Engineering Technology Trends Vol 1 Issue 2 2023
DOI: 10.37155/2972–483X–0102–1

Original Research Article

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Application of Ecological Water Conservancy Engineering Design in Water Conservancy Construction

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How to cite: Shu-Shan Li. Application of Ecological Water Conservancy Engineering Design in Water Conservancy Construction. *Engineering Technology Trends*, 2023; 1(2). DOI: 10.37155/2972-483X-0102-1

Abstract: With the increasing development of water conservancy technology, various forms of water conservancy projects have been formed in the use of rivers. While the construction of water conservancy projects brings social and economic benefits to the people, it also damages the natural environmental conditions and natural environment on which people depend to survive to a certain extent. How to weigh the pros and cons, effectively realize the value of water conservancy, reduce the damage to the natural environment by water conservancy construction, and ensure the sustainable development of the ecological environment are the keys to current water conservancy management.

Key words: Ecological water conservancy; Design; Water conservancy construction; Application

Introduction

In the design and implementation of water conservancy projects, through the introduction of environmental design ideas, we can better manage the construction environment at all stages of water conservancy, analyze the environmental impact factors caused by changes in the natural environment, and then take corresponding protection measures to better reduce the negative impact of water conservancy projects on environmental ecological damage. In addition, eco-water conservancy engineering design can not only better adapt to the requirements of comprehensive management, natural landscape, recreation and entertainment, but also be closer to the local natural requirements and adapt to local conditions to achieve harmonious coexistence between man and nature.

1. The Importance of Ecological and Water Conservancy Engineering Design

Ecological water conservancy engineering design refers to the planning and implementation of a series of technical and management measures to protect and repair water resources, water environment and ecosystems, rationally use water resources, reduce flood disasters, improve water quality, and promote sustainable economic development. The design of ecological water conservancy engineering helps to protect water resources. Water is the basic resource

for human survival and development, and is also a key element to maintain ecological balance. Ecological water conservancy engineering design can ensure the sustainable use of water resources, reduce the waste and pollution of water resources, and protect the integrity of the aquatic ecosystem through scientific management and planning. Ecological water conservancy engineering design can reduce flood threats, and reduce the frequency and loss of flood disasters by repairing ecosystems, improving the structure of rivers and embankments. Water resources are the foundation of many industries, such as agriculture, industry and tourism. Through the rational planning and management of water resources, and effectively solving the problem of water shortage and water pollution, we can provide reliable water resources for various industries, promote industrial upgrading and growth, and achieve sustainable economic development[1]. Ecosystems are the basis for the common survival of all kinds of life on earth and the key to maintaining ecological balance. Through measures such as building ecological and water conservancy projects, restoring wetlands and rehabilitating water ecosystems, people can provide a suitable habitat environment, protect and increase species diversity, and maintain the stability and health of ecosystems. We should attach great importance to the design of ecological water conservancy projects, constantly innovate in practice, take scientific and effective measures to promote the development of ecological water conservancy projects, and build a good foundation for water resources and ecological environment for sustainable development.

2. Principles of Ecological Water Conservancy Engineering Design

2.1 Ecological priority principle

The principle of ecological priority is an important principle in the design of ecological water conservancy projects. It refers to putting the protection and restoration of the health of the ecosystem in the first place when designing and implementing projects. This principle emphasizes the importance of the ecological environment and the impact of human activities on the natural environment. Under the principle of ecological priority, designers need to fully consider and evaluate the potential impact of the project on the ecosystem to ensure that the project minimizes damage to the ecological environment. At the same time, the design process should focus on how to restore and protect the water resources ecosystem so that people can provide a suitable habitat and maintain species diversity and ecological balance. The principle of ecological priority requires designers to take sustainable technologies and measures, such as rational planning of water sources, wetland protection, river remediation, *etc.*, to minimize interference to the ecosystem. In addition, people should pay attention to the long-term effects of ecological protection during the construction process, and carry out regular monitoring and evaluation to ensure that the project achieves the expected goals in ecological protection. By implementing the principle of ecological priority, we can protect and repair water ecosystems, maintain biodiversity, improve water quality, reduce the risk of floods and disasters, and promote sustainable development. The implementation of this principle helps to establish a harmonious coexistence between man and nature, protect our environmental resources, and leave a better world for future generations.

