ASIAN INFRASTRUCTURE INVESTMENT BANK

People's Republic of China
Henan Flood Emergency Rehabilitation and Recovery Project-Zhengzhou Component

Integrated Jinshui River Management Sub-Project

Environmental and Social Impact Assessment and Management Plan

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Executive Summary

1. Introduction

This environmental and social impact assessment (ESIA) and environmental social management plan (ESMP) report is prepared for the Integrated Jinshui River Management Sub-project in Zhengzhou City, Henan Province under the Zhengzhou Component of Henan Flood Emergency Rehabilitation and Recovery Project financed by Asian Infrastructure Investment Bank (AIIB). Zhengzhou Integrated Jinshui River Management Sub-project involves total length of 22.26km, including river bank protection, reconstruction of riverside roads and bridges restoration and upgrading project, improvement of drainage and sewage systems, and riverside green spacing and river ecosystems. After the implementation of the project, the Jinshui River flood control standard will achieve 1 in 100 years.

2. **Methodology**

According to AIIB's environmental and social policy requirements, the Environmental and Social Management Planning Framework (ESMPF) of the Henan Flood Emergency Rehabilitation and Recovery Project, and the environmental and social risk screening results of Integrated Jinshui River Management Sub-project, the Integrated Jinshui River Management Sub-project is classified as environmental and social category A project, which requires the preparation of an environmental and social impact assessment report, including an environmental and social management plan. The environmental and social impact assessment of this project was carried out based on the following methodology.

1) Literature and design documents review to identify key environmental and social impacts.

2) Site visits carried out by the environmental and the social impact assessment survey team during October 2021 to March 2022, aiming to collect the baseline information of surrounding environment, land status, identify sensitive points and impact factors, as well as the socio-economic living conditions of the affected people in the project area.

3) Interviews conducted from February 9-18, 2022, and March 8-15, 2022, at four districts in the project area.

- Agency interviews and information collection. Agencies and departments involved in the project area, such as the Department of Integrated Jinshui River Management Sub-project under the Zhengzhou Municipal Urban and Rural Construction Bureau of Henan Province (i.e., the project implementation unit), Zhengzhou Housing Acquisition Service Center, Zhengzhou Urban and Rural Construction Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological and Environmental Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Security Bureau (Labor Insurance Bureau), Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Civil Affairs Bureau, and Transportation Administration Bureau. Total of 76 agency interviews and discussions were conducted, and basic data and documentation closely related to the project were collected.

- Focus group interviews. In order to have a more comprehensive understanding of the needs and suggestions of the affected people in the project area (including women, the poor, disadvantaged groups, residents along the route, students, hospitals, village committee leaders, etc.), the social assessment survey team conducted 30 focus group discussions with a total of 469 participants in the project area. Among them, 141 were female, accounting for 30.06%; 80 were elderly people, accounting for 17.06%; 248 were working staff of neighborhood committees and

resident representatives, accounting for 52.88%.

- Key informant interviews. The social assessment survey team interviewed key informants at the project county and district, township and street, and village/community levels, mainly targeting 72 key informants in four districts (including 19 in Erqi District; 20 in Zhongyuan District; 18 in Jinshui District; and 15 in Zhengdong New District). To more fully understand the stakeholders' attitudes toward the project and to solicit suggestions for project design and project implementation.

- Questionnaire survey. A total of 520 questionnaires were completed in the four project counties using the probability proportional to size sampling (PPS sampling) method, of which 520 were valid questionnaires, with a return rate of 100%.

3. Major environmental impacts and mitigation measures

The environmental impact of this project mainly comes from the noise, dust, odor by the dredging of Dihu Lake during the construction period, the disposal of sediment, the impact of construction materials and sludge transportation on traffic and the impact on the South-North Water Diversion Trunk Canal and the Lucunhe heritage site.

The project involves Erqi District, Zhongyuan District and Jinshui District, and there are many households in the surrounding area, especially kindergartens, schools and hospitals and other environmentally sensitive points with high requirements for sound environment. In order to reduce the impact of bridge demolition and reconstruction, dredging, pipeline relocation and material transportation and other construction machinery and traffic noise on the sensitive receivers along the project construction site within 200m, the contractors should reasonably arrange the construction time, prohibit the construction transportation from 22:00 to 6:00 at night and 12:00 to 2:00 at lunch break. Sound barriers should be installed if necessary to reduce the noise impact. When vehicles pass through residential areas, it is required to limit the speed of transport vehicles, prohibit the sounding of loud horns, and reasonably arrange the transport time to avoid vehicle noise affecting the residents. In accordance with the "Zhengzhou Noise Pollution Prevention and Control Measures" (2015), if damage is caused to the surrounding organizations and individuals due to noise pollution, compensation for the damage will be made in accordance with the law. The amount of compensation will be supervised and managed by the competent environmental protection department or other noise pollution prevention and control departments.

Construction dust control during the construction period will strictly follow the requirements of construction sites in the "Henan Province 2021 Air Pollution Prevention and Control Implementation Plan" and "Zhengzhou City 2021 Air Pollution Prevention and Control Implementation Plan", requiring the eight 100% system, (i.e. the construction site surrounding 100% enclosure, all kinds of materials stacked 100% coverage, earthwork excavation and demolition work 100% wet operation, access to vehicles 100% cleaning, construction site road surface 100% hardening, muck vehicles 100% closed transportation, construction area of more than 10,000 square meters and earthwork related construction site 100 % Install online video monitoring, vehicles and non-road mobile machinery at the site reach the standard of "eight hundred percent"), two prohibitions (prohibit on-site mixing of concrete, prohibit on-site configuration of mortar), install online monitoring and monitoring equipment for dust on the construction site, and network with the monitoring platform of local government.

The total construction waste is 631,800 m^3, including spoil earth volume 415,200m^3, demolished construction waste 57,600 m^3 , and demolished piling platform 21,500m^3, and river dredging sediment 137,500m^3. The construction solid waste will be dumped to the Chedagou disposal site operated by Zhengzhou Gujia Technology Industry Co. There will be no drying field at the site for Dihu Lake dredging. The dredged sediment will be transported directly to the Chedagou disposal site by closed tanker trucks to reduce the impact of odor on the surrounding residents through the Ring Road, which has less impact on the residents.

Lucunhe section is located within the construction control zone of Lucunhe heritage site, including landscape greening, repair of a weir dam, a new weir dam, the laying of replenishment pipeline and habitat creation. During the construction process, once the cultural relics are found, the construction should be stopped immediately and reported to the cultural relic's protection department in time. The construction can only be resumed after excavation and treatment with approval. The rural section of the project involves the secondary protection zone of the South-North Water Transfer Trunk Canal, including greenway, South-North Water Transfer South Side Flyover and landscape greening. Those works does not involve the primary protection zone. The south water north side flyover is 560 meters away from the inverted siphon and will not affect the structural safety of the inverted siphon.

4. **Major social impacts and mitigation measures**

The main positive impacts of this project include: (1) improve the supporting facilities of the river; (2) improving the flood control standard of the river, reducing the impact of flooding; (3) improve the traffic congestion along the river, making travel more convenient; (4) improving the landscape along the river, improving the surrounding natural environment and increase tourism and other income; (5)reduce soil erosion and water pollution along the Jinshui River and increase employment opportunities; (6) strengthen the river management of the Jinshui River across residential communities and improve the river management capacity along the Jinshui River. The negative impacts of project implementation include: (1) resettlement impacts of 16 streets/towns in 3 districts of Zhengzhou City, including 6 streets and 1 township in Erqi District, 3 streets in Zhongyuan District, and 6 streets in Jinshui District. The farmland acquisition involves a total of 6 communities/villages in two streets/towns in Erqi District, 2 communities in Songshan Road Street and 4 villages in Huzhai Township. The project will require a total of 3,169.96 mu of land to be permanently occupied, including 507.35 mu of collective land and 2,662.61 mu of state-owned land, with a total of 37 households and 145 people affected by land acquisition. There are no vulnerable groups among the families affected by this project. Residential housing demolition and relocation involves a total of 711 ㎡ of residential houses in the northern section (West Third Ring - Dongfeng Canal section), all of which are brick and concrete structures, directly affecting 6 households and 22 people, all of whom are urban residents. Non-residential housing demolition and relocation affects three enterprises and four buildings, involving a total of 3796.98 square meters of non-residential housing in the northern section (West Third Ring - Dongfeng Canal section), all brick structure, affecting the population of 5 households and 43 people. Temporary land occupation is mainly generated by the need for temporary land for the project, mainly including temporary access roads, construction camps, equipment parking lots, steel, timber processing workshops, comprehensive warehouses and other land. The temporary occupation of a total of 16.2 mu, mainly for the original river, the open space on both sides of the river, the original road and the river bank land, which occupies 13.12 mu of state-owned land, occupying 3.08 mu of collective land (unused vacant land washed away after the flood), does not affect to households. (2) Negative impact of natural and social environment during construction.(3) Impact of migrant workers: The increased communication and contact between migrant workers and residents along the Jinshui River is not conducive to social stability, increasing health and hygiene risks, etc. Construction by migrant workers is easy to bring more pressure to community epidemic prevention; and the conflict of different social and cultural customs (including religious belief, tomb, temple, wedding and funeral festival customs, etc.); (4) Gender-based violence may occur in the construction process and in the daily affairs of the site, including discrimination against women in employment, including gender-based violence such as threats, coercion or arbitrary deprivation of liberty.

Corresponding mitigation measures and social management plans have been developed: (1) reduce the risk of land acquisition and demolition; (2) regularly carry out education and training related to flood prevention and drainage; (3) carry out participatory river management along the Jinshui River; (4) support public health and service facilities along the Jinshui River to meet the needs of residents; (5) protect women's labor rights and interests, and give priority to women labor in the project area provide employment positions; (6) strengthen the management of foreign labor

importation to prevent social risks such as AIDS and New Coronavirus; (7) adopt appropriate construction methods to avoid the lives of residents in the project area being affected by the project construction; (8) improve the labor force protection system and working conditions to safeguard the legitimate rights and interests of laborers, etc. The effectiveness of these measures will be evaluated based on the monitoring results of the supervision and external monitoring units to determine whether these measures need to be adjusted and improved.

5. Implementation Arrangements

The Zhengzhou Urban and Rural Construction Bureau is the implementing agency for the Integrated Jinshui River Management Sub-project, and the Department of the Zhengzhou Integrated Jinshui River Management Sub-project was established in December 2021 to coordinate and promote the construction. Under the guidance of the Zhengzhou AIIB Loan Project Management Office, the Department of Integrated Jinshui River Management Sub-project is responsible for (1) designating an environmental and social coordinator for each bid section to coordinate the implementation of the environmental and social management plan; (2) ensuring that the environmental and social management plan, monitoring program, and mitigation measures are incorporated into the bidding documents and construction contract; (3) maintaining the grievance mechanism; (4) addressing unforeseen adverse impacts and report them to AIIB in a timely manner; and (5) engage qualified environmental external monitoring units and social external monitoring units. The Zhengzhou Project Management Office is required to report regularly on the implementation of the ESMP for subprojects under its jurisdiction, i.e., once per quarter of project implementation, as a stand-alone document and as part of the project implementation report. Based on the results of AIIB's assessment of the implementation of environmental and social related measures, the environmental and social monitoring reports are submitted quarterly in the first year of project implementation and semi-annually thereafter.

6. Stakeholder Engagement

Based on the nature of the Integrated Jinshui River Management Sub-project, the results of the field survey and interviews with relevant organizations, the main stakeholders of this project were identified as the direct beneficiaries and groups negatively affected by the construction of the project within the impact area of this project, including residents, disadvantaged groups, people affected by land acquisition and relocation, schools, hospitals, etc. Secondary stakeholders include the Department of the Integrated Jinshui River Management Sub-project under the Zhengzhou Municipal Bureau of Urban and Rural Construction, Zhengzhou Municipal Housing Acquisition Service Center, Erqi District Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological and Environmental Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Security Bureau, Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Civil Affairs Bureau, Transportation Administration, under the jurisdiction of Houzhai Township, Wulibao Street, University Road Street, Mingong Road Street, Songshan Road Street, Mifengzhang Street offices, design units, construction units, supervision units, etc.

