occurred in the "city to see the sea." Improper maintenance and management of the urban stormwater systems [1], a lower return period, insufficient drainage zoning [2], improper pipe connections, and other issues resulted in a waste of resources, rain, and the serious phenomenon of urban waterlogging. This issue is not conducive to urban economic development and also seriously affects the standard of living. The sponge urban philosophy is based on building a new pocket park, which can not only effectively alleviate the problem of urban stormwater systems but also lay a foundation for the construction of an environmentally friendly city. A pocket park in Chaohu City, for example, can be related to the transformation of its rainwater sponge system.

2. Overview of Concepts and Features

2.1. Sponge City Concepts. The term "sponge city" indicates that the city has the function of a sponge, which can respond flexibly to natural disasters and adapt to environmental changes [3]. The functions of a sponge city are mainly embodied in the six aspects of "seepage, retention, storage, purification, use, and drainage" [4]. The core of the construction is to build aquatic ecological infrastructure across different scales, combining multiple specific technologies [5], and promote coordinated development of urban and ecological environment.

2.2. Evaluation Criteria for Sponge City Construction. The sponge city concept is implemented based on three main aspects: protecting the existing ecological system in the city, promoting urban ecological restoration and restoration, and maintaining low impact during exploitation. Evaluation of construction typically includes the construction hardening rate, the total annual runoff control rate, the rainwater utilization rate, and the pollutants (SS) control rate. In general, sponge city divides the construction area into 5 categories based on the annual runoff control rate in the implementation standards: category 1 is 85%–90%, category 2 is 80%–85%, category 3 is 75%–85%, and category 4 is 70%–85%, and category 5 is 60%–85%. The overall control rate of pollutants is 40%–60%.

2.3. Pocket Park (Vest-Pocket Park or Minipark) Concepts. A "pocket park" indicates a smaller urban open space, generally with a patchy scattered nature or hidden in the urban fabric [6]. Typically, pocket parks are parks formed by further adding leisure and entertainment facilities on the basis of planting greenery on smaller plots. Pocket park construction areas are generally one to three times the area of housing construction. With general domestic rural housing construction areas of 400 m^2, the provisions in the "park design specifications GB51192-2016" [7], and the district resident population of 10,000, the area of the inner park is not less than 10,000 m^2. Therefore, the construction area of pocket parks is generally 400–10,000 m^2.

2.4. Pocket Park Features. The location of a pocket park is less limited and can be developed from any open space or forgotten space in a city. Compared with traditional parks, pocket parks have characteristics including a small area, built in high-density urban areas, few but not single functions, patchy discrete distribution, ecological nature, and a high frequency of use. Through analysis, pocket parks can be divided into parks with different functions according to different properties. According to the location of the pocket park, it can be summarized as a park with ecological, social, landscape, psychological, and filling functions [8]. If divided according to the layout form and use function of the pocket park, the park can be classified as a recreational, decorative, transportation, and comprehensive park [9]. The scope of pocket parks is shown in Figure 1.

2.5. State-of-the-Art Pocket Park Construction. As a structure that effectively utilizes the abandoned sites in the city, the pocket park not only makes full use of the urban space but also increases the urban green spaces, forming a unique urban landscape structure. Many experts have conducted research on pocket parks. Shen Lingzhi explained that combining pocket parks with old city landscapes helps to create more urban land resources; Zhang Haopeng sorted out the principles of pocket park construction in the community, which is adopted in several construction cases. Yu Guojiang highlighted the importance of pocket parks in protecting urban ruins. However, problems still exist in the construction of pocket park, including unreasonable choices of the pocket park location, uniformed construction layout, not fully realized ecological functions, and shortage of internal circulation system of the park. Currently, the pocket park is not conducive to the urban water environment and limits its ecological functions. Therefore, it is important to adopt a reasonable and effective construction plan that transforms the construction method of pocket parks. It would help to address the urban water environment problems and have important significance in promoting the construction of environmentally friendly cities.

