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Planning and Design of Mine Pit Park Based on the Theory of Urban Double Repair: An Example of 986 Pit Renovation in Xiao Qinling National Nature Reserve, Henan Province

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Abstract: Starting from the current situation of China's mining abandoned land and the concept of urban double-cultivation, this paper systematically compares the content and significance of "urban double-cultivation" in China, and briefly introduces the basic status of mining pits. The value of the application of the concept of "urban double-cultivation" in the landscape design of mine parks and the problems existing in the current park landscape design are explained, and the requirements and measures of the landscape design of mine parks based on the concept of "urban double-cultivation" are explored in detail. The new model of secondary use of abandoned mine pits in urban renewal under the guidance of the concept of "urban double-cultivation" is also explored, and the effective transformation design method for transforming abandoned mine pits into urban parks is summarized by combining the example of 986 pits in Xiao Qinling National Nature Reserve in Henan Province.

1. Introduction

With the urban development and economic transformation, some traditional mining industries have left a lot of "scars" due to pre-mining, and transforming them into mine parks is the main form of management of mining abandoned land in China. The authors discuss the transformation methods of gold mine abandoned land from two perspectives of "ecological restoration" and "urban repair", in order to provide some ideas for the restoration and transformation of mining abandoned

land.

2. The Concept of "Urban Double Repair

The concept of "Urban Double Repair" was proposed in June 2015, which is an urban renewal concept with Chinese characteristics that integrates ecological restoration, urban renewal and urban revitalization. The concept of "urban rehabilitation", short for ecological restoration and urban repair, refers to the use of the concept of re-ecology to restore the damaged natural environment and topography in cities and improve the quality of ecological environment; the concept of renewal and weaving to remove illegal buildings, restore urban facilities, spatial environment and landscape, and enhance the characteristics and vitality of cities[1].

2.1. Ecological Restoration

Ecological restoration aims to restore the structure and function of the damaged urban ecosystem to its natural condition before the disturbance, focusing on minimizing the disturbance to the ecosystem caused by urban development activities on the one hand, and restoring the self-regulating function of the urban ecosystem through a series of means, so that it gradually has the ability to overcome and eliminate external disturbances and promote the ecosystem to balance in a dynamic process. On the other hand, through a series of means to restore the self-regulating function of urban ecosystem, it gradually has the ability to overcome and eliminate external disturbance, and promote the ecosystem to adjust and balance in the dynamic process[2].

2.2. Urban Repair

Urban repair is to adopt good urban planning and design concepts and methods to continuously improve the quality of urban public services, improve the conditions of municipal infrastructure, discover and protect urban history, culture and social networks in a systematic, progressive and targeted manner, so that the urban function system and the spatial places it carries can be comprehensively and systematically repaired, compensated and perfected to make the city more livable and more dynamic.

Urban double repair for mine abandoned land is the planning of the stock of land again, which needs to take into account not only the resources, functions, economy and surrounding environment of the site, but also the ecosystem, hydrological structure and soil structure of the site, and even the way the site integrates in the city as a whole, which is an effective way to build a mine pit restoration and upgrading and urban renewal and camping as one. Based on the concept and design practice strategy of urban double repair, many practical cases of mine pit transformation have been launched in China, such as Nanjing Jiangning Tangshan Mine Pit Park, Shanghai Chenshan Botanical Mine Pit Garden, Gansu Baiyin Flaming Mountain National Mine Park, Nanning Garden Expo Park Quarry Garden, Tangshan South Lake Park, etc. All of them follow the design principles of respecting ecological and natural attributes and meeting the needs of urban vitality, and through effective and low-intervention They link the harmonious relationship between human and nature through effective and low-intervention landscape design, and establish a new coexistence logic between the old environment and the new demand by breaking the old and establishing the new, transforming the disadvantageous resources of the mine pit into a project with very different characteristics.

3. Current Situation of Abandoned Mine Pit Base

Xiao Qinling National Nature Reserve is located in the "Golden Triangle" of the Yellow River, rich in biological resources and mineral resources. In particular, the huge gold resources in the Xiaoqinling National Nature Reserve in Henan Province have made Lingbao City famous as a "gold city". However, due to the long-term over-exploitation in the past, there are many mining pits, slag all over the mountain, the mountain is full of sores, and the ecological damage is serious. 5 first-class tributaries that gush down from the mountain into the Yellow River are full of pollution, adding muddiness to the mother river.