During the preliminary preparation stage of the project, the preparer of the feasibility study, the preparer of the social assessment and the preparer of the environmental assessment, etc., carried out project information disclosure activities, as well as full informed consultation and public participation activities such as interviews, field surveys, focus group discussions, key informant interviews and questionnaire surveys for the relevant information of the project. The survey found that residents in the project area suffered from the impact on their daily lives and had urgent needs for the project; residents along the river expect to repair pedestrian bridges and facilitate access as soon as possible; teachers, students and parents of schools along the river hope to carry out bridge restoration and upgrading projects along the Jinshui River as soon as possible; residents along the river expect to improve public infrastructure and beautify the urban landscape along the Jinshui River; residents along the river expect to improve and strengthen river management along the Jinshui River; Low-income groups have higher enthusiasm and willingness to participate in

project construction; Women have a strong desire to participate; the residents in the project area have improved their knowledge of the project; the residents are very supportive to the project. Meanwhile, based on questionnaires, symposiums, in-depth interviews and interviews with key informants, the information disclosure and public participation plan of the project was developed through a participatory way.

The Chinese and English versions of the ESMPF for the AIIB funded Henan Flood Emergency Rehabilitation and Recovery Project have been published on the website of the Henan Provincial Department of Finance (https://czt.henan.gov.cn/2021/11-05/2342160.html) and the AIIB website (China: Henan Flood Emergency Rehabilitation and Recovery Project - Projects - AIIB). The Chinese and English versions of the ESIA and ESMP of this subproject, including the grievance mechanism, will be made public on the website of Zhengzhou Municipal Bureau of Urban and Rural Construction and the website of AIIB before construction. Meanwhile, Zhengzhou Urban and Rural Construction Bureau will reserve hard copies of this ESIA and ESMP in its office accessible to the public.

7. Grievance mechanism

The grievance mechanism for this project consists of two main types.

The first is a grievance mechanism at the project level, i.e., a channel of appeal to affected residents, social groups, institutions, etc., during the implementation and operation of the project.

The second is a grievance mechanism provided to project workers including direct and contract workers.

Zhengzhou Urban and Rural Construction Bureau established the Integrated Jinshui River Management Sub-project Department in December 2021, and four staff are responsible for the operation of the grievance mechanism. If the Zhengzhou Urban and Rural Construction Bureau receives an appeal, the person in charge of the Zhengzhou Urban and Rural Construction Bureau should first verify whether the content of the appeal is related to the project. If the content of the appeal is related to the project, regardless of whether the appeal is related to the environment and society, the person in charge should start coordination to resolve the appeal. If the content of the appeal has nothing to do with this project, the person in charge shall forward the appeal to the relevant authorities. All appeals should be recorded in the case and notify the relevant personnel of the appeal process.

1 Introduction

In the middle and late July of 2021, Henan Province was continuously hit by a historically rare and extensive heavy rainfall. The heavy precipitation periods were concentrated and last for long time, and many precipitation data broke the extreme values since the local hydrological records were available. Zhengzhou, Xinxiang and Jiaozuo cities were severely affected by the flooding, and each city district/county suffered serious losses in transportation, municipalities and water conservancy, and the infrastructure needs to be restored as soon as possible. In order to help the people in those cities to carry out post-disaster recovery and reconstruction work, the PRC government applied to the Asian Infrastructure Investment Bank (hereinafter referred to as "AIIB") for an emergency concessional and loan to support post-disaster recovery and reconstruction projects in Henan Province. The AIIB project will focus on water conservation facilities, municipal facilities, transportation facilities, comprehensive flood warning and emergency response systems, and institutional capacity building to support post-flood recovery in Zhengzhou, Xinxiang and Jiaozuo cities in Henan Province.

The heavy rainfall from 18:00 to 0:00 on July 18, 2021 led to 28 bridges damaged to varying degrees along the Jinshui River, 3.25 km of damaged banks, 8 km of seriously silted river after the disaster, and the water quality was seriously affected. The Jinshui River is the only urban river in Zhengzhou that connects the four major urban service centers and the old and new urban areas, and is one of the most important flooding and drainage channels in the central city of Zhengzhou. It is urgent to carry out reconstruction work for Jinshui River to improve the city's emergency management capacity. Zhengzhou Urban and Rural Construction Bureau proposed the "Zhengzhou Integrated Jinshui River Management Sub-project" in August 2021. In October 2021, Zhengzhou Urban and Rural Construction Bureau submitted the feasibility study report of Zhengzhou Integrated Jinshui River Management Sub-project to Zhengzhou Development and Reform Commission, and Zhengzhou Development and Reform Commission approved the project on December 10, 2021. The approval number is "Zheng Development and Reform City [2021] No. 818". The AIIB loan is an important source of funding for the comprehensive improvement project of Jinshui River in Zhengzhou.

Integrated Jinshui River Management Sub-project starts from Guojiazui reservoir dam (K0 + 000) to the Dongfeng canal (K22 + 261) . The total length is 22.26km. The design flood control standard is 1 in 100 years, and the estimated total investment is 2822.1 million Chinese yuan.

According to AIIB's environmental and social policy requirements, the project's ESMPF, and the environmental and social risk screening of Zhengzhou Integrated Jinshui River Management Sub-project, the project is an environmental and social category A, which requires the preparation of an environmental and social impact assessment report, including an environmental and social management plan. This environmental and social impact assessment report meets both AIIB environmental and social framework requirements and domestic environmental and social related legal and regulatory requirements. The preparation of this report is based on (1) the Environmental Impact Assessment Report of the Integrated Jinshui River Management Sub-project; (2) the feasibility study and preliminary design report of the Zhengzhou Integrated Jinshui River Management Sub-project; (3) the site visits conducted by the EIA unit and the social impact assessment survey team during October 2021-February 2022; and (4) the interviews between February 9, 2022 and February 18, 2022 with agencies and departments of the Urban and Rural Construction Bureau, Natural Resources and Planning Bureau, Housing Acquisition Affairs Center, Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Human Resources and Social Affairs Bureau, Civil Affairs Bureau, Ecological and Environmental Bureau, Transportation Administration Bureau, Statistics Bureau, District Office, and other affected people in the project area (including women, poor, disadvantaged groups[1], residents along the river,

[1]In accordance with the requirements of AIIB's Social Security Policy ESS1, the vulnerable groups in this project are defined as disabled people, five-poor households, female-headed households, low-income households, etc.

schools, hospitals, village committee leaders, etc.); (5) questionnaire surveys and environmental and social-related data made public by relevant government departments.

This report is structured as follows:

1. Policy, legal and regulatory framework
2. Project Description
3. Environmental and social baselines
4. Environmental and social impact assessment
5. Alternatives Analysis
6. Public participation and information disclosure
7. Grievance mechanism
8. Environmental and Social Management Plan

2 Policy, Legal and Regulatory Framework

This report was prepared in compliance with the current applicable environmental and social laws and regulations of the People's Republic of China, local and departmental regulations of Henan Province and Zhengzhou City, technical guidelines and specifications, and the requirements of AIIB's Environmental and Social Framework (revised 2021).

2.1 Applicable environmental and social related laws and regulations

- Law of the People's Republic of China on Environmental Protection (implemented on January 1, 2015).
- Law of the People's Republic of China on Environmental Impact Assessment (amended on December 29, 2018).
- Land Management Law of the People's Republic of China (Revised) (January 1, 2020)
- Regulations on the Implementation of the Land Management Law of the People's Republic of China (Order of the State Council No. 743) (September 1, 2021)
- Decision of the State Council on Deepening Reform and Strict Land Management (Guo Fa [2004] No. 28) (October 21, 2004)
- Guiding Opinions on Improving the Compensation and Resettlement System for Land Acquisition (Guotou Zifa [2004] No. 238) (November 3, 2004)
- Notice of the State Council on Issues Related to Strengthening Land Regulation and Control (Guo Fa [2006] No. 31) (August 31, 2006)
- Measures for Announcement of Land Requisition (Ministry of Land and Resources Order No. 10) (January 1, 2002)
- Regulations on the Expropriation and Compensation of Houses on State-owned Land (Order of the State Council No. 590) (January 21, 2011)
- Notice of the State Forestry and Grassland Administration of the Ministry of Natural Resources, Ministry of Agriculture and Rural Affairs on Issues Related to Strict Control of Arable Land Use (Natural Resources Development [2021] No. 166) (November 27, 2021)
- Law of the People's Republic of China on the Promotion of Cleaner Production (implemented on July 1, 2012).
- Law of the People's Republic of China on Prevention and Control of Air Pollution (amended on October 26, 2018).
- Law of the People's Republic of China on Prevention and Control of Water Pollution (amended June 27, 2017, implemented January 1, 2018); Law of the People's Republic of China on Prevention and Control of Environmental Noise Pollution (amended December 29, 2018).
- Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (amended on April 29, 2020).
- Law of the People's Republic of China on the Prevention and Control of Soil Pollution (August 31, 2018).
- Law of the People's Republic of China on Soil and Water Conservation" (implemented on March 1, 2011).
- Land Management Law of the People's Republic of China (implemented on January 1, 2020).
- Law of the People's Republic of China on the Protection of Cultural Relics (amended on November 5, 2017).
- Forestry Law of the People's Republic of China (amended on December 28, 2019).
- Law of the People's Republic of China on Wildlife Protection (October 26, 2018).
- Law of the People's Republic of China on Work Safety (2014).
- Law of the People's Republic of China on Prevention and Control of Occupational Diseases (2011).
- Labor Law of the People's Republic of China (1995).

- Law of the People's Republic of China on the Protection of Minors (amended in 2020).
- Law of the People's Republic of China on the Protection of Persons with Disabilities (amended in 2018).
- Social Insurance Law of the People's Republic of China (amended in 2018).
- Urban and Rural Planning Law of the People's Republic of China (2015).

2.2 Applicable environmental and social related sector regulations, policies

- Regulations on Environmental Protection Management of Construction Projects (State Council Decree No. 682, amended on July 16, 2017).
- List of Environmental Impact Assessment Classification Management of Construction Projects (2021).
- Opinions on Further Strengthening Ecological Protection Work (Huanfa [2007] No. 37).
- Notice on the Issuance of Interim Measures for the Review and Management of the Total Emission Indicators of Major Pollutants in Construction Projects (Huanfa [2014] No. 197).
- Notice on Further Strengthening the Management of Environmental Impact Assessment to Prevent Environmental Risks" (Ministry of Environmental Protection Huanfa [2012] No. 77).
- Notice on the issuance of the Guidelines for the Delineation of Ecological Protection Red Line (Environmental Protection Office Ecology [2017] No. 48).
- Guidance Catalogue for Industrial Restructuring (2019 version).
- Measures for Public Participation in Environmental Impact Assessment (Order No. 4 of the Ministry of Ecology and Environment).
- Regulations on Labor Protection in Workplaces with Toxic and Hazardous Substances (2002).
- Interim Regulations on Payment of Wages (1995).
- Regulations on the Implementation of the Labour Law (2018).
- Regulations on Environmental Protection of Construction Projects in Henan Province (2016.3.29).
- Regulations on Water Pollution Prevention and Control in Henan Province (2019.10.1).
- Regulations on Prevention and Control of Air Pollution in Henan Province (2018.3.1).
- Henan Province Solid Waste Pollution Prevention and Control Regulations" (2012.1.1).
- Zhengzhou Notice on Further Strengthening the Management of Urban Construction Waste Transport Vehicles (2017).
- Notice on the Issuance of Henan Province's 2021 Atmospheric, Water, and Soil Pollution Prevention and Control Offensive and Agricultural and Rural Pollution Control Offensive Implementation Plan (Yuhuangyang Tackling Office [2021] No. 20).
- Opinions on Strengthening the Construction of Social Stability Risk Assessment Mechanism for Major Decisions in New Situations (2021)
- Notice on the Issuance of Interim Measures for Social Stability Risk Assessment of Major Fixed Asset Investment Projects of the National Development and Reform Commission (NDRC Investment [2012] No. 2492)
- Notice of the General Office of the National Development and Reform Commission on the Issuance of the Chapter on Social Stability Risk Analysis of Major Fixed Asset Investment Projects and the Outline for the Preparation of Assessment Reports (for Trial Implementation) (NDRC Investment [2013] No. 428)
- Opinions of the General Office of Henan Provincial People's Government on Regulating the Allocation and Use of Compensation Fees for Land Requisitioned for Collective Ownership by Farmers (Yu Zhengban [2006] No. 50).
- Notice of the People's Government of Henan Province on the Announcement of the Implementation of the Comprehensive Land Price Standard for the Acquired Area in Henan Province (Yu Zheng [2016] No. 48).
- Notice on the Implementation of the Regulations on the Expropriation and

Compensation of Houses on State-owned Land in Henan Province" (Yu Zheng [2012] No. 39).

2.3 Guidelines and technical specifications

- Technical Guidelines for Environmental Impact Assessment - General Outline (HJ2.1-2016).
- Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment (HJ2.2-2018).
- Technical Guidelines for Environmental Impact Assessment - Surface Water Environment (HJ2.3-2018).
- Technical Guidelines for Environmental Impact Assessment - Sound Environment (HJ2.4-2009)
- Technical Guidelines for Environmental Impact Assessment - Groundwater Environment (HJ 610-2016).
- Technical Guidelines for Environmental Impact Assessment - Ecological Impact (HJ19-2011).
- Technical Guidelines for Environmental Impact Assessment - Soil Environment (for Trial Implementation) (HJ964-2018).
- Technical Guidelines for Environmental Risk Assessment of Construction Projects (HJ/T169-2018).