3. Related Research and Case Analysis

3.1. Related Research. The concept of a sponge city can be reflected in the construction of residential areas, campuses, parks, roads, and so on, and the concept of a sponge city can be fully reflected by adopting various sponge transformation measures. As a small urban public open space, a pocket park not only provides people with comfortable leisure and entertainment places but also adds many green elements to the city, promoting the construction of an environmentally friendly city. At present, many scholars have conducted research on this aspect. For example, Li and others analyzed that the combination of pocket parks and sponge cities can greatly help strengthen urban rainwater control [10]. Zheng et al. and others proposed that the concept of sponge cities and pocket park construction has an important role in regulating the regional microclimate [11]. Tan et al. used the concept of the city as the basis for sponge pocket park sites to solve the lack of urban green space, inadequate drainage facilities, and other issues [12].

3.2. Case Analysis. With the continuous promotion of the sponge city concept, there have been many specific cases of integrating the sponge city concept into the reconstruction and construction of pocket park at home and abroad. A specific case analysis of the sponge renovation and construction of pocket park is shown in Table 1.

4. Sponge Transformation of the Rainwater System in a Pocket Park: Taking a Pocket Park in Chaohu City as an Example

4.1. Overview of the Pocket Park before the Renovation. The studied pocket park is located in Chaohu City, Anhui Province. The city has four distinct seasons, sufficient sunlight, and a mild climate. The annual average rainfall is 1124 mm, and the rainfall is abundant, which meets the requirements for sponge transformation of pocket park.

This pocket park is located next to the old residential area, with a construction area of 5644 m^2. Its functions are mainly sports, entertainment, and ecology; the green area in the park is approximately 50% of the construction area about 2822 m^2. There are also a circular ecological lake and an arc-shaped wisteria corridor and two Chinese-style background walls; the ecological lake area is approximately 25% of the

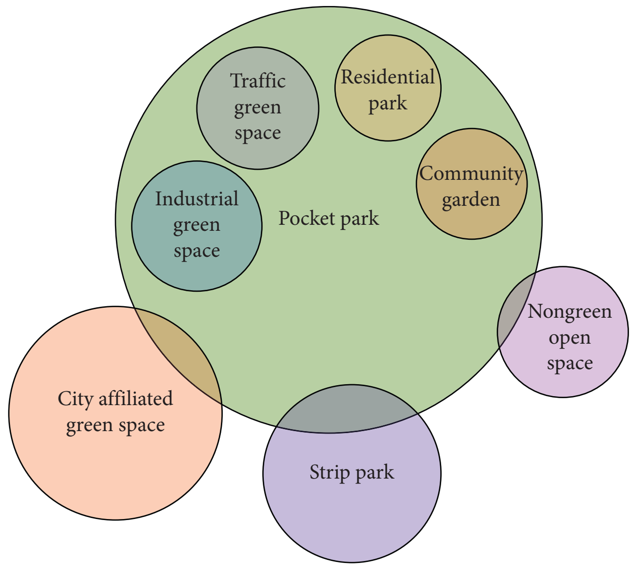

Figure 1: The scope of pocket parks.

construction area, about 1411 m^2. There is also a 2 m wide circular plastic runway inside the park to provide sports conditions for the surrounding residents.

4.2. Operation Status and Existing Problems of the Pocket Park Rainwater System before Transformation

4.2.1. The Original Rainwater System Operation of the Pocket Park. The underlying surface of the park that receives rainwater is mainly embodied in three aspects: road paving, green space, and water bodies. The operation process of the rainwater system is primarily that the runoff formed by rainfall is discharged into the nearby rainwater outlet and then enters the municipal rainwater pipeline; the rainwater that falls on the green space is infiltrated by the soil, and the excess runoff flows into the ecological lake; and the rainwater that falls on the ecological lake that does not exceed the net municipal level is accepted as consumptive rain.

4.2.2. Problems in the Original Rainwater System of the Pocket Park. Due to the short construction time of the pocket park, the internal rainwater system facilities are relatively incomplete and there are obvious problems in the operation. This is mainly reflected in the lack of timely drainage when the rainfall is large, and water accumulation forms easily; the utilization rate of rainwater is low, the phenomenon of rainwater waste is serious, and the overall layout of greening is single.