3.1. Base Overview

The project site is located in the Little Qinling National Nature Reserve in Henan Province, near ZaoXiangYu and HuoshiYa in the western part of Lingbao City at the border of Henan and Shaanxi Provinces, about 60 km from downtown Lingbao City, with a base area of 17,500 square meters. The base is located between two valleys, the upper layer is an abandoned gold mine pit and mining site, leaving behind small railroad tracks for transporting ore. The lower level is divided into left and right parts by steep canyons, both covered by crushed ore and land, with a basic height difference between the upper and lower levels of 5 to 8 m (see Figure 1). There is a 3 to 5 meter wide river channel along the base, which is covered with waste rock and is in urgent need of overall planning and landscape enhancement. [3].

Figure 1. Current picture of the base 1

3.2. Analysis of Current Problems

Mining mining has caused damage to the urban ecological environment, waste encroaching on urban development space, cave-in areas forming geological disaster hazards, and abandoned land causing damage to soil, vegetation and other ecosystems. The development history of mining cities at home and abroad shows that the above phenomena have become common features of mining cities. The original mountain vegetation of the base is completely destroyed and the production waste spreads throughout the environment, giving it a dilapidated scene. (As Figure 2, 3, 4) At the same time, the scouring of the mountain by rain accelerates the loss of soil and its nutrients, and the lack of growth base for plants and animals triggers the gradual breaking of the ecological chain.

Since the pollution of gold mining is acidic, the land is degraded, nutrient loss and harmful substances are increased, so the treatment of contaminated soil and contaminated water bodies becomes an urgent problem to be solved [4]. At the same time, the management of slopes, tailings and vegetation restoration are also major issues that need to be solved. Therefore, the following solutions are proposed for the above problems.

3.2.1. The Solution of Terrain Remediation

(1) Gravel treatment solution for slope angle greater than 30 degrees

In the mining area, when the slope angle of rubble is greater than 30 degrees, it will form safety hazards such as slope instability and landslide. Therefore, when dealing with such slopes, it is necessary to remove the stored stone slag and floating soil to enhance the stability of the slope structure.

(2) Remediation plan for slopes less than 30 degrees

Slopes less than 30 degrees in the mining area have the characteristics of gentle geology and stable structure. When remediating such slopes, the planting area is built with high-quality soil according to the distribution of slag and stone. If the stone composition is poor, it can be used for depression filling and garden road construction to reduce material procurement, control material transportation cost and ensure the effect of mine ecological restoration.

3.2.2. Soil Nutrient Adjustment

Soil backfill restoration method, which is applicable to the lot with more serious soil pollution, should strengthen the soil planting capacity restoration. For the soil layer which is not seriously contaminated by the pollution procedure, it can be covered with new soil on the surface of the original soil layer to achieve the soil restoration effect. Soil backfill, according to the mine vegetation planting type comprehensive determination, tree green cultivation area soil backfill thickness of 1.2-1.5 meters, shrub cultivation area soil backfill thickness of 0.6-0.8 meters, ground cover green flowers and lawn backfill soil layer thickness of 0.3-O.5 meters[5].

Figure 2. Current picture of the base 2

Figure 3. Current picture of the base 3

Figure 4. Current picture of the base 4

4. Landscape Design Objectives of the Mine Park Based on the Concept of "Urban Double Repair

Based on the concept of "urban double-cultivation", there are four main objectives in the planning and design of the 986 pit mine park in Xiao Qinling National Nature Reserve of Henan Province.

(1) Minimal intervention in the industrial landscape, as far as possible to retain the original natural landscape, mining culture, historical relics, to make it a place to write the industrial history of Lingbao City, mining culture and style of display.

(2) With the ecological restoration of the mine scenery as the core, the ecological environment of 986 Pit Mine Park is restored through various ecological design techniques and modeling methods to reproduce pleasant natural scenery and create a good visiting environment.

(3) Refine the designed plant landscape, implement ecological restoration and pit reclamation, build a green barrier and a sea of colorful flowers, and turn this place into an ecological science education base.

(4) Create a composite functional area, realize the functional repair of the mine area, form a multi-directional development axis and diversified development nodes, and drive the industrial and economic transformation and development of the mine area.

5. Mine Park Renovation Methods Under the Concept of "Urban Double Repair

5.1. Ecological Restoration Methods

(1) Restoration of ecological pattern

In the transformation of mining abandoned land, it is necessary to integrate the fragmented space and repair the ecosystem network, firstly, assess and eliminate the geological safety hazards, and construct the landscape ecological pattern under the premise of considering the integrity of the ecosystem, continuity of geographic units and sustainability of economic and social development, and set the boundaries of vegetation restoration and water restoration by combining natural and artificial elements.

(2) Restoration of water network and green network

The water network is the main skeleton for constructing urban ecological security pattern, and it assumes the functions of flood prevention and drainage, cultural bearing, water body self-purification and tourism landscape in urban construction [6]. Restoration of water network ensures water environment and water safety, and restores river ecology systematically and holistically, mainly through siltation cleaning, sewage treatment, water purification, and optimization of ecological shoreline.