2.4 AIIB Environmental and Social Requirements

Since the project will be funded by AIIB, the AIIB Environmental and Social Framework (ESF) will be applied to the project. Its key elements are as follows.

- Environmental and Social Policy (ESP), Environmental and Social Standards (ESSs) and environmental and Social Exclusion Checklist. The ESP sets out mandatory requirements for banks and their clients to identify, assess and manage environmental, social risks and impacts associated with AIIB supported projects.

- Environmental and Social Criteria 1 (ESS 1) : Aims to ensure the environmental and social robustness and sustainability of the project and to integrate environmental and social factors into the project decision-making process and implementation. ESS 1 applies if the project is likely to have adverse environmental risks and impacts or social risks and impacts (or both).The scope of environmental and social assessment and management measures is proportional to the risks and impacts of the project. ESS1 provides high-quality environmental and social assessments and risk and impact management through effective mitigation and monitoring measures during project implementation. ESS1 sets out detailed requirements for environmental and social assessments to be carried out on any project the AIIB invests in.

- Environmental and Social Criteria 2 (ESS 2) : If the screening process of the project indicates that the project involves involuntary migration (including recent or foreseeable involuntary migration directly related to the project), ESS 2 applies. Involuntary resettlement includes physical displacement (relocation, loss of residential land or loss of housing) and economic displacement (loss of land or access to land and natural resources) as a result of; Assets or acquired assets, loss of sources of income or livelihood) (a) Involuntary acquisition of land; (b) Involuntary restriction of land use or access to legally designated parks and protected areas. It covers such displacement, whether such losses and involuntary restrictions are total or partial, permanent or temporary. ESS2 establishes detailed requirements for project migration schemes involving involuntary migration.

- Environmental and Social Criteria 3 (ESS 3).ESS3 applies if there are indigenous people (ethnic minorities) in or with whom the project is proposed and they are likely to be affected by the project.

2.5 Applicable evaluation and emission standards

According to the opinion letter of Zhongyuan Sub-Bureau, Erqi Sub-Bureau and Jinshui Sub-Bureau of Zhengzhou Ecological Environment Bureau on the Implementation standard of Environmental Impact Assessment of Zhengzhou Jinshui River Comprehensive Remediation Project (2021) :

- Ambient air to implement the "Ambient Air Quality Standard" (GB3095-2012) level 2 standard and 2018 amendment;
- The surface water environment complies with the class IV standard of Surface Water Environmental Quality Standard (GB3838-2002);
- The quality of acoustic environment complies with the standards of acoustic Environment Quality (GB3096-2008), class 1 and class 2 standards;
- Groundwater environment to comply with the "Groundwater Quality Standards" (GB/T14848-2017) class III standards;
- The atmosphere during the construction period of the project shall comply with the second-level standard of Comprehensive Emission Standard of Air Pollutants (GB16297-1996);
- Noise during construction shall be subject to the environmental Noise Emission Standard for Construction Site Boundary (GB12523-2011).
- Domestic sewage during the construction of the project shall comply with the third-level standard in Table 4 of comprehensive Sewage Discharge Standard (GB8978-1996);
- General solid waste shall comply with the pollution Control Standard for Storage and Landfill of General Industrial Solid Waste (GB18599-2020).

The AIIB's Environmental and Social Framework (revised in 2021) requires projects to conform to internationally recognized standards such as the World Bank Group's Environmental Health and Safety Guidelines for pollution prevention and control technologies and practices based on international good practices.[2] Therefore, this project is more stringent in the internationally recognized standards and domestic standards. Specific applicable standard values are as follows:

2.5.1 Environmental Quality Standards

1. Air Quality

The Ambient Air Quality Standards (GB3095-2012) classify air quality into two categories. category 1 standards apply to special areas such as nature reserves and environmentally sensitive areas, and category 2 standards apply to all other areas, including urban and

[2] http://www.ifc.org/ehsguidelines

industrial areas. The site of this subproject falls within a Class 2 ambient air quality functional area. The World Bank Group's EHS Guidelines are referenced from the WHO Global Air Quality Guidelines[3] . The Global Air Quality Guidelines provide guidance on thresholds and limit values for key air pollutants that pose health risks. In addition to the guidance values, the WHO Global Air Quality Guidelines provide transition period targets designed to facilitate a gradual shift from high to low concentrations. Table 2-1 compares the Ambient Air Quality Standards (GB 3095-2012) Class 2 standards with the WHO standards. The Class 2 standard limits for 24-hour SO_2 (0.15 mg/m^3) of the Ambient Air Quality Standards (GB 3095-2012) are higher than the upper limit of the World Bank Group interim standard (0.125 mg/m^3); while the 24-hour PM_{10} (0.15 mg/m^3) and $PM_{2.5}$ (0.075 mg/m^3), annual average NO_2 (0.04 mg/m^3) and $PM_{2.5}$ (0.035 mg/m^3) are the same as the upper limit of the WHO transitional standards. In general, the Chinese standards are highly equivalent to the WHO guidelines or interim target values, so this subproject adopts the Ambient Air Quality Standard (GB3095-2012) Class 2 standard and the WHO standard for 24-hour SO_2 .

Table 2-1 Comparison of China GB 3095-2012 and WHO Global Air Quality Guidelines (Unit: mg/m^3)2

	Item	Average period	GB 3095-2012 Category 2	WHO Global Air Quality Guidelines	
				Intermit	Target
1	SO_2	1 year	0.06	Not applicable	Not applicable
		24 hours	0.15	0.05-0.125	0.04
		1 hour	0.50	Not applicable	Not applicable
2	PM_{10}	1 year	0.07	0.02-0.07	0.015
		24 hours	0.15	0.05-0.15	0.045
3	$PM_{2.5}$	1 year	0.035	0.01-0.035	0.005
		24 hours	0.075	0.025-0.075	0.015
		1 hour	Not applicable	Not applicable	Not applicable
4	NO_2	1 year	0.04	0.02-0.04	0.010
		24 hours	0.08	0.05-0.12	0.025
		1 hour	0.20	Not applicable	Not applicable
5	Carbon monoxide	24 hours	4.0	7.0	4.0
		1 hour	10.0	Not applicable	Not applicable
6	O_3	Maximum average of 8 hours per day	0.16	0.12-0.16	0.10
		1 hour	0.20	Not applicable	Not applicable

Source: WHO Global Air Quality Guidelines (2021) and GB 3095-2012 of the People's Republic of China.

2. Sound Environment

The Sound Environment Standard (GB 3096-2008) classifies five functional areas according to their tolerance of noise pollution: from Class 0 to Class 4. Class 0 applies to areas where quiet is particularly needed, such as rehabilitation and convalescent areas, and therefore has the most stringent day and night noise standards. Class 1 applies to areas with predominantly residential areas, hospitals and clinics, educational institutions

[3] https://www.who.int/zh/news-room/questions-and-answers/item/who-global-air-quality-guidelines

and research centers. Class 2 applies to areas with a mix of residential and commercial functions. Category 3 applies to areas with industrial production, warehousing and logistics as the main functions. Class 4 applies to areas adjacent to traffic noise sources such as major roads and highways, and is subdivided into 4a and 4b, with the former applying to road traffic noise and the latter to railroad noise. According to the Technical Specification for Classification of Sound Environment Functional Area (GB/T15190-2014) and the Sound Environment Quality Standard (GB3096-2008), the sound environment quality standard (GB3096-2008) 4a is implemented within 35m on both sides of the red line of the highway in the evaluation area, while the residential area outside 35m is implemented as class 1 and the mixed commercial and residential area is implemented as class 2 The residential area outside the 35m area is subject to Class 1 standard and the mixed commercial and residential area is subject to Class 2 standard.

Comparing the standards of each functional area with the World Bank Group EHS guidelines listed in Table 2-2, the noise standard value of Class 1 area of Sound Environmental Quality Standards (GB3096-2008) is the same as the World Bank Group EHS guidelines, and the domestic standards are stricter than the World Bank Group standards for industrial areas and areas on both sides of road trunk lines. Therefore, this project implements the Class 1 zone standard of Sound Environment Quality Standard (GB3096-2008).

Table 2-2 Sound quality standards (equivalent sound level: LAeq: dB)2

Noise functional area category	**Applicable area**	**GB 3096-2008**		**World Bank Group Environmental, Health and Safety Standards**	
		Daytime	**Nighttime**	**Daytime**	**Nighttime**
0	Areas requiring extreme quiet, such as convalescent areas	50	40	55	45
1	Areas mainly used for residential, cultural and educational institutions	55	45		
2	Mixed residential, commercial and industrial areas	60	50		
3	Industrial Zone	65	55	70	70
4a	The area on both sides of the city roads	70	55		

3. Surface Water

The surface water body involved in this project, Jinshui River, is subject to the "Surface Water Environmental Quality Standard" (GB3838-2002) Class IV standard.

Table 2-3 Applicable surface water environmental quality standards

Indicators	**Unit**	**Limit value**
pH	/	6 to 9
DO	mg/L	> 3
COD	mg/L	<30
BOD_5	mg/L	<6
Ammonia nitrogen	mg/L	<1.5

Total phosphorus	mg/L	<0.3 (lake, reservoir 0.1)
Total Nitrogen	mg/L	<1.5
Potassium permanganate index	mg/L	<10
Volatile phenols	mg/L	<0.01
Anionic surfactants	mg/L	<0.3
Sulfide	mg/L	<0.5
Oil	mg/L	<0.5
Copper	mg/L	<1.0
Zinc	mg/L	<2.0
Arsenic	mg/L	<0.1
Lead	mg/L	<0.05
Mercury	mg/L	<0.001
Selenium	mg/L	<0.02
Cadmium	mg/L	<0.005
Hexavalent chromium	mg/L	<0.05

4. Soil Environment

The quality of dredged sediment is determined by reference to the soil pollution risk screening value limits in the "Soil Environmental Quality - Risk Control Standards for Soil Pollution on Agricultural Land (Trial)" (GB15618-2018) and "Soil Environmental Quality - Risk Control Standards for Soil Pollution on Construction Land (Trial)" (GB36600-2018) to determine whether it can be used for resource utilization. Soil pollution risk screening value refers to the content of pollutants in the soil equal to or lower than the value, the risk to human health can be ignored; more than the value, there may be risks to human health, further detailed investigation and risk assessment should be carried out to determine the specific scope of pollution and risk level. The first category of land refers to residential land in urban construction land. The second category of land refers to industrial land in urban construction land.

Table 2-4 Soil environmental quality standards

Indicators	**Unit**	**Risk Screening Value**			
		Soil Environmental Quality - Risk Control Standards for Soil Contamination on Agricultural Land (for Trial Implementation) (GB15618- 2018)		**Soil Environmental Quality - Risk Control Standards for Soil Contamination of Construction Land (GB36600-2018)**	
				Type I sites	**Type II sites**
pH	dimensionless	＞7.5	6.5 <pH≤7.5	/	/
Cadmium	mg/kg	0.6	0.3	20	65
Mer	mg/kg	3.4	2.4	8	38

cury					
Arsenic	mg/kg	25	30	20a	60a
Lead	mg/kg	170	120	400	800
Chromium	mg/kg	250	200	3.0 (Hexavalent chromium)	5.7 (Hexavalent chromium)
Copper	mg/kg	100	100	2000	18000
Nickel	mg/kg	190	100	150	900
Zinc	mg/kg	300	250	/	/

2.5.2 Pollutant emission standards

(1) Air pollutants

During the construction period, the secondary standard in the Comprehensive Emission Standards for Air Pollutants (GB16297-1996) is implemented.

Table 2-1 Comprehensive Emission Standards for Air Pollutants

Contaminants	Unorganized emission monitoring concentration limit mg/m^3
Particulate matter	1.0
Nitrogen oxides	0.12
Asphalt fumes	Production equipment must not have obvious disorganized emissions exist

(2) Noise

The construction operation noise enforces the Environmental Noise Emission Standards for Construction Site Boundaries (GB 12523-2011). In addition, the World Bank EHS guidelines require that the increase in background noise outside the site at the nearest receiving point should not exceed 3 dB.**错误!未找到引用源。**

Table 2- 5 Noise limits for construction activities (Unit: Leq [dB (A)])2

		Noise limitation	
Period	**Main noise sources**	**Daytime**	**Nighttime**
Construction period	Bulldozers, excavators and loaders; pile drivers; concrete mixers, vibrators and chainsaws; elevators	70	55

(3) Sewage discharge

Construction site wastewater discharges are regulated by the Comprehensive Wastewater Discharge Standard (GB 8978-1996). The primary standard applies to discharges to Class III water bodies under GB 3838-2002. The secondary standard applies to discharges into Class IV and Class V water bodies. The tertiary standard applies to discharges to municipal sewers that enter municipal wastewater treatment plants for secondary treatment. The domestic sewage during the construction period relies on the existing municipal sewage treatment facilities, and the construction site sewage discharge is carried out in the tertiary standard.