2.2 Principle of comprehensive consideration

The principle of comprehensive consideration is one of the important principles in the design of ecological and water conservancy projects. It emphasizes the need to comprehensively and systematically consider various factors and the views and needs of stakeholders in the process of project design and implementation. This principle requires designers to pay attention not only to environmental protection and ecological restoration, but also to take into account economic development and social benefits when designing eco-water conservancy projects. Designers need to comprehensively consider factors such as the natural environment, social and economic conditions, cultural traditions, *etc.* to achieve the best balance. Under the principle of comprehensive consideration, designers need to cooperate with departments, experts and scholars, social organizations and local residents to carry out extensive information collection and needs surveys to understand the opinions and expectations of all parties. Such cross-border cooperation can promote consensus-building and reduce potential disputes and conflicts. The principle of comprehensive consideration also emphasizes flexibility and sustainability in the project design

and implementation process. Designers should adopt innovative technologies, green construction concepts and sustainable resource utilization methods to ensure that the impact of the project on the environment is minimized, so as to extend the life cycle of the project and improve efficiency. Through the implementation of the principle of comprehensive consideration, eco-water conservancy engineering design can better meet the needs and expectations of all parties and achieve coordinated environmental, economic and social development. The implementation of this principle not only helps to improve the feasibility and success rate of engineering projects, but also maximizes benefits to society and promotes sustainable development and harmonious coexistence between man and nature.

2.3 Principles of advanced technology

The principle of advanced technology is one of the important principles in the design of ecological and water conservancy engineering. It emphasizes that when designing and implementing engineering projects, the latest science and technology and advanced technological means should be used to improve the efficiency, reliability and environmental friendliness of the project. Following the principle of advanced technology means that designers need to fully understand the various relevant technologies and choose the most suitable technical solutions. This includes the use of advanced measurement, simulation and prediction technologies to accurately evaluate the impact of the project, and the use of advanced building materials and equipment to improve the quality and sustainability of the project. The principle of advanced technology also requires designers to pay attention to the innovation and uniqueness of engineering. By introducing new technologies and concepts, the design scheme can be optimized and the performance and efficiency of the project can be improved. For example, in terms of water resources management, advanced technologies such as intelligent monitoring and control systems and water resources information platforms are introduced to achieve accurate water resource scheduling and management. The principle of advanced technology also encourages designers to consider future development trends and challenges, such as climate change and the contradiction between supply and demand of water resources. Through the adoption of advanced technologies and strategies, these challenges can be met in advance to ensure the sustainable development of the project [2]. With the help of advanced technical means, people can improve the efficiency, reliability and environmental friendliness of engineering and achieve sustainable development goals. At the same time, through innovation and introduction of new technologies, we can prepare for future challenges and ensure that the project is competitive and adaptable in the long-term operation.

3. Specific Application of Ecological Water Conservancy Engineering Design

3.1 River management

River management is one of the specific applications of ecological and water conservancy engineering design. It aims to improve the hydrological, water quality and ecological conditions of rivers through scientific planning and integrated management, so as to improve the efficiency of water resources and promote the healthy development of ecosystems. In terms of river regulation, the adjustment of river water level, flow rate and volume can be achieved through measures such as building dams, strengthening river banks, sorting out river beds, *etc.*, so as to achieve the goals of flood control, water storage and improving waterway traffic capacity. In terms of water purification, physical, chemical and biological treatment technologies, such as artificial wetlands, biological filters, aeration equipment, are used to remove pollutants from river channels, improve water quality, and protect the habitat of aquatic organisms. River bank restoration is another important aspect. People protect river banks from erosion and collapse through bank protection projects, vegetation restoration, soil conservation, *etc.*, and promote soil water conservation and biodiversity restoration. Ecological restoration is the core content of river management. Through wetland restoration, ecological compensation, fish discharge and other measures, people restore and improve the natural ecosystem of rivers, provide a suitable habitat environment, and promote biodiversity conservation. River dredging is also an important engineering means. Through regular dredging and widening the bottom of the channel, people increase the volume of the channel, improve the flow conditions, reduce the risk of flood disasters, and ensure the smoothness of

the waterway. River management also pays attention to river landscape design. Combined with ecological principles and aesthetic requirements, it improves the environmental quality of the river through greening and landscape shaping, creates a pleasant urban landscape, and improves people's sense of identity and closeness to the river. Through the combination of these measures and technologies, river governance aims to achieve the sustainable use of water resources, promote the healthy development of rivers, improve the quality of the natural environment, and provide people with a safe, beautiful and sustainable living space.