The green network is an important performance indicator of the beautiful overall natural environment and rich ecological resources of the city. To restore the green network, it is necessary to consider the connection with the mountain and water bodies to restore the urban spatial environment and landscape appearance on the one hand, and to take into account the city's historical and humanistic resources to build a diversified and complete green network on the other.

(3) Restoration of damaged sites

On the one hand, it is necessary to restore the production function of the land, mainly by purifying water bodies and cleaning up pollutants. From soil improvement, vegetation restoration, soil and water conservation, reclamation mode and other methods to achieve land reclamation and the introduction of the planting of heavy metal-absorbing vegetation to achieve soil and water conservation and purification. On the other hand, it is necessary to eliminate safety hazards, mainly by means of biotechnology and engineering technology, repairing damaged sites and soil restoration such as collapsed land and gangue hills, and rainwater management strategies can be realized through key technologies such as "seepage, storage, purification, use and discharge", and incorporating mining waste land into urban "sponge "green space system.

5.2. Urban Repair Method

The focus of the transformation of mining abandoned land under the concept of "urban double repair" is to promote industrial structure upgrading and enhancement through functional repair, so as to promote the transformation of sustainable urban development and regional renewal.

(1) Using industrialization to upgrade and repair urban functions

From the perspective of urban functions, mining abandoned land can be repaired through industrial transformation and upgrading, such as transforming into commercial land, residential land, scientific research land, leisure land, etc. Especially for mining abandoned land with profound historical and cultural deposits, it can be repaired by improving public service facilities such as culture, education and medical care, holding related cultural activities, developing related cultural industries, and focusing on realizing functions and new types of cultural creativity, art design, leisure and entertainment, tourism services, etc. It can further repair and improve the functions of the city by improving public service facilities of culture, education and medical care, holding related cultural activities and developing related cultural industries, and focusing on the integration

of new industries such as cultural creativity, art design, leisure and entertainment, and tourism services[7].

(2) Repairing urban ecological environment with industrial upgrading

Mining areas, due to their exploitation, lead to serious destruction of the natural environment and backward infrastructure, but at the same time, new ecosystems and development opportunities are created. For example, some abandoned mining sites can be used for recreation and irrigation after effective treatment. Based on the concept of "urban double repair", the transformation of mining abandoned land advocates the realization of "city-ecosystem" as one, not only changing the status quo of broken ecological environment, but also repairing its ecological pattern, repairing urban ecological environment through industrial upgrading, and turning mining abandoned land (2) To develop abandoned mining sites into urban scenic areas, urban agricultural areas, and new recreational areas through industrial upgrading to meet the demand for ecological tourism and to bring into play the value of recycling [8].

(3) Repairing urban culture with industrialization and upgrading

Reviving mining culture through industrial upgrading of mining abandoned sites makes cities more livable and regional. Take the old plants and facilities and give them new functions again to stimulate the vitality of the old mining areas. The old plants and facilities are often the memories of the old generation. Preserving and giving new functions to them, restoring and creatively transforming the cultural buildings and structures in the mines can not only stimulate the memory and vitality of the old mines, but also revive and enrich the culture of the mines, and achieve the purpose of livability and regionalization.

6. Landscape Design Practice of Mine Park Based on the Concept of "Urban Double Repair

Xiao Qinling 986 Mine Park is a composite mine park with mining relics as the main part and regional culture as the landscape and leisure characteristics, and environmental renewal, ecological restoration and cultural re-creation as the means, integrating scientific research, science popularization, sightseeing and leisure. It is planned to divide the Little Qinling 986 Mine Park into 5 functional areas: A mining, beneficiation and smelting process area, B mining culture display area, C theme culture area, D leisure and recreation area, E ecological walking area. (As shown in Figure 5 and 6)