Table 2-6 Comprehensive sewage discharge2 Standard

Parameters	**Level 1** **Suitable for discharge into Class III water bodies**	**Grade 2** **Suitable for discharge into Class IV and Class V water bodies**	**Grade 3** **For discharge to municipal sewers**
pH	6-9		
SS mg/L	70	150	400
BOD_5 mg/l	20	30	300
COD mg/l	100	150	500
Volatile phenols mg/l	0.5	0.5	2.0
NH_3-N mg/L	15	25	---
LAS (= anionic surfactant) mg/L	5.0	10	

(4) Solid waste

General industrial solid waste implementation of the "general industrial solid waste storage and landfill pollution control standards" (GB18599-2020).

3 Project Description

The Jinshui River is a major secondary tributary of the Jalu River, originating from the source of the Jinshui River in Houzhai Township, Erqi District, Zhengzhou, and flowing from southwest to northeast through Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District, and is one of the main flood drainage channels in the central city, and the only urban river in Zhengzhou that connects four major urban service centers and runs through the old and new urban areas. The heavy rainfall. The rainstorm has the characteristics of long duration, large accumulated rainfall, wide precipitation range, concentrated precipitation time, and extreme nature. According to the post-disaster statistics, 28 bridges along the Jinshui River were damaged to varying degrees, 3.25 km of bank slopes were damaged, 8 km of the river was seriously silted up after the disaster, and the water quality was seriously affected. In order to promote the function of the Jinshui River as soon as possible, and promote the improvement of urban emergency management capacity, Zhengzhou Urban and Rural Construction Bureau launched the Integrated Jinshui River Management Sub-project.

The Integrated Jinshui River Management Sub-project starts from the dam of Guojiazui Reservoir in the south to Dongfeng Canal in the north, with a total length of about 22.3km, and the scope of implementation is the Jinshui River and its green space on both sides (the green space does not include the south side of the South-North Water Diversion Main Canal), with a red line area of about 213.1045 ha. The project description in this chapter is based on preliminary Design Report of Zhengzhou Integrated Jinshui River Management Sub-project (Shanghai Municipal Engineering Design and Research Institute (Group) Co., Ltd and East China Engineering Survey and Design Institute Co., LTD., March 2022).

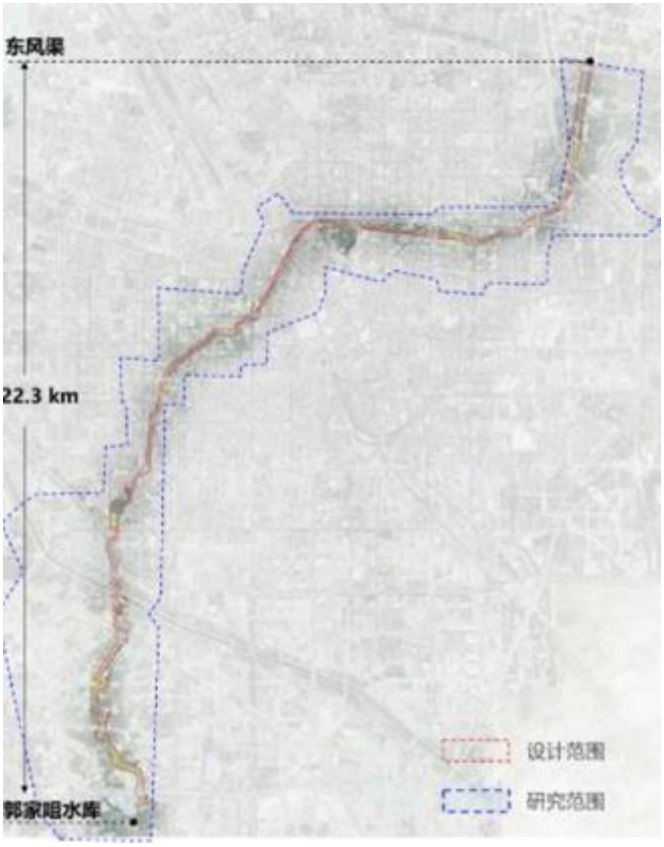


Figure 3-1 Integrated Jinshui River Management Sub-project Scope

The main construction content of this project includes five parts: river protection, bridge reconstruction, water quality and ecological environment improvement, landscaping and intelligent management.

3.1 River protection

The river protection works mainly consists of embankment protection , weir construction, sluice gate construction and dredging.

3.1.1 Shore protection

The length of this project is 22.3 km, with pile number K0+000~K22+261, starting from Guojiazui Reservoir and ending in Dongfeng Canal (Figure 3-2). According to the river planning flood control standard requirements, the focus of this time combined with the post-disaster damage situation to implement section repair and renovation, the implementation of damaged sections of the river repair and flood control to enhance. For the country section upstream (K0+000~K4+300) untreated river section new barge, improve the flood control function; for the urban section (downstream of the West Third Ring) disaster damage river section for barge repair; for the urban section of aging, local damage river section for improvement and upgrading, while for the urban section of the relatively adequate space for the river section for transformation, widen the flooding section, improve the flooding capacity of the river.

1) Rural Section

The upstream section of the river, i.e., the upstream part of the West Third Ring Road, is a rural section, and most of the current slopes on both sides are earth slopes, which were damaged in the flood. Both sides of the river channel from Guojiazui Reservoir to Zhengmi section are steep slopes. It is proposed to set up a retaining wall at the foot of the slope, which is 0.5m above the flood level, and a 3.5m wide walkway on the top of the retaining wall as greenway penetration in the river channel, with a 5m wide greening space reserved between the walkway and the soil slope. For high steep surface backfill slope, slope cutting + anchor + active protection network + 3D geotechnical network mat grassing slope protection method can limit the sliding of unstable soil within a certain range and reduce the occurrence of slope collapse. The section from Zhengmi Road to West Third Ring Road mainly considers the greenway on both sides and sets up a short retaining wall at the foot of the slope and a 3.5m wide walkway on the top of the wall.

(2) Urban section

The urban section of the river downstream of the West Third Ring has been built with embankments, but the cross-section is complex and varied, with rectangular cross-sections, trapezoidal cross-sections and compound cross-sections. Combined with the landscape needs of different river sections, without narrowing the flooding section, the ecological transformation of the embankment, while using lowering the elevation of the greenway, walkway widening, piling to transform the section type, etc., to increase the hydrophilicity of the barge, to achieve the full penetration of the greenway. Yellow River Road downstream of the river is relatively wide, there are stone masonry and other forms of shore protection, better perception, well-preserved, so for this section of the embankment shoreline will not be demolished, only to update the construction of the greenway, to achieve the overall improvement of the landscape effect.

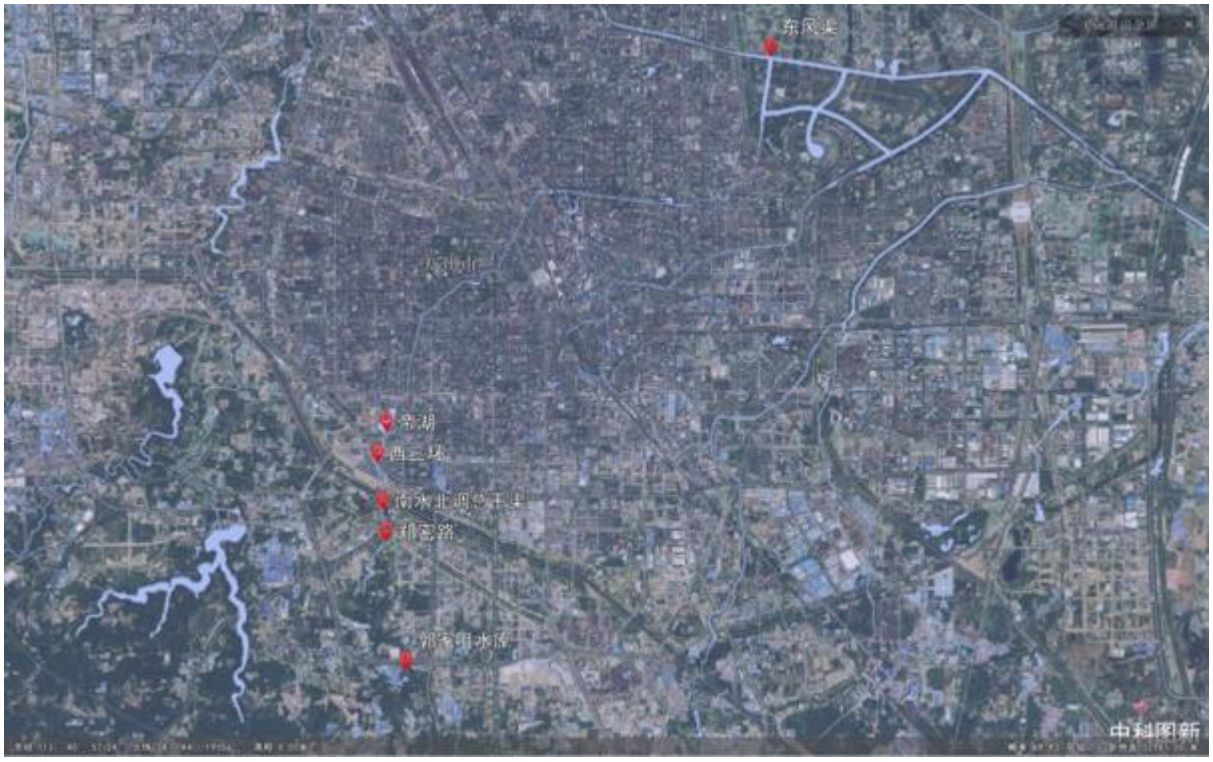


Figure 3-2 Schematic diagram of the location nodes of the urban section and the rural section

3.1.2 Weir

There are 18 rubber dams along the Jinshui River, and a total of 17 rubber dams that are aging and no longer in operation are to be demolished. To ensure the passage of the greenway along the river and to change the overall ecological appearance of the river, weirs that have been damaged or lost their functions are to be demolished and renovated, including 4 weirs to be demolished, 5 weirs to be repaired, and 5 new weirs to be built along the landscape nodes. After the completion of the project, there will be 1 rubber dam and 10 physical weirs along the Jinshui River. Both sides of the weir dam site is a landscape green space, the earth and construction materials can be temporarily stacked in the green belt, the weir dam construction does not involve land acquisition and demolition and other immigration impact.

Table 3-1 Weirs to be removed

No.	Pile number	Weir height (m)	Weir width (m)	Elevation of the top of the weir (m)	Current Photo
1	K3+846	1.8	44.6	130.1	
2	K4+707	0.4	38	126.46	
3	K6+549	0.5	21.8	120.85	
4	K12+813	0.8	18.2	99.8	

Table 3-2 Rehabilitation of weirs

No.	Pile number	Weir height (m)	Weir width (m)	Elevation of the top of the weir (m)	Current Photo
1	K0+978	1	32.84	139.78	
2	K2+971	1	41	131.80	

3	K6+780	0.2	38	119.90	
4	K7+732	0.5	40	114.8	
5	K7+963	0.5	29.7	113	

Table 3-3 New Weir

No.	New stake number	Weir height (m)	Weir width (m)	Elevation of the top of the weir (m)	Photo
1	K0+510	1	17	144.01	
2	K3+224	0.5	35	128.25	

3	K10+871	0.5	10.1	103.50	
4	K12+512	0.5	12	100.0	
5	K16+329	0.5	17.3	93.80	

3.1.3 Sluice gate

The project proposes to build 2 new sluice gates, both of which are reconstructed at the same site, with landscape green belt on both sides. During construction, earth and construction materials can be temporarily stacked in the green belt, and the sluice gate project does not involve land requisition and demolition, and there is no new requisition and relocation and other migration effects. The site of Dihu Lock is located at the lower outlet of Dihu Lake (pile number K7+519), the main function is to control the landscape water level of Dihu Lake. The main function of Dihu gate sequence garden gate is landscape water storage, the site is located at the sequence garden landscape node (pile number K9+708).