3.2 Water environmental protection

Ecological water conservancy engineering design has important applications in water environmental protection. Water environmental protection aims to improve and maintain the quality of water bodies, protect the health of ecosystems, and meet human needs for clean water resources. Through the construction of sewage treatment plants, sewer networks and other facilities, people effectively collect, treat and control the discharge of sewage, reduce the direct release of pollutants to the water body, and improve the water quality. Modern monitoring technologies and methods are used to regularly monitor the pollutant content and water quality parameters in the water body, evaluate the health status of the water body, and provide a scientific basis for decision makers. Rational planning and management of water resources, including the protection of water sources, wetlands and ecosystems, can promote the sustainable use of water resources and avoid damage caused by overexploitation and pollution. In response to non-point source pollution such as agriculture, cities and industry, people have taken measures such as anti-seepage of farmland, rainwater collection and utilization, and the development of environmental protection industries to reduce the risk of pollutants entering the water body. Through wetland restoration, river remediation, vegetation greening and other means, the restoration and protection of aquatic ecosystems can be promoted, and the self-purification capacity and biodiversity of water bodies can be improved. Establishing a sound emergency response mechanism and timely handling of aquatic environmental emergencies can reduce the impact of disasters on water bodies and ecosystems. It aims to protect water resources, improve water quality, maintain ecological balance, and provide a clean and sustainable water environment for human beings.

3.3 Water energy utilization

Ecological water conservancy engineering design has a wide range of applications in water energy utilization. Water energy utilization aims to realize the full energy potential of water resources and provide a clean and renewable energy supply. By building dams and diversion channels, people guide the flow of water through rivers or lakes to turbines, convert the kinetic energy of water into electricity, and realize large-scale hydropower generation. People use small-scale water resources in mountainous areas, farmland and other places to build small hydropower stations using micro-hydropower technology to meet local power needs and promote rural electrification and economic development. In the coastline or estuary area, through the installation of tidal power generation devices, the energy generated by tidal fluctuations is used to convert it into electricity to provide sustainable and clean energy. Waves and current energy at sea are used to convert them into electrical energy through technologies such as floating devices or submarine turbines to provide renewable energy for offshore areas. In areas rich in water resources, people use hydrothermal pumps or directly use hydropower for heating, refrigeration and other applications to improve energy efficiency and reduce dependence on traditional energy sources. Through the design of irrigation systems, water flows are introduced into farmland to meet the growth needs of crops. At the same time, excess water is stored during low-load periods to balance the use of water resources[3]. Through reasonable planning and design, ecological water conservancy projects can maximize the energy potential of water resources and provide clean and renewable hydropower resources for sustainable development. Water energy utilization can not only provide a stable and reliable energy supply, but also reduce dependence on traditional energy, reduce carbon emissions, and promote environmental protection and sustainable economic development.

3.4 Ecological water replenishment and wetland protection design

Ecological water conservancy engineering design

has important applications in ecological water replenishment and wetland protection. Ecological water replenishment aims to restore and maintain the ecological function of rivers, lakes and other waters, provide a suitable ecological environment, and protect biodiversity. Wetland protection design focuses on protecting wetland ecosystems to ensure their normal operation and biodiversity. By adjusting the water storage level of the reservoir and controlling the range of water level fluctuations, people simulate the natural hydrological process, so as to maintain the water quantity and quality of rivers and lakes appropriate conditions, and provide an ecological environment suitable for fish reproduction, migration and habitat. Through wetland restoration projects, the hydrological, soil and vegetation characteristics of damaged wetlands are rehabilitated to restore the self-purification capacity and biodiversity of wetlands. At the same time, wetland protection plans have been formulated to limit the impact of human activities on wetlands and ensure the integrity and stability of wetland ecosystems. People formulate reasonable ecological water rehydration plans according to the actual situation of rivers and lakes. By relocating external water sources or storing water, increase the flow and water level of the water body, improve water quality, and improve the biological habitat environment. Scientific and reasonable water resources management and allocation can ensure that the wetland ecosystem has a sufficient supply of water, prevent the impact of overexploitation and pollution on wetlands, and maintain the stability and function of wetlands. In the wetland protection area, people design and build appropriate ecological projects, such as artificial wetlands, aquatic vegetation belts, *etc.*, to provide suitable habitat conditions and promote the development of wetland biodiversity. Through the comprehensive use of ecological water replenishment and wetland protection design, people can restore and protect the ecological functions and biodiversity of waters and wetlands. These applications aim to maintain the health of water ecosystems, provide sustainable water resources for human beings, and protect precious wetland ecosystems.

Conclusion

In a word, if people want to do a good job in the design of ecological water conservancy projects in the process of water conservancy construction, they must be able to closely combine with the actual situation to ensure the overall quality of the design of eco-water conservancy projects. By deepening the design research and analysis of ecological and water conservancy projects from the theoretical level, people can provide corresponding theoretical reference for the development of practical design work.

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