4.3. Sponge Renovation Measures for the Rainwater System of the Pocket Park

4.3.1. Comparison of the Advantages and Disadvantages of Sponge City Concept Transformation Measures. The sponge city concept emphasizes the three aspects of “natural accumulation, natural infiltration, and natural purification” [13] to reduce runoff, reduce rainwater pollution, and improve the circulation function of the rainwater system. Practice showed that various transformation measures based on the sponge city concept have certain advantages and disadvantages in different actual projects. The advantages and disadvantages of various sponge transformation measures are shown in Table 2.

4.3.2. Basis for Sponge Transformation Measures. Analyzing the pros and cons of various sponge renovation measures, we summarize that all renovation measures have applicable scenarios. We analyze the selection of sponge renovation measures of different construction types here. Select different building measures, such as the transformation of sponge shown in Table 3.

4.3.3. Retrofit of the Rainwater System in the Pocket Park. According to the existing renovation conditions of the pocket park, through the analysis and comparison of various renovation measures, several measures were selected, including water-permeable pavement ground, grass ditches, sunken green space, rainwater gardens, a rainwater circulation system, and a rainwater storage system. This transformation was performed, which organically combined several transformation measures.

(1) Pave the ground with water-permeable materials. The road in the park is composed of pedestrian roads and plastic runways, combined with the different functions of the road, to achieve the water permeability transformation. They chose to use a permeable cement concrete material to pave the sidewalk and to use permeable asphalt concrete to modify the original plastic runway [14]. The reconstructed road can not only speed up the absorption of rainwater on the ground but also enhance the aesthetic effect of the pocket park. Considering that the rainwater is

heavy and urgent during heavy rains and that the permeable ground cannot absorb all the rainwater in time, the permeable pavement ground can be set with a certain slope during implementation, and the excessive rainwater can be drained to the surrounding green space in time.

(2) Plant grass ditch. The grass ditch is a landscape surface drainage ditch that integrates rainwater transmission function with the reduction of suspended solid particles and organic pollutants [15]. During the renovation design, the green belt and green space in the park were added with grass-planting ditches, so that rainwater runoff from roads and greening will slowly flow through the grass-planting ditches to achieve the purpose of removing suspended solid particles and organic pollutants and effectively control the nonpoint source pollution in the park.

(3) Change the sunken green space. The green space in the park was transformed into a sunken slope to form a sunken green space. Through the infiltration and storage functions of the green space, the phenomenon of rainwater runoff was reduced. To reduce the degree of rainwater pollution, a certain amount of gravel can be added to the reconstructed sunken green space to effectively intercept the larger solid impurities in the rainwater.

(4) Add a rain garden. Combined with the topographical features and planning layout of the pocket park, a rainwater garden was added at the end of the sunken green space, and plants were planted in the rainwater garden to achieve the purpose of storing and purifying rainwater.

(5) Add a rainwater circulation system. Sprinkler irrigation water supply pipes and underground backwater filtering blind pipes were added in the pocket park [16], connecting the backwater filtering blind pipes to the catch basin located at the lowest part of the park, and the corresponding operating facilities were installed to form a complete rainwater circulation system to ensure the dynamic flow of rainwater.

(6) Add terminal storage facilities. Rainwater storage tanks were set up at the end of the rainwater pipe network in the park to achieve the purpose of reasonable control of rainwater drainage and utilization. Through the calculation of the total annual diameter of the pocket park and related requirements, a reasonable rainwater regulation and storage mode was selected from the independent internal regulation and storage mode, the regional coordination regulation and storage mode, and the external system regulation and storage mode.

4.3.4. Reconstruction Design of the Pocket Park Rainwater System. (1) *Design Calculation of the Permeable Pavement*. The pocket park is located in Chaohu City, part of which belongs to Hefei City. Therefore, the rainstorm intensity formula refers to the Hefei City standard. The rainstorm intensity formula is [17]

$$i = \frac{25.8280\,(1 + 1.3659 lgP)}{(t + 20.5150)^{0.9126}}, \quad (1)$$

where i is the formula of rainstorm intensity, mm/min = 0.6 mm/h = 0.006 L/(s·hm^2); t is the rainfall duration, 45 min; and P is the return period, 2 a. Substituting the data, this is 0.838 mm/min.