1) Dihu Sluice Gate

The Dihu Gate mainly consists of the upstream rock throwing prevention section, the lock chamber section, the downstream dissipation pond section and the downstream slurry block masonry, with a total length of 33.0 m. The gate opening size of the lock is 38.0×1.8 m (width×gate height) and is divided into 7 hydraulic lift gates with gate size 6×1.8 m (5 fans) + 4.0×1.8 m (2 fans) (width×gate height). The water retention level of the gate is designed according to the combination of water level, according to the upstream flood level 117.20m/downstream normal water level 115.8m. Upstream rock throwing anti-wash section: The upstream rock throwing anti-wash section is located in the current water of Dihu Lake, 3m long, 50.73m wide and 1.0m thick, using rock throwing bottom protection as the upstream anti-wash measure. Lock chamber section: The lock chamber section is 4.0m long, 38.0m wide, with a bottom slab thickness of 1.9m and a cast-in-place C30 reinforced concrete structure with a C15 concrete bedding layer of 0.1m thickness. 3.9m

high gate piers on both sides are cast-in-place C30 reinforced concrete structures with a top width of 1.0m and an outer slope ratio of 1:0.45, and railings are set at the top of the gate piers. In order to reduce seepage, the left and right bank side piers are equipped with 0.5m wide concrete thorn wall, 5.35m long. Downstream dissipation pool section: the dissipation pool section is 7.0m long, 38.0m wide, cast-in-place C30 reinforced concrete structure, the thickness of the bottom slab is 0.5m, and C15 concrete bedding layer is laid, 0.1m thick. Downstream slurry block masonry: 6.0m long, 38m wide, top elevation 115.50. The upper part is 0.6m thick slurry block, and the lower part is paved with C15 concrete bedding layer with thickness 0.15m and cement mortar standard M10. The bottom is back filtered by geotextile (400 g/m^2). The ⌀10cm PVC drainage pipe is used in the slurry masonry section with a 2m plum-shaped spacing. Downstream stone throwing anti-wash section: The downstream stone throwing anti-wash section is located in the river bed downstream of the Binhu North Road Bridge, using stone throwing bottom as the downstream anti-wash measure. Length 3m, width 38m, thickness 1.0m, the bottom is paved with geotextile (400g/m^2), the top elevation 115.50 and the downstream river bottom elevation consistent.

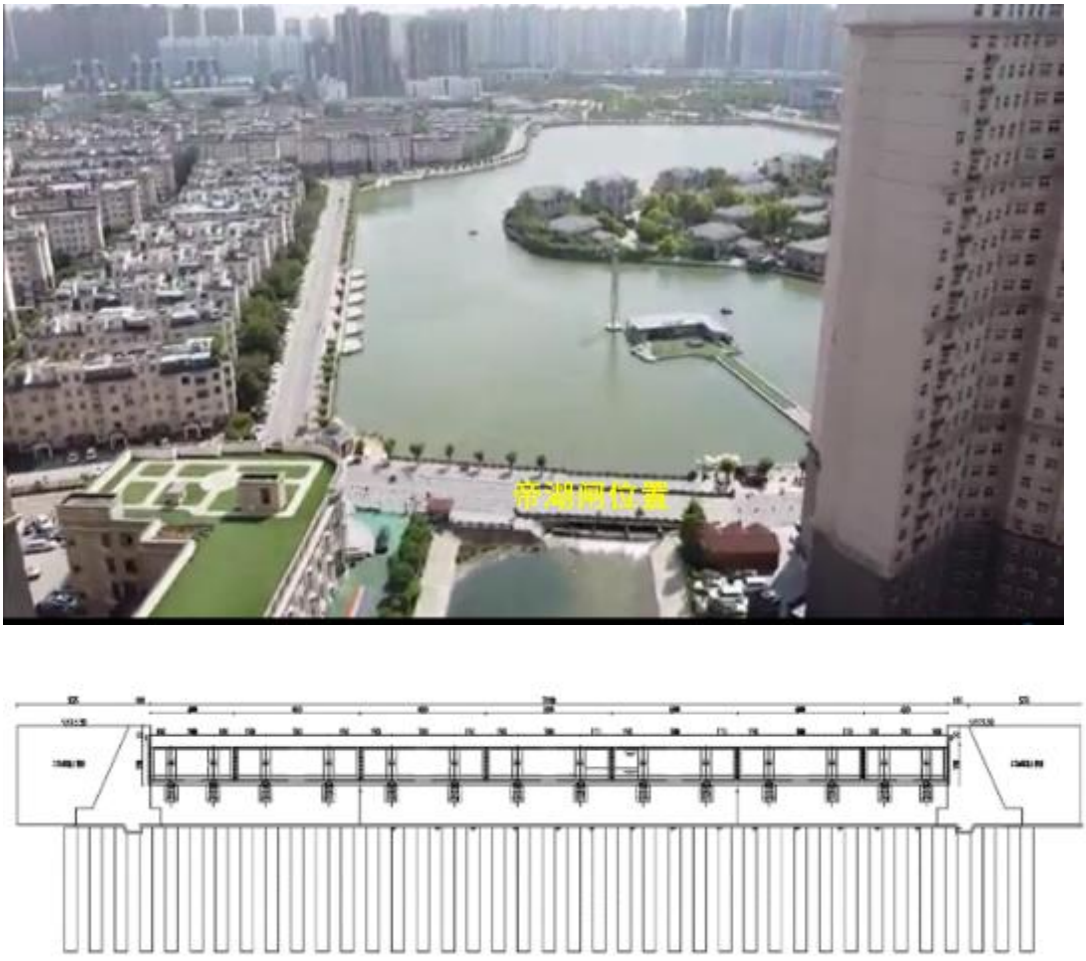


Figure 3-3 Location and cross-sectional layout of Dihu Gate

2) Xuyuan Gate

The gate size is 14×1.2m (width×gate height) and the bottom elevation is 106.3m (the same as the bottom elevation of the river). The gate top elevation is 107.5m, the gate pier elevation is 108.20m, and the gate is 2 fans 7m (width) × 1.2m (height). The water retention level of the gate is combined according to the normal water level and designed according to the upstream normal water level of 107.30m/downstream normal water level of 106.60m.

Upstream stone throwing anti-wash section: 1.2m long, 14m wide, 0.6m thick, bottom elevation 105.70, using stone throwing bottom as an upstream anti-wash measure. Upstream cover section: 3.0m long, 14m wide, 0.5m thick, with C30 reinforced concrete structure and 0.1m thick C15 plain concrete bedding layer. Lock chamber section: the lock chamber section is 4.0m long, 14.0m wide, the thickness of the bottom slab is 1.2m, it is cast-in-place C30 reinforced concrete structure with C15 concrete bedding layer of 0.1m thickness. 3.1m high gate piers on both sides are cast-in-place C30 reinforced concrete structure, the top of the retaining wall is 1.0m wide, the outer slope ratio is 1:0.45, and the railing is set at the top of the gate pier. Downstream dissipation pool section: dissipation pool section 8.0m long, pool width 14.0m, cast-in-place C30 reinforced concrete structure, bottom plate thickness of 0.5m, laying C15 concrete bedding layer, thickness 0.1m. Downstream slurry block masonry: 8.0m long, 14m wide, top elevation 106.30m. 0.6m thick slurry block masonry at the top, laying C15 concrete bedding layer at the bottom, thickness 0.15m. The bottom is backfiltered with geotextile (400 g/m2). The ⌀10cm PVC drainage pipe is used in the slurry masonry section with a 2m plum-shaped spacing. Downstream rock throwing anti-wash section: 2m long, 14m wide, 1.0m thick, with geotextile (400g/m^2) at the bottom, the top elevation 106.30 is the same as the downstream river bottom elevation.

Figure 3-4 Xuyuan gate location and cross-sectional layout

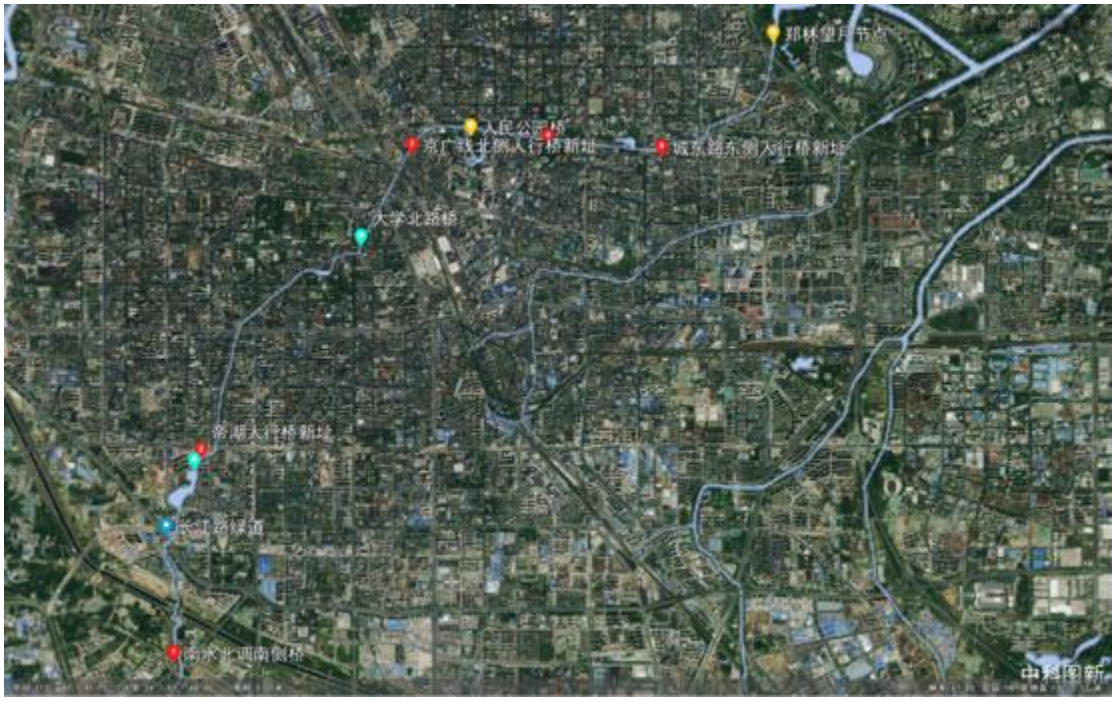
3.1.4 Dredging

During the "7-20 rainstorm", a large number of slopes collapsed and piled up in the river channel, mainly between Guojiazui Reservoir and Jinhai Road, about 4km, which needed to be cleared.

During the rainstorm, a large amount of sediment poured into Dihu Lake from upstream, causing a large amount of siltation, and the storage capacity of Dihu Lake became smaller, so dredging was needed. In the midstream section, the river from West Changjiang Road to Zhongzhou Avenue has siltation and a lot of garbage and collapsed stones, so it needs to be cleared, and the volume of river clearance is about 49,100,000 m³.

3.1.5 Bridge restoration and upgrading

There are 56 bridges across the river in the scope of this project (excluding 2 railroad bridges and 2 pedestrian bridges in the railway-related section of North Gate), including 40 municipal vehicular bridges and 16 pedestrian bridges. According to the impact of "7-20 rainstorm" on the bridges, combined with the bridge structure, surrounding environment, traffic function importance, etc., the bridge restoration and upgrading project is divided into the following five aspects.



Note: Green icon=reconstruction of vehicular bridge; red icon=demolition and reconstruction of pedestrian bridge; yellow icon=new pedestrian bridge; blue icon=new greenway

Figure 3-5 Location map of new and reconstructed bridges

3.1.5.1 Damage and reconstruction of bridges

1) North University Road Bridge

The bridge will be demolished and rebuilt in situ. The upper structure adopts 3x10m precast prestressed concrete hollow slab; the lower part adopts: rectangular cover beam column pier, pile column abutment and thin wall abutment; the foundation adopts expanded foundation and bored pile foundation. River centerline and road centerline angle is 90 °

intersection, bridge pier axis and parallel to the water flow line, bridge pier water resistance of 5.63%. Road section layout: the left side of the pedestrian bridge (3m sidewalk + 3m non-motorized lane + 0.5m guardrail) + 2.8m skeleton belt + main bridge (0.5m guardrail + 26.25m. lane + 0.5m guardrail) + 2.8m skeleton belt + right side of the pedestrian bridge (0.5m guardrail + 3m non-motorized lane + 3m sidewalk).

Figure 3-6 North University Road

2) Binhu North Road Bridge

The current bridge length is 20m, the opening line on the river is about 40m, the bridge is under the solid weir, the bottom of the bridge beam is about 70cm from the top of the weir, the bridge position at the 100-year design flow is about 33.5 m^3 /s, the original bridge overflow capacity of about 12 m^3 /s, resulting in this point for flood choke. This bridge in the 7-20 flood damaged seriously, North Road and the road in the sidewalk railing completely broken; northwest corner of the platform after the barge was seriously water damage; During the flood period, the water level did not cross the bridge deck, and the girder body was displaced.