Figure 5. General plan 1: 500

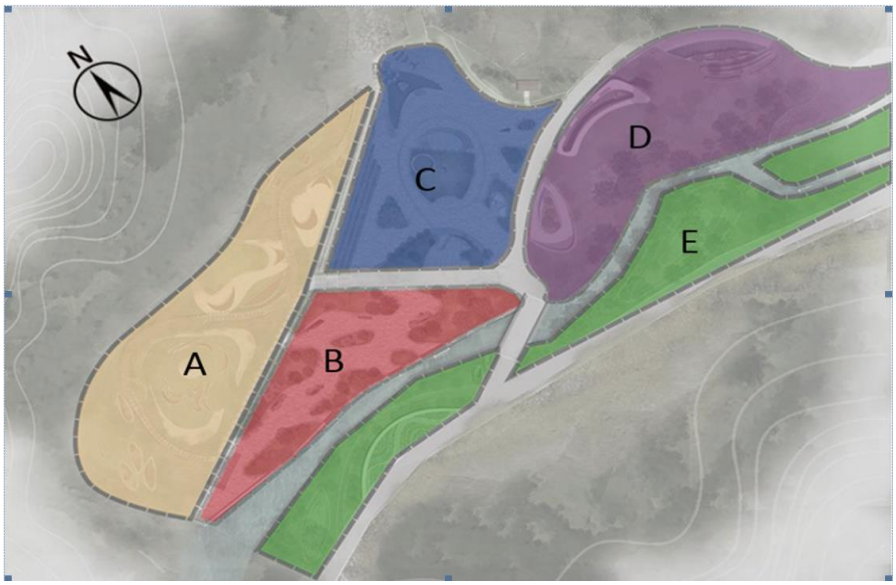

Figure 6. Functional zoning diagram

1) mining, mineral processing, smelting process area

The overall design technique of landscaping is adopted. The element of small railway track runs through the whole area and becomes the main road network, and is accompanied by gravel, reeds and wolf tail grass to make the space full of original wild interest; the flower pond in the shape of bucket car limits the space and penetrates the sight line at the same time; the addition of the main sculpture of golden lotus echoes the theme of gold mine. (Figure 7)

Figure 7. Effect drawing

2) Mining Culture Display Area

Incorporating elements of Japanese landscape, different kinds of gold ores are displayed using microtopography and pine and cypress plants as the design language, and the addition of mine shaped vignette sculptures and seats makes the whole area a fresh and elegant space. (As Figure 8)

Figure 8. Effect drawing

3) Theme Culture Zone

As the main landscape node, the theme culture area is in the climax position of the whole base. The interesting steps perfectly combine the topography and avoid the original height difference of the base; the fishtail-shaped water fall makes full use of the water source seeping out of the pit, and the design of dotted water features makes the space more dynamic; the torch-like sculpture is placed to reflect the theme; the whole space is well-defined, and the scene is different at every step. (Figure 9 and 10)

Figure 9. Effect drawing

Figure 10. Effect drawing

4) Leisure and recreation area

The original rich topography of the base is fully retained, and the whole area is done with large lawn with piano-shaped curved rest space, and the addition of pond, planting pool and cultural wall enriches the landscape level. Micro-topography is made along the river area, birch forest and flower mirror are designed, and the display of vignettes are appropriately integrated to make the space more ornamental. (As Figure 11)

Figure 11. Effect drawing

7. Significance and Prospect

Mining exploitation leaves a large amount of abandoned land, which not only wastes urban land resources and restricts urban economic development, but also brings a series of social and environmental problems. From the transformation of the 986 pit mine park in the Little Qinling National Nature Reserve, it is important to explore the transformation of mining abandoned land under the concept of "urban double repair" at the social, cultural and economic levels.

Social level, it helps to improve the vitality of the city. The 986 mine park in Xiaoqinling will not only protect the mining heritage itself, but also promote the improvement and restoration of ecological environment, adjust the function structure and industrial structure of the city, and further enhance the urban vitality of Lingbao.

At the economic level, it is conducive to the transformation and development of urban economy and plays an important role in revitalizing the inefficient land use in cities and towns [9,10]. At present, it is in the transition period from incremental planning to stock planning, and the importance of revitalizing the inefficient land use in cities and towns is becoming increasingly prominent. Under the concept of "double repair", the planning of Xiaoqinling 986 Mine Park has transformed the mining wasteland. On the premise of optimizing the urban ecological environment, it has changed the past problems of scattered land use, extensive use, unreasonable use, and dilapidated buildings, and has successfully achieved cost intensive, functional integration The goal of ecological friendly transformation is to become a typical example of the transformation of inefficient urban land with high efficiency, high quality, safety and pollution-free.

To sum up, under the concept of "urban double repair", the transformation planning of mining wasteland should follow the principles of integrity, gradualness, continuity of context, ecological priority, etc., and use specific methods of ecological restoration and urban repair, such as ecological pattern restoration, water network green network, damaged sites, industrial upgrading, etc., with a detailed analysis of the actual case of the planning of Xiaoqinling 986 Mine Park, from vegetation planting, landform reconstruction, ecological pattern, cultural structures In terms of reuse of abandoned facilities, industrial upgrading, etc., it points out the transformation planning approach of mining wasteland under the concept of "urban double repair", which provides a reference for the sustainable development of mining wasteland and the city where it is located, and promotes the healthy and sustainable development of the city.

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Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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