The thickness of the permeable ground base layer H_1 [18] is as follows:

$$H_1 = (0.1i - 720k) \times \frac{100t}{60n}, \quad (2)$$

where k is the soil-based gun and permeability coefficient [18], 10^{-4}, and n is the aquifer porosity [18], 20%. Substituting the data, this is 18.59 cm. As the base layer thickness of sidewalks and motor vehicles is 15–20 cm, the calculated H_1 meets the requirements.

The thickness of the permeable ground surface H_2 is as follows.

As the reconstructed roads are all water-permeable concrete, the surface layer range is 30–40 mm, so we chose 40 mm.

(2) *Design and Calculation of the Planting Ditch*. The design rainfall runoff Q_j is as follows:

$$Q_j = \Phi i B \times 10^{-3}, \quad (3)$$

where Φ is the comprehensive runoff coefficient of the catchment area [19], 0.4–0.5; choose 0.4; B is actual catchment area, hm^2. Substituting the data, this is 0.024 m^3/s.

The rainwater runoff transmission capacity of grass ditch Q_c is as follows:

$$Q_c = \frac{A(R)^{(2/3)}\eta^{(1/2)}}{\psi} = \frac{A(A/\chi)^{(2/3)}\eta^{(1/2)}}{\psi}, \quad (4)$$

where A is the cross-sectional area of grass ditch, according to relevant data [20]; the value is 1.04 m^2; R is the hydraulic radius of the cross-section, m; η is the longitudinal slope [20], less than or equal to 4%; χ is the wet cycle of the cross-section [20], 4 m; and ψ is the drag coefficient [20], 2%–10%, and we chose 8%. Substituting the data, this is 0.92 m^3/s. As Q_c is much greater than Q_j, the grass-planting ditch met the design specifications.

(3) *Calculation of the Sunken Green Space*. The critical sinking depth Δh_0 of the sinking green space is as follows:

$$\Delta h_0 = \frac{CY}{1000f} + \frac{(1-C)Y}{1000} - 3600\gamma, \quad (5)$$

where C is the green space runoff coefficient [21], 0.15; Y is the green space rainfall, 45 mm; γ is the park soil infiltration rate, 2×10^{-5} m/s; and f is the green area ratio, 50%. Substituting the data, this is −0.02 m. Since the calculation result is less than 0, this indicates that the original green space in the park is in a good position, can play a role without further sinking, and meets the relevant requirements. The calculation is 0.1 m. To test the reliability of the calculation, the following formula is used for the calculation [22]:

$$\Delta h_0 = 100 \times \frac{\Phi}{f} \int_{t_2}^{t_1} i dt - (t_2 - t_1) 60\gamma, \quad (6)$$

where t_1 is the time when the storm runoff and green space infiltration at the beginning of rainfall are equal, min; t_2 is the time when the storm runoff and green land infiltration are equal in middle and late rainfall, min. The calculated value of the depth Δh_0 of the sinking green underground depression met the requirements.

The rainwater infiltration rate S [19] is as follows:

$$S = 60\gamma J F_1 T, \quad (7)$$

where J is the hydraulic slope, assuming vertical infiltration of rainwater, $J = 1$; F_1 is the green area, m^2; and T is the infiltration time, 60 min [19]. Substituting the data, this is 203.18 m^3.

The difference in the water storage of the sunken green space ΔU [19] is as follows:

$$\Delta U = F_1 \Delta h_0, \quad (8)$$

where Δh_0 is the critical sinking depth of the sunken green space, m. Substituting the data, this is 282.2 m^3.

The rainwater infiltration rate N [19] is as follows:

$$N = \frac{S + \Delta U}{(YCF_2 + YF_1)} \times 1000 \times 100\%, \quad (9)$$

where S is the rainwater infiltration capacity, m^3; ΔU is the sunken green space water storage difference, m^3; C is the green space runoff coefficient; and F_2 is the green space service runoff area, m^2. Substituting the data, this is 355%, and 355% is much greater than 100%. Then, the sinking green space in the pocket park can meet the rainwater collection capacity.