Figure 3-7 Damage to Binhu North Road Bridge

Combined with the current situation of the bridge and the disaster, Binhu North Road renovation scheme is as follows: demolition of the current bridge, weir, after expanding the section of the new bridge and flap gate, bridge gate construction at the same time, together with the Binhu North Road flood choke problem.

The superstructure of the new bridge adopts 2x20m precast prestressed concrete hollow slab, and the lower part adopts: column pier, thin-walled platform, and bored pile foundation. River centerline and road centerline angle is 90° intersection, the bridge pier axis and parallel to the water flow line, the pier water resistance of 3.89%. Road section layout: 2.25m (sidewalk) + 9m (carriageway) + 2.25m (sidewalk) = 13.5m. pier pile diameter is 1.2m, pier diameter is 1.0m, cover beam height is 1.3m, main beam height is 0.65m. bridge deck pavement adopts 10cm asphalt concrete + 15cm C50 reinforced concrete leveling.

3.1.5.2 Bridge rehabilitation and upgrading

The remaining bridges will be retained. While restoring and promotion of the damage to the shore and cone slope under the bridge, it is transformed in combination with the slow -through demand under the bridge, and the landscape and night view lights are created without affecting traffic. A total of 49 bridges will be transformed.

Figure 3-8 Bridge restoration

3.1.5.3 Demolition and reconstruction of pedestrian bridges

Some old footbridges will be demolished and rebuilt, with cracks and exposed ribs and other issues. A total of 5 footbridges will be demolished and rebuilt.

1) Pedestrian bridge on the north side of the Dihu Lake

The old bridge will be demolished and the new bridge will be built about 70m downstream of the existing bridge. The bridge structure is a steel box girder arch bridge with a span of 34.57m, a vector height of 3.05m, and a vector-to-span ratio of 1/11.3. The total width of the bridge is 4m, with an orthogonal arrangement. The box arch section height is 900mm, and a 6.5mx6.5m viewing platform is set up on both sides of the bridge head in combination with the bearing structure. The thickness of steel box girder top and bottom plate are 16mm, longitudinal ribs are 12mm, transverse stiffening ribs are 14mm. substructure is solid arch abutment, bearing platform is 3.5m thick, two rows of 1.5m diameter bored piles are connected underneath.

Figure 3-9 Effect of landscape bridge on the north side of Dihu Lake

2) South side bridge of south water transfer

The current bridge here is 20 meters long and 4.7 meters wide, and is a pedestrian bridge or a part of non-motorized traffic. The water crossing section under the bridge is a prefabricated pipe culvert, the bridge body is a brick structure with mortar surface, and the bridge deck is concrete pavement. This bridge was partially damaged during the 7-20 flood and flooding when the water level did not exceed the bridge deck and the pipe culvert was blocked. In order to optimize the water crossing capacity under the bridge, strengthen the flood control capacity, and improve the safety and durability of the bridge, and at the same time protect the bridge on both sides of the personnel and non-motorized traffic capacity, the current bridge will be demolished and a new concrete bridge. The new bridge adopts the form of trestle bridge, connecting the greenway and slow walking system along the route, and setting landscape railings to ensure the safety of pedestrian traffic and improve the landscape performance.

The new bridge adopts 4x8m cast-in-place continuous rigid concrete slab bridge, with a total length of 32m and a width of 6m. The top of the superstructure cast-in-place concrete slab is 6m wide and the main board is 0.6m thick, with a 1m wide flange on each side, and the flange thickness gradually changes from 0.15m to 0.25m. Convenient construction, pier pile foundation are used 0.8m diameter bored piles. The full width of the bridge deck 6m, the bridge deck transverse layout form: 0.5m (railing) + 5.0 (bridge deck) + 0.5m (railing) = 6.0m; bridge deck with 1% two-way cross slope.

Figure 3-10 Before and after scheme of the south side bridge of the south water transfer

3) Beijing-Guangzhou line north side of the pedestrian bridge

The current bridge is located 40m north of the Beijing-Guangzhou Railway, the bridge form is a medium-bearing arch bridge, the bridge length is about 18m, the bridge width is about 3.5m, the bridge is close to the Beijing-Guangzhou Railway to serve the residents, and the bridge scale and bridge height is low to meet the flooding needs of the river after the reconstruction, so it will be demolished and rebuilt. The new bridge is located about 140m downstream of the existing bridge, the east side of the bridge is facing the gate of the Xiangshuiwan community, and the west side of the bridge is connected to the current residential area, so that residents can travel quickly and conveniently and serve a wider area.

Figure 3-11 The current situation of the pedestrian bridge on the north side of the Beijing-Guangzhou Line and the reconstruction

4) Shengwei Erzhao Bridge

The Shengwei Erzhao Bridge is located in Jinshui District, Zhengzhou City, adjacent to Duling Street in the west and Renmin Road in the east, connecting the administrative and commercial areas and residential areas on the north and south sides of the Jinshui River. The current bridge is about 37m long, which has been in service for long time and was damaged during the "7.20" heavy rainstorm, endangering the safety of pedestrians and vehicles. Therefore, the current bridge will be demolished and reconstructed to eliminate structural safety hazards and to meet the requirements of the river section and flood control standards, as well as to improve the landscape quality of the bridge, so as to harmonize with the landscape of the Jinshui River after the improvement and improve the travel experience of the surrounding residents and tourists.

The Shengwei Erzhao adopts a 28m span steel arch bridge with a total length of 37m and a positive bridge arrangement. The main span of 28m can cross the main river channel and the walkway on both sides at the same time, and the total length of 37m can meet the requirements of the upper entrance width of the river channel, and the clearance of the road and walkway under the bridge can be met. The bridge deck layout is 2.0m (pedestrian path) + 7.0m (traffic lane) + 2.0m (pedestrian path) = 11.0m, the longitudinal slope of the bridge deck is 4%, and the bridge deck has a two-way cross slope with a slope of 1%. Downstream of the bridge walkway clearance ≥ 2.2m, the bridge elevation is not less than 99.25m, can be connected with the topography on both sides of the river bank.

Figure 3-12 Layout of the rebuilt Shengwei Erzhao bridge

5) East side of Chengdong Road pedestrian bridge

The pedestrian bridge on the east side of Chengdong Road is located about 300m east of Chengdong Road, east of Dongming Road, connecting the north and south banks of Jinshui River, for the daily travel needs of residents and merchants on both banks. The current bridge is a reinforced concrete arch bridge, with a total length of 20m. The bridge was damaged during the 7.20 flood, and the main arch ring has serious leakage of reinforcement, which is a major safety hazard. The demolition and reconstruction of the current bridge can not only eliminate safety hazards, but also be more coordinated with the natural landscape on both sides.

The new pedestrian bridge adopts a 27.8m upper-bearing steel pipe arch bridge plan, with a total length of 31.98m and a total deck width of 4m, with a longitudinal slope of 4% and no cross slope. Control under the bridge road clearance ≥ 2.5m, bridge deck elevation at the bridge platform 96.3m, and the river bank on both sides of the terrain.

Figure 3-13 Pedestrian bridge on the east side of Chengdong Road before and after the project

3.1.5.4 New pedestrian bridge

Combined with the demand for activities of the surrounding public and the traffic situation, two new pedestrian bridges will be built in the two existing parks, which do not involve any land acquisition and resettlement.

（1） People's Park Bridge

People's Park Bridge is located about 600m east of Minggong Road, Jinshui Road, crossing the Jinshui River and located inside the People's Park. The upper deck is a 29.5m girder bridge and the lower deck is a 17.3m arch bridge, both of which are connected by steel pipes to form one. The upper deck is 3.5m wide, the lower deck is 2.5m wide, the clearance under the control bridge is ≥2.5m, and the elevation of the bridge deck at the bridge platform is 100.02m, which can be connected with the topography on both sides of the river bank.

Figure 3-14 New People's Park Bridge

（2） Zhenglin Wangyue Node

The bridge is located in the interior of Zhengzhou Forest Park, the Zhenglin Wangyue Landscape Node. The node is one of the twelve scenes of Jinshui along the Jinshui River. The current river bank is not crossed by any pedestrian bridge on the left and right sides. The superstructure of this bridge is made of (17.5+36.0+17.5)m continuous steel box girders, with pier and girder solidification, steel-composite piers, light concrete abutments and bored pile foundations.

Figure 3-15 Effect of the new Zhenglin Wangyue node

3.1.5.5 Greenway Bridge

Greenway bridges will be built to meet the demand of slow walking system through the Changjiang Road.

The proposed Changjiang Road Greenway Bridge is located east of Tongbai South Road and west of the Jinshui River. Since the height difference between the bottom of the bridge across the Jinshui River and the normal water level is only 1.3m, the walkway cannot be crossed under the bridge, so a new greenway bridge is built across the Yangtze River Road to ensure the walkway is crossed. This solution solves the traffic safety problem caused by the visitors crossing the road. Its light and flexible shape is not only convenient for the public on both sides of the river, but also more harmonious with the natural landscape on both sides. The bridge is located in the vibrant sports area (South-North Water Transfer Canal ~ Longhai West Road), where the project is located on both sides of the residential land density, focusing on enriching the current waterfront activity function space, to create a vibrant water corridor of public space for all ages.

Figure 3-16 Design of new Changjiang Road Greenway Bridge

3.2 Water quality and ecological enhancement

The "7-20 flood" caused some damage to the original ecological environment of the Jinshui River, and also revealed some problems in the structure of the river water ecosystem. In response to the ecological problems identified, 2 major types of measures were proposed, including pollution control and ecological treatment, to ensure water quality stability and restore a healthy water ecosystem.

3.2.1 Interception and control of pollution

During the heavy rainstorms, pipeline sewage overflow problem is obvious. It is need to carry out the relevant sewage pipeline relocation and stormwater outfall transformation (including the landscape transformation of stormwater outfalls, interceptor facilities, misconnection sewage and initial stormwater interceptor wells).

1) Sewage pipe relocation

Combined with the vertical design of the area where the project is located, the relocation of the sewer pipe mainly includes four parts: West Haining Road - Huaihe Road (726m), East Construction Road - Shunhe North Street (4228m), Future Road - Zhongzhou Avenue (866m), the relocation of the part across the river (500m), at the same time, the interceptor wells along the river with high risk of backflow are upgraded to improve the interception efficiency and ensure regional sewage collection normal operation of the system. The main construction method of excavation pipeline project: preparation → construction sampling → pipe trench excavation → pipe laying, installation → water closure test → backfill tamping. After the completion of pipeline laying, the owner and site supervisor should be notified in time to carry out the closed water test of the pipeline system, and backfill work should be carried out after passing the test.

The pipeline rehabilitation program for each section is as follows.

a) West Nautical Road ~ Huaihe River section: the current Jinshui River sewer along the river is located 8.0 m within the blue line, and the river cross-section conflict, it will be removed, in the right side of the Jinshui River 3.0 m within the blue line laid d500 sewage pipe, collect sewage along the line from south to north into the current Huaihe Road d800 sewage pipe.

b) East Jianshe Road ~ Shunhe North Street section: in the planning road to West Chenzhuang West Street section, the new sewage pipe is located in the central and western 4.0m, West Chenzhuang West Street to Minggong section, the design of the sewage pipe is located in the central and western 13.0m to 16.0m. The rest of the section along the planning path, laid in the right bank of the Jinshui River. Sewage east main pipe relocation project through the Jinshui River mainly in five places, the first is located on the north side of the intersection of Jianshe Road and Jinshui River, the second is located on the south side of the intersection of Jingguang Expressway and Jinshui River, the third is located at the intersection of Erqi Road and Jinshui River, the fourth is located at the intersection of Duling Street and Jinshui River, the fifth is located on the west side of the intersection of Renmin Road and Jinshui River. Along the line, a customer branch pipe with diameter of d500~d600 and length of 2m is reserved in the direction of the right bank of Jinshui River every 100m unilaterally in consideration of the peripheral customers taking over, and the pipe head is blocked. The part within 350m of the railroad is included in the special design of the railroad and is not included in the scope of this project.

c) Future Road to Zhongzhou Avenue: the current sewage pipe on the left bank of the Jinshui River is located 1.5 m to 4.2 m within the blue line and is planned to be retained. The current sewage pipe on the right bank of Jinshui River affects the river planning, it will be removed and a d500 sewage pipe will be laid 3.0m inside the blue line on the right side of Jinshui River to collect sewage along the line and discharge it into the current d600 sewage pipe of Zhongzhou Avenue from south to north.

d) Others: East Jianshe Road to Shunhe North Street section of the cross-river pipeline with the relocation of the sewage east trunk pipe according to the planning of synchronous update and relocation. Other areas are investigated and docked, need to be updated in situ or planned relocation of cross-river pipeline with the river regulation project. Mainly for the workers Road, West Hanghai Road, Ruhe Road, University Road, Zhongzhou Avenue and other 5 locations. The corresponding volume of d500 and d600 sewage pipes is about 500m. At the same time, the non-municipal sewage pipes along the river (along the drainage pipes of the land) will be sorted out and relocated, and the drainage of the land will be relocated to the sewage network at the municipal road. Take North Binhu Road - Gongren section of the left bank of the river sewage pipe as an example, this section of the sewage pipe for the Dihu community drainage pipe, located in the upper mouth of the river line, the Jinshui River needs to be abolished, this time consider its internal pipe network transformation, the district sewage relocation to the west side of Wangfu Street municipal sewage pipe.

2) Rainwater outfall renovation and new outfalls

At present, there are 384 various types of outfalls distributed along the Jinshui River. North gate mouth at the railroad 350 meters within the scope of the 3 existing outfalls, 4 new outfalls have been included in the railroad special along the river road, has been completed at the end of May 2022 renovation and construction, no longer counted in this project. This rainwater outfall renovation and new construction include.

a) Existing stormwater outfalls retained, 56 landscape decorations.
b) Removal of existing stormwater outfalls, 50 places.
c) Modification of existing stormwater outfalls, landscape decoration 251 places.
d) The existing combined flow system was renovated in one place by using intelligent interception wells.
e) The existing mixed misconnection interceptor will be modified in 23 places.
f) Eight new outfalls.

3) Waterlogging on adjacent roads

Local waterlogging exists along the Jinshui River, with a total of 10 main waterlogging locations, and the causes of waterlogging are roughly divided into three cases: (1) insufficient drainage capacity of the stormwater system; (2) the existence of low points on the road; and (3) there is no outlet into river.

3.2.2 Ecological Management

(1) Ecological water replenishment

Ecological water replenishment project is to enhance the hydrodynamics of the river and improve its self-purification capacity by replenishing clean water into the urban rivers. The living water cycle measure can be used both as a temporary measure and as a long-term measure for water quality maintenance. By providing ecological recharge to the upper reaches of the river, it also meets the needs of artificially created habitats for basic water conditions.

The water source of this replenishment project uses the Yellow River water, the original water outlet replenishment point is only set in the middle and upper reaches of the Jinshui River, in the water outlet to Guojiazui reservoir section still lack of water replenishment. According to the full study of the regional water diversion system, in order to ensure the ecological replenishment of the upstream section of the Jinshui River, it is proposed to implement the Jinshui River diversion point to Guojiazui Reservoir water pipeline, which will carry the clear water from the Jinshui River diversion point to the upstream, thus realizing the ecological replenishment of the upstream. On the premise of taking into account the ecological water demand of the downstream river landscape and the ecological recharge demand of the upstream, and considering the economy and ecological landscape treatment effect, the scale of the ecological recharge flow is determined to be 0.8 m^3 /s (Figure 3-17: water withdrawal permit). Accordingly, the ecological water replenishment project can be divided into water replenishment pumping station project and water replenishment pipeline project. The scale of this water recharge pumping station is designed according to 0.8m^3 /s, with a pumping head of 35m and an installed power of 528kW. The pumping station is a reinforced concrete sinkhole pumping station, with a supporting construction of a transformer and distribution room and a management house. The pumping station is located at the southeast side of the intersection of Jinhai Road and Jinshui River, with a total area of 2274.3 m^2 , including a comprehensive management room of 292.5 m^2 , a distribution room of 75 m^2 , and a pumping station of 173.24 m^2 . The water replenishment pipeline is led from the water intake point of Jinshui River, laid upstream along the right bank of Jinshui River, and finally laid to the river below the reservoir. The pipe diameter is DN900 and the pipe length is 4182 m. Among them, the ductile iron pipe is selected for the excavated section and the PE100 pipe is used for the section crossing the current municipal road.

Figure 3-17 Water withdrawal permit for ecological recharge

(2) In-situ enhanced purification

According to the calculation results of water environmental capacity (chemical oxygen demand, ammonia nitrogen and total phosphorus) in the preliminary design, both Guojiazui reservoir - Dihu section and Dihu - into the Dongfeng canal have surplus environmental capacity, and the environmental capacity of the upstream Guojiazui reservoir - Dihu section is higher than the downstream Dihu - into the Dongfeng canal section. Although there is still a surplus of environmental capacity throughout the year, differences in temperature, precipitation, pollution inflow and runoff in each month may still result in water quality not meeting standards in some months. In order to stabilize the water quality of the Jinshui River and the surrounding park and control the reproduction and outbreak of algae, in situ strengthening purification measures are proposed to be laid out in the nodes of Dihu and Zhengda Meihu. After the ecosystem is constructed, we mainly use microbial control

equipment and submerged plants to purify and maintain the water quality in the long term, and improve the food chain and food web by building aquatic animal systems to enhance the stability of the water ecosystem, thus, 240 tons of sulfur-based solid denitrification materials, 54 tons of high-efficiency slow-release phosphorus removal materials are used. In addition, 10 sets of EAS microbial control equipment, 41,200m2 of aquatic plants were planted on the bottom and shore of the lake, and 8,000kg of fish, mussels and snails were injected to form a stable water ecosystem and stabilize and improve the nutrient and transparency indexes of the water out of Dihu Lake.

Table 3-4 In-situ intensified purification project volume table

No.	Project Name	Quantity	Unit	Remarks
1	**Dihu Lake Intensive Purification Project**			
	Sulfur-based solid-state denitrification materials	240	ton	2.4kg/m^2 , in batches
	Efficient slow release	50	ton	0.5kg/m^2 , in batches
	EAS microbial regulators	8	Taiwan	EAS-II type, power 1kw; Main technical parameters: (1) Size: 1.0*0.6*1.4m; (2) Material: S304 stainless steel, thickness 1.5mm; (3) Operating power: not more than 1.0kw; (4) Floor space: not more than 5 ㎡ (including the guardrail covers an area); (5)Function: the functional area includes anoxic and aerobic areas, with proprietary bio-safety agents to achieve: a. adjustment of the microbial community structure in the raw water, promoting the metabolism of the dominant decarbonization and denitrification bacteria; b. rapid replication of the optimized indigenous microbial population under the action of nutrient salts and enzymes; (6) operation and control: convenient operation, with flow and level control functions. (7) Accessories: including water pump, release device, overflow pipe, outlet pipe, water inlet pipe, outlet, pharmaceuticals and valves, etc.
	EAS Microbial Control Equipment Cables	1600	m	Cable type YJV-4*4+PE2.5
	EAS Microbial Control Equipment Fundamentals	8	individual	Concrete strength not less than C20, foundation square meter size 2m×2.5m, thickness 150mm
	Aquatic planting	1200	m^2	reeds, aquatic iris, etc.

	Submerged plant growing	40000	m^2	*Vallisneria natans*, *myriophyllum verticillatum* etc.
	Fish placement	5000	kg	Silver carp and bighead carp fry (average length about 100mm) density 50g/m^2
	Benthic release	3000	kg	Bottom-dwelling organisms such as snails and mussels (average shell length about 5cm) were placed at a density of 30g/m^2.
2	**Zhengda Meihu Purification**			
	EAS microbial control equipment	2	Taiwan	EAS-II type, power 1kw; main technical parameters: (1) External dimensions: 1.0*0.6*1.4m. (2) Material: S304 stainless steel, thickness 1.5 mm. (3) operating power: not more than 1.0kw; (4) floor space: not more than 5 ㎡ (including the guardrail occupies); (5) functional areas including anoxic and aerobic areas, supporting proprietary biological security agents to achieve: a. adjustment of the microbial community structure in the raw water, to promote the metabolism of decarbonization and denitrification dominant groups; b. under the action of nutrient salts and enzymes, the optimized indigenous microbial populations quickly replication in large numbers. (6) Operation and control: easy to operate, with flow and level control functions. (7) Accessories: including pumps, release devices, overflow pipes, outlet pipes, water inlets, outlets, pharmaceuticals and valves, etc.
	EAS Microbial Control Equipment Cables	200	m	Cable type YJV-4*4+PE2.5
	EAS Microbial Control Equipment Fundamentals	2	individual	Concrete strength not less than C20, foundation square meter size 2m×2.5m, thickness 150mm
	Efficient slow-release phosphorus	4	ton	Putting according to 0.5kg/m2

	removal materials			
	Floating Leaf Planting	174	m2	Including water lily, nymphaea peltata, gorgonians, etc.
	Aquatic planting	454	m2	Including water onion, yellow calamus, and chinaberry
	Submerged plant growing	1027	m2	Including *Vallisneria natans*, *myriophyllum verticillatum*, etc.

(3) water ecosystem restoration

The entire Jinshui River crosses the countryside and towns, and the flora and fauna in the corresponding areas and the surrounding residents have a high demand for a high-quality water ecological environment. In order to improve the interaction between biology-habitat and human-nature, this project takes into account the river's background, the characteristics of both sides of the river and biodiversity needs, and will implement biological restoration and habitat creation-"The ecological river with water, fish and grass, and harmony between people and water". The implementation of rural section habitat restoration 16231m^2 , urban section aquatic plant community restoration 13357m^2 , ecological riverbed treatment 67436.6m^2 , ecological planting frame arrangement 1223m, ecological active water transformation 401m.

Deep pool works and rock mass works.

The average design depth of the whole section is 0.3m-0.5m, among which the design depth of the urban section is 0.3m. The exposed riverbed caused by insufficient water supply poses a greater potential ecological risk to fish. In order to weaken such risk, this design mainly creates part of deep pool habitat in the shallow urban section to provide habitat and refuge for fish, and at the same time lays rock groups at the bottom of the deep pool and upstream concave bank area to provide a safer and more stable habitat for fish and play a certain anti-wash effect.

1) Deep pools

Deep pools and shallows are complex habitats commonly found in natural rivers, providing a complex living environment for plankton and fish, avoiding natural enemies, and contributing to the enrichment of river biodiversity, which is of great significance to river ecological restoration. Based on the geomorphological characteristics of natural rivers, shallows and deep pools are arranged at corresponding locations, such as deep pools at the concave banks of river bends and shallows at the transition sections between deep pools. Deep pools and shallows can increase the natural aeration of the river, increase the contact oxidation and adsorption capacity of the water body with various concave and convex surfaces, promote the uptake and digestion and decomposition of plants, animals and microorganisms, etc., so that the self-purification of the river is greatly enhanced and the living conditions of organisms are increasingly improved.

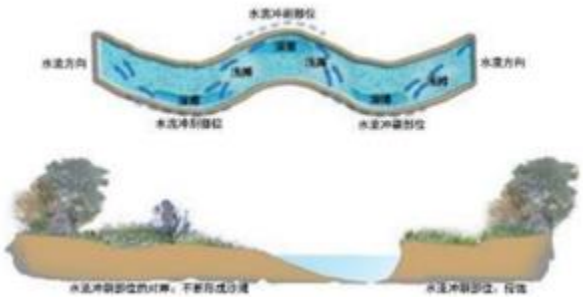


Figure 3-18 Riverbed deep pool and shallow pool design

2) Rock masses

The placement of rocks or rock masses in the substrate can increase the structural complexity and diversity of hydraulic conditions in a water system, which can have a positive impact on the composition of organisms including aquatic insects, fish, amphibians, mammals and birds, and the distribution of aquatic biota. Rock masses are generally used in small, wide, shallow water systems with stable, straight slopes ranging from 0.5% to 4%. A rock group consists of 3-9 gravels with a spacing of 0.1-1m.