(4) *Rainwater Garden Calculation*. The rainwater garden surface area D [23] is as follows:

$$D = E \frac{\eta_{max} H_t}{\sigma \xi}, \quad (10)$$

where E is the rainwater garden catchment area, m^2; η_{max} is the maximum runoff coefficient before rainwater garden construction, based on the asphalt pavement runoff coefficient as the standard 0.9 [21]; H_t is the maximum rainfall within t hours of the return period, taken 2 hours from Chaohu City, and the maximum rainfall is 200 mm; σ is the permeability coefficient of the rainwater garden, generally 0.3; and ζ is the time for complete rainwater infiltration in the rainwater garden, 2 h. Substituting the data, this is 423.3 m^2.

(5) *Calculation of the Water Demand for the Pocket Park*. According to the relevant norms and standards, the greenery in the park is maintained at the first level [24]. The quota standards are shown in Table 4.

The average daily water consumption for greening is Q_1:

$$Q_1 = \frac{F_1 \times L_1}{X}, \quad (11)$$

where L_1 is the greening and sprinkling quota, $m^3/(m^2 \cdot a)$; X is the sprinkling days, 365 d. Substituting the data, this is 3.866 m^3.

The average daily water consumption of roads is Q_2:

$$Q_2 = \frac{F_3 \times \omega \times L_2 \times 10^{-3}}{X}, \quad (12)$$

where F_3 is the road area in the pocket park, m^2; ω is the annual sprinkling times, times/year; and L_2 is the road sprinkling quota, $L/(m^2 \cdot times)$. Substituting the data, this is 0.174 m^3.

The average daily water consumption of the rainwater treatment system is 5% of the average daily water consumption of greening and roads [24], which is Q_3:

$$Q_3 = (Q_1 + Q_2) \times 5\%, \quad (13)$$

where Q_1 is the average daily water consumption for greening, m^3; Q_2 is the average daily water consumption for roads, m^3. Substituting the data, this is 0.202 m^3.

The average daily water consumption not encountered was 10% of the average daily water consumption of greening, roads, and rainwater treatment systems [24], which is Q_4:

$$Q_4 = (Q_1 + Q_2 + Q_3) \times 10\%, \quad (14)$$

where Q_3 is the average self-consumption water consumption of rainwater treatment system, m^3. Substituting the data, this is 0.425 m^3.

Then, the average daily rainfall demand of the pocket park is Q_r:

$$Q_r = Q_1 + Q_2 + Q_3 + Q_4, \quad (15)$$

where Q_4 is the average daily water consumption not met, m^3. Substituting the data, this is 4.667 m^3.

The daily variation coefficient is 1.5, and the maximum daily rainfall demand is Q_{max}:

$$Q_{max} = e \times Q_r, \quad (16)$$

where e is the daily variation coefficient, 1.5; Q_r is the average daily rainfall demand of the pocket park, m^3. Substituting the data, this is 7.001 m^3.

(5) *Recyclable Rainwater in the Pocket Park*. Combined with the related codes [21], the rainwater runoff coefficient is shown in Table 5.

Rainwater daily runoff W_d (the rain-recyclable coefficient is taken as 0.7) [24] is as follows:

$$W_d = \theta \times 10 \times \lambda \times h_a \times F_m, \quad (17)$$

where W_1 is the greening daily runoff, m^3; W_2 is the road daily runoff, m^3; θ is the rainfall recyclable coefficient, 0.7; λ_1 is the Greenland rainwater runoff coefficient; λ_2 is the road rainwater runoff coefficient; h_{a1} is the maximum Greenland rainfall, mm; h_{a2} is the maximum rainfall on the road, mm; F_1 is the green area, m^2; and F_3 is the road area in the pocket

Table 1: Analysis of specific cases of sponge renovation in pocket parks.

	Name	Scale	Characteristics
Foreign	St. Louis City Park	10,000 m^2	Integrate rainwater regulation and storage management and operation technology, use local peculiar plants to maintain rainwater facilities, and achieve effective rainwater infiltration and retention.
	California Park West Havenhurst	610 m^2	Inject various ecological features into prominent seating areas and gathering areas, and build a sustainable oasis by organically combining vegetation, water features, and buildings.
Domestic	Tsinghua University Shengyinyuan Rainwater Park	8316 m^2	Take measures to reform the sponge dry pond, ditch grass, gravel ditch, permeable paving, and so on to reduce stormwater runoff and increase the infiltration of rainwater and rainwater storage capacity, not only as an effective solution to the problem of accumulation of rainwater in the region but also to greatly improve the visual effect.
	Hangzhou Cuiyuan Park	6070 m^2	Through rational planting of vegetation, the natural water storage and seepage capacity of the park can be effectively improved, which has a significant effect on reducing the rainwater pollution.

Table 2: Comparison of the advantages and disadvantages of various sponge transformation measures.

Retrofit measures	Advantage	Disadvantage
Permeable pavement	Timely absorption of ground rainwater to avoid the formation of water accumulation and waterlogging	Large amount of construction works and high maintenance cost
Grass ditch	Low construction and maintenance costs	Larger venue restrictions
Sunken green space	Wide application range, effectively alleviating rainwater pollution	Affected by the terrain, the operating storage volume is small
Rain garden	Simple and convenient construction technology and easy management later	Plant selection is more limited
Plant selection is more limited	Convenient construction and simple maintenance	Plant selection is more limited
Green roof	Reduce rainwater runoff discharge and alleviate rainwater pollution	Limited use conditions, not suitable for sloped roofs
Artificial wetland	The function of absorbing rainwater is better, and the formed ecosystem can purify rainwater	Plant selection is more limited
Rainwater circulation system	Improve the rainwater reuse rate and reduce resource waste	Large amount of construction works and high maintenance cost
Rainwater storage system	Reasonably adjust the rainwater treatment path	Large area and high maintenance cost
Rainwater pipeline transformation system	Discharge of rainwater in time to essentially solve the problem of waterlogging	The construction is difficult, the amount of work is large, and the cost is high

Table 3: Selection of sponge renovation measures for different buildings.

Built system	Available low-impact development measures
Residential green area	Green roof, rainwater garden, sunken green space, permeable paving, rainwater overflow, and initial rainwater abandonment facilities
Park green area	Permeable paving, grass ditch, sunken green space, rain garden, rainwater circulation system, rainwater storage system, and vegetation buffer zone
Municipal roads	Sunken green space, rainwater wetland, grass-planting ditch, permeable pavement, abandoned flow well, and rainwater overflow
Water system control	Sunken green spaces, rainwater wetlands (artificial construction includes dredging and river improvement projects), grass-planting ditch, vegetation buffer zone, and ecological revetment
Sewage control	Permeable pipe
Drainage and waterlogging prevention	Permeable pipe

Table 4: Standard table of the rainwater utilization quota.

Name	Greening and sprinkling	Road sprinkling (90 times/year)
Quota	0.500 $m^3/(m^2 \cdot a)$	0.500 $L/(m^2 \cdot times)$

Table 5: Rainwater runoff coefficient table.

Name	Concrete and asphalt roads	Green space
Rainwater runoff coefficient	0.900	0.150

park, hm^2. Substituting the data, W_1 is 13.334 m^3, W_2 is 40.002 m^3, and W_d is 53.336 m^3.

The initial rainfall runoff must be discarded. Taking the initial rainwater discarded height as 2 mm, the rainfall discarded flow W_q is

$$W_q = 10 \times \upsilon \times F_3, \quad (18)$$

where ν is the height of the initial rainwater discharge, mm. Substituting the data, this is 28.220 m^3.

The available rainwater W is

$$W = W_d - W_q, \quad (19)$$

where W_d is the rainwater daily runoff, m^3; W_q is the rainfall discarded rainfall, m^3. Substituting the data, this is 25.116 m^3.

After calculating $W > Q_{\max}$, the reconstruction of the pocket park meets the requirements.

(6) *Calculation of the Pocket Park Runoff Pollutant Control*. The pollutants in the pocket park use suspended solids (SS) as the pollutant control index for the pocket park runoff. The standard for the removal rate of suspended solids (SS) for each part is shown in Table 6.

Then, the average removal rate, β, of suspended solids (SS) after taking low-impact development measures is

$$\beta = \frac{F_1 \times 70\% + F_3 \times 70\%}{F}, \quad (20)$$

where F is the total area of the park, m^2. Substituting the data, this is 52.5%.

Annual runoff control rate G is as follows:

$$G = Z \times \beta, \quad (21)$$

where Z is the total annual runoff control rate, 85%; β is the average removal rate of suspended solids (SS) after measures are taken. Substituting the data, this is 44.625%.