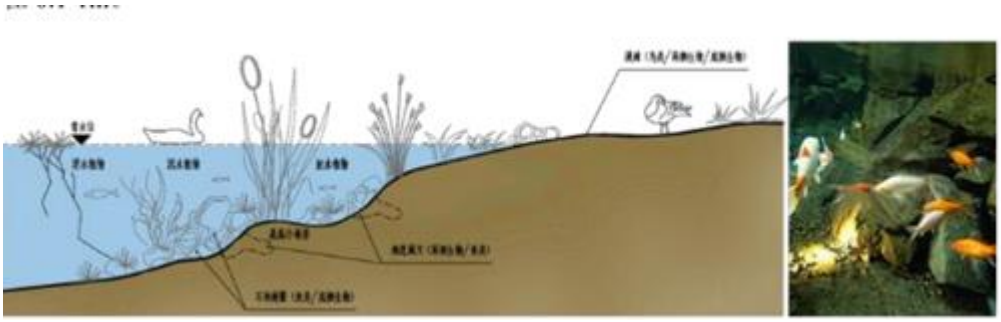


Figure 3-19 Illustration of habitat shaping of rock masses

In the upstream countryside section, aquatic plant rolls were used to protect the banks in the riverbed, and the irrigation and grasses were planted in the habitat creation project to ensure the planting environment and slope stability of the banks. According to the landscape design, most of the countryside section has a wide range of banks with a gentle slope and a flow velocity of less than 1m/s. However, both banks are exposed earthen embankments, which are susceptible to constant scouring by water, so slope protection is needed to maintain the bank structure on both banks. Since the flow velocity in this section is not very high, an ecological revetment of aquatic plants is used, which can resist the flow velocity of less than 2m/s. In this ecological way, the scouring of the embankment by the river can be effectively reduced. The aquatic vegetation roll is a high-density cylindrical roll made of coconut palm fiber mesh. It can effectively protect the river barge, resist water scouring and prevent soil erosion. At the same time, aquatic plant rolls can effectively trap and filter slope runoff from river rainfall and reduce nutrients such as N and P. The design material of the plant roll includes 200 thick protective piles of 50-150mm natural stones with a width of 1.5m; 500mm diameter aquatic plant rolls wrapped with geoconut netting, the wrapping is a 1:1 mixture of planting soil and gravel; a mixture of planting soil and gravel with 75% gravel content, 0-50mm particle size and 20% soil content; 700g/m2 of geoconut netting; short wooden piles with a length of 300mm, and a short wooden stake every 1m. 300mm, every 1m; 300 thick planting soil on the slope; 300 wide*300 thick gravel

trench, filled with 20-40 grain size gravel; 100 thick planting soil on the gravel trench. In this project, the area of aquatic plant roll ecological shore protection is 51403 m^2 , and the distribution pile number is K0+391 to K6+173.35.

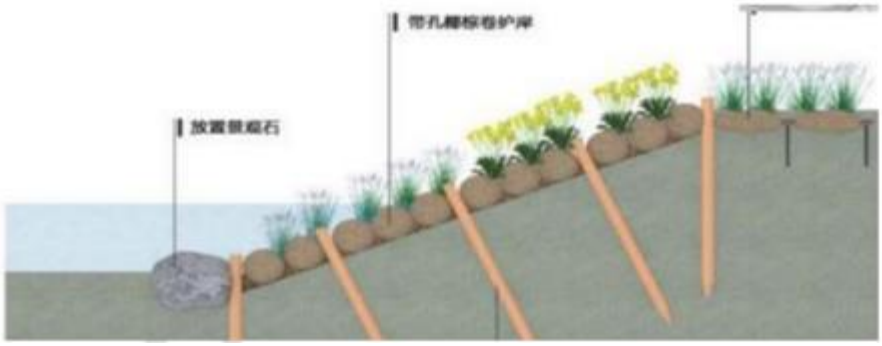
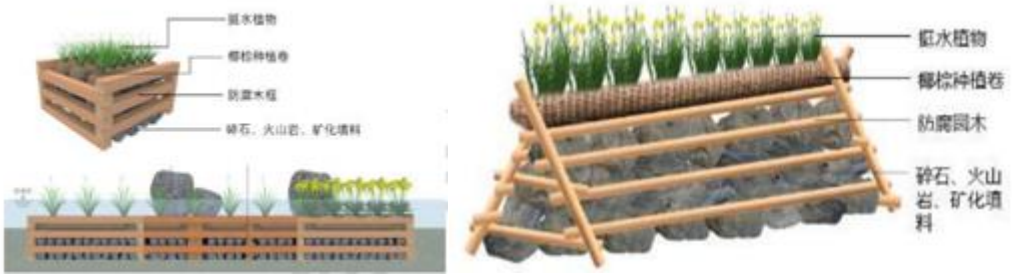


Figure 3- 18 Schematic diagram of aquatic plant roll ecological berms

Ecological planting frame.

For the river water quality problem, two types of ecological planting frames are used in this design: fish nest ecological planting frame and reject ecological planting frame. These two types of ecological planting frames are arranged in the straight river channel. The straight, hardened river channel is against the natural river flow pattern, so the ecological planting frames can help restore the river ecology by changing the flow direction and increasing the flow pattern while purifying the water quality.



Fish nest ecological planting frame Rejected ecological planting frame

Figure 3-20 Schematic diagram of the ecological planting frame

(4) Enclosed water in the parks

As an important gathering point for urban residents, the water quality and surface perception of the park are very important. However, the on-site investigation found that many existing or planned parks along the middle reaches of the Jinshui River have poor water flow and poor water quality and perception, so it is necessary to implement closed water revitalization projects for several key parks and landscape nodes. People's Park and Zijingshan Park along the Jinshui River have a water system, but due to the lack of upstream water, the park water system as a whole is in a stagnant state. People's Park has a pumping station with a scale of 122 m^3 /h, and Zijing Mountain Park has a pumping station with a scale of 79 m^3 /h. The water quality of Meilu Lake in Zhengzhou University block is poor, mainly due to the lack of water sources, and the park water system as a

whole is in a stagnant state. Park water system, to achieve the park water body of living water. A pumping station is set up in Meishan Lake, with a capacity of 50 m^3 /h.

3.3 Greening improvement project

During the "7-20 storm", the damage to the Jinshui River was mainly caused by the collapse of the current river retaining walls and slopes, which led to the destruction of the landscape and green space on the banks. Under this project, the slope of the revetment will be changed into an upright shoreline and the flood cross-section will be enlarged, while the arrangement of water-friendly space and the introduction of activity space will be increased. At the same time, on the basis of repairing the damaged greenery, the old park (built in 1998) along the current Jinshui River will be improved and upgraded to perfect the service function of the waterfront space and provide convenient fitness and activity space for the surrounding residents. The main contents of the project include: the greenway walking system, riverfront renovation and upgrading, the greening upgrading along the river, the important node upgrading and the supporting facilities. Specific details are as follows.

(1) Greenway walking system

To create a waterfront system with independent right-of-way, connect the river and the urban green space system along the river, and solve the problem of incoherent walking system along the Jinshui River, the water-friendly walking trail system and the cycling greenway will be constructed. The river is connected to the surrounding public green space and the current park, and the South-North Water Transfer Canal is the boundary, and the upstream is a countryside type greenway, with a length of 5.1km on one side and 9.8km on both sides, with a width of 3.5m. The width of the waterfront slow walking system is 2.5m (the width of the local section is 3.5m), and the width of the green belt on the side of the wall is about 0.5m. The width of the slow walking system is about 3.0~4.5m, and the length of the single side is about 16.96km, and the length of the double side is 33.92km.

(2) River bank renovation and upgrading

From the perspective of creating an ecological waterfront vitality corridor in Zhengzhou and ecology, comfort, economy and hydrophilicity, it combines ecological restoration, environmental enhancement and space utilization to beautify and enhance the landscape along the slurry barge and the surrounding green space. The site is an open space for commercial and recreational interaction, continuous opening, quality of life and cultural display and promotion. According to the function of the site and the nature of the surrounding land, the site is divided into ecological countryside, dynamic sports area, intelligent creation and enjoyment area, city well and humanistic area, and urban waterfront area. The Ecological Countryside Zone is 5.1km long, starting from Guojiazui Reservoir in the south and ending at the South-North Water Diversion Canal in the north, with a good ecological base, the source of the Jinshui River, streams, dry streams, reservoirs, woodlands, fields and other resources, creating a dense waterfront forest, a scenic forest zone and a science education base. The vibrant sports zone starts from the South-North Water Diversion Canal in the south and ends at Songshan South Road in the north, with a total length of about 5km. It is located in the center of the old city and surrounded by many parks and colleges and universities, creating a special scene of dreamy flower forest and technology creation and enjoyment. The city well humanistic zone starts from the railroad bridge in the west and ends at the future road in the east, with a total length of about 5.4km. The zone is dominated by parkland on both sides and has a strong humanistic atmosphere of the Shang Dynasty, highlighting the characteristics of the city well and humanistic charm. The urban waterfront area starts from Future Road in the south and ends at Dongfeng Canal in the north, with a total length of about 3.3km. This area is located in Zhengdong

New District, with mainly residential land and park land on both sides, creating a new CBD waterfront and TOD waterfront space. There are three levels of nodes along the route, including 12 primary nodes, 15 secondary nodes and 20 tertiary nodes. Node combination: According to the arrangement of nodes along the Jinshui River renovation and upgrading project in 1998, landscape nodes are sorted out to emphasize cultural inheritance and continuity.

4) Flora zoning

According to the 1998 Jinshui River renovation and upgrading project, different planting schemes are designed following four seasons. The spring garden starts from Longhai West Road and ends at Songshan Road; the summer garden starts from Songshan Road and ends at Longhai Railway; the autumn garden starts from Longhai Railway and ends at Chengdong Road. Winter Garden starts at Chengdong Road and ends at Zhongzhou Avenue; At the same time, the current activity venues will be updated, pavilions and other structures will be constructed, and rose garden, lilac garden and wisteria porch are added to increase regional popularity and plant landscape effect.

5) Construction works

The current public toilets and management rooms along the route will be renovated and upgraded, supplementing the arrangement of the stage system along the greenway, underground parking along the route, and expandable buildings such as book bars, water bars and other business function buildings. This project is to implement landscape greening area of about 142 ha, including greening area of about 105ha and civil construction area of about 37 ha, including 10 important nodes along the line for key improvement and upgrading, 15 general nodes along the line, 20 small and micro nodes and regular sections for regular improvement and upgrading, specifically including: greenway slow walking system project (water-friendly slow walking system, water-friendly platform, water pavilion), river bank renovation and upgrading project (embankment top riding system) upgrading project (dike top riding system, secondary and tertiary garden path system, etc., reconstruction and new leisure facilities such as pavilions, reconstruction and upgrading of fitness facilities, updating public facilities system (trash bins, benches, signs, warning signs, public light poles and sculptures, etc.)), greening upgrading project along the line, important node upgrading project and supporting construction project (luster lighting system, sprinkler irrigation system).

3.4 Intelligent Management

The park built its own central management system platform and constructed a smart park design scheme of "one smart management system + four smart application scenarios". Through the Internet of Things (IoT) technology, the Jinshui River intelligent management platform is highly integrated with a variety of intelligent devices, so that all kinds of intelligent devices can be operated in the park management platform to realize the wisdom of park management. The intelligent management system is divided into three management platforms as follows.

(1) Intelligent Asset System

The Jinshui River project site is densely populated with large seedlings, and this renovation and upgrading requires replanting of the current vegetation, through the "Mr. Tree" management system to identify the current seedlings and planning to plant additional seedlings, the current seedlings for system statistics, new seedlings from the field to transport and point planting for the whole process of management, while as a later

management and maintenance Provide identity certification and supervision of the rising trend. Specifically, it includes the following aspects: (1) construction of tree traceability files, control of the park's green assets (2) scientific tree maintenance and management based on real-time monitoring and big data analysis (3) tree sentiment, public fun interaction, spread of scenic culture and ecological civilization.

The Jinshui project site large seedlings, increase in the engineering need to the status quo of vegetation replanting, through "Mr. Tree" management system of the status quo and planning to add verification of planting seedlings, status seedling system statistics, new seedling planting from all appearances, transport and point to the whole process of management, at the same time as the custody late provide identity authentication and growth regulation. Specifically, it includes the following aspects :(1) the establishment of tree tracing archives to control the park's green assets; (2) the scientific maintenance and protection of trees based on real-time monitoring and big data analysis; (3) the communication of scenic culture and ecological civilization through the interaction of public interest with trees.

(2) Intelligent management and maintenance system

Mainly includes the arrangement of wisdom facilities and interactive facilities, as well as follow-up equipment repair management, such as interactive screen, wisdom runway, intelligent sitting bench, intelligent guide system and other wisdom facilities arrangement and early warning repair management. 3、Wisdom supervisory system: mainly for the shore monitoring system for wisdom enhancement, digital management and statistical analysis of the flow of people in and out of the riverfront park, the formation of quantitative data on the park management and operation and maintenance and facilities, and the arrangement of the increase and decrease of special activities for systematic analysis and refinement, to facilitate management. At the same time, it can be used as an intelligent supplement to the early warning system in smart water, creating a safe river and smart park. Provide scientific management and comprehensive application technology platform for integrated management and daily operation of riverside. In this technology platform to achieve the waterfront park after the completion of the operation of energy savings and labor cost reduction. Among them, the smart park system architecture should use the Internet, data, cloud computing, artificial intelligence and other modern information technology deployment design, respectively, perception layer, basic hardware layer, basic platform layer, business application layer and application display layer, should be to enhance the venue operation efficiency, and user experience as the goal-oriented, to achieve the venue IOT, 3D visualization, intelligent, humanized management.

3.5 Construction