We calculated that the annual total control rate of SS was greater than 40%, and the annual total control rate of SS after sponge transformation was 44.625% > 40% [22]; therefore, the pollutant control rate requirement is met.

5. Reconstruction Effect and Effect Evaluation of the Pocket Park

5.1. Analysis of the Effect of Sponge Renovation in the Pocket Park. After the pocket park underwent a series of sponge renovation measures, the phenomenon of water accumulation and waterlogging in the park was significantly reduced, the utilization rate of rainwater was greatly improved, the runoff pollution was effectively controlled, and the sense of the park landscape experience was further enhanced. The comparative analysis of the pocket park sponge before and after transformation is shown in Table 7.

5.2. Using Analytic Hierarchy Process (AHP) to Evaluate the Effect of Pocket Park Sponge Renovation. Sponge cities will encounter various challenges in the construction process. The sponge city indicators and decision-making evaluation models constructed by the fuzzy multicriteria method are conducive to discovering problems and providing a basis for solving problems [25]; the construction effect evaluation of sponge cities can be used; AHP is conducive to the study of problems at different levels. AHP refers to a decision-making method that decomposes complex target decision-making problems into the target level, criterion level, and plan level and, on this basis, carries out quantitative and qualitative analyses [26]. AHP is divided into the establishment of a hierarchical model, judgment matrix, single-level sorting, and consistency check. The total level sorting and consistency check several processes and, by model and calculation, finalize the lowest compared to the highest level of importance. We used AHP to evaluate and analyze the effect of pocket park reconstruction. The hierarchical structure system of the transformation effect of the pocket park rainwater system is shown in Figure 2.

Five relevant experts were selected to rank the effects of various transformations of the pocket park rainwater system, and the effects of various measures were selected according to the expert's ranking results. The criterion of index scale is shown in Table 8.

The index scale of the criterion level is shown in Table 9.

The index scale of the social effect plan is shown in Table 10.

The index scale table of environmental effect plan is shown in Table 11.

The index scale of the rainwater control effect plan is shown in Table 12.

The index scale of the economic control effect plan is shown in Table 13.

The analysis software Yaahp of the AHP was used to calculate and analyze the data of various indicators and to obtain the relative weight of each indicator of the pocket park rainwater system. The relative weight values of various indicators are shown in Table 14.

By attributing weights in the comparative analysis of the programs, we show the stormwater control effect maximum weight value and prove that, after a series of measures to sponge the pocket park, the rain system was significantly improved, reaching the initial transformation of the sponge purpose. At present, the relevant construction evaluation of sponge cities is mainly focused on technology but lacks its multidimensional evaluation of society and economy. In response to this phenomenon, mathematically related network models can be used to construct an evaluation system, such as neural network models [27] and n-Prism network models [28], to optimize the reasonable layout of sponge cities.

Table 6: Standard table of the removal rate of suspended solids (SS).

Name	Removal rate (%)
Road (permeable paving)	70
Greenbelt	70

Table 7: Comparative analysis table before and after low-impact development and transformation measures.

Control effect	Before taking reform measures (%)	After taking reform measures
Road hardening rate	25	<5%
Rainwater runoff control rate	50	75%
Rainwater utilization	50	80%
Pollutant control rate	25	44.625%

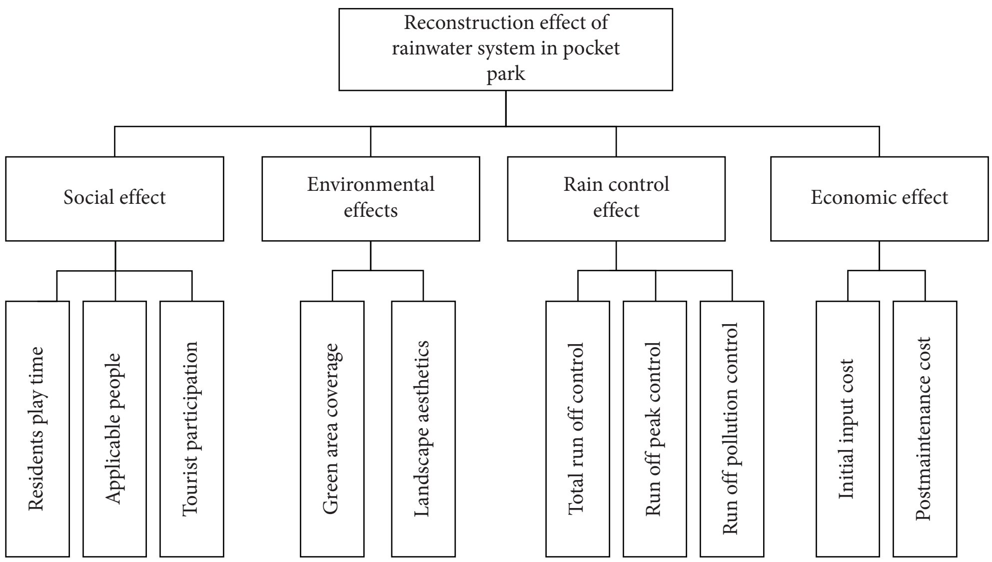

Figure 2: Hierarchical structure system diagram of the transformation effect of the pocket park rainwater system.

Table 8: Standard table of the index scale.

Scaling	Meaning	Scaling	Meaning
1	Both are equally important	1	Both are equally important
3	Compared with the two, the former is slightly more important	1/3	Compared with the two, the latter is slightly more important
5	Compared with the two, the former is more important	1/5	Compared with the two, the latter is more important
7	Compared with the two, the former is very important	1/7	Compared with the two, the latter is very important
9	Compared with the two, the former is absolutely important	1/9	Compared with the two, the latter is absolutely important
2, 4, 6, 8	The intermediate level of the above adjacent judgment	1/2, 1/4, 1/6, and 1/8	The intermediate level of the above adjacent judgment

Table 9: Standard level index scale table.

	Social effect	Environmental effects	Rain control effect	Economic effect
Social effect	1	4	1/5	5
Environmental effects	1/4	1	1/8	3
Rain control effect	5	8	1	8
Economic effect	1/5	1/3	1/8	1

Table 10: Scale table of social effect plan level indicators.

	Residents play time	Applicable people	Tourist participation
Residents play time	1	3	1/5
Applicable people	1/3	1	1/6
Tourist participation	5	6	1

Table 11: Index scale table of the environmental effect plan level.

	Green area coverage	Landscape aesthetics
Green area coverage	1	3
Landscape aesthetics	1/3	1

Table 12: Index scale table of the rainwater control effect plan.

	Total runoff control	Runoff peak control	Runoff pollution control
Total runoff control	1	1/3	4
Runoff peak control	3	1	8
Runoff pollution control	1/4	1/8	1

Table 13: Index scale table of the economic control effect plan.

	Initial input cost	Postmaintenance cost
Initial input cost	1	3
Postmaintenance cost	1/3	1

Table 14: The weight table of the effective plan of the pocket park rainwater system.

Index	Weights
Social effect	0.2156
Environmental effects	0.0846
Rain control effect	0.6529
Economic effect	0.0469
Residents play time	0.0420
Applicable people	0.0190
Tourist participation	0.1546
Green area coverage	0.0635
Landscape aesthetics	0.0212
Total runoff control	0.1671
Runoff peak control	0.4379
Runoff pollution control	0.0478
Initial input cost	0.0352
Postmaintenance cost	0.0117

6. Conclusions

Through the renovation of the pocket park, we further demonstrated that the pocket park, as a leisure and entertainment place for residents, not only provides a comfortable resting environment but also promotes the development of a good urban environment. Incorporating the concept of a sponge city into the construction of a pocket park not only improves the function of rainwater system and alleviates water pollution but also accelerates the pace of building an environmentally friendly city.

With the improvement of the quality of life of the urban residents, people's requirements for the surrounding living environment also increase. Concept-built pocket parks will be the mainstream direction of urban infrastructure construction. At present, although there have been many cases of building pocket parks based on the sponge city concept, there are still many shortcomings in the construction or renovation process. Therefore, when incorporating the sponge city concept into pocket park construction, we must pay attention to the principles of ecological priority and local conditions [29]. To achieve the purpose of protecting and developing the environment simultaneously, we provided a solid foundation for the construction of sponge cities.

Data Availability

All the data used to support the findings of this study are included within the article. Any other data are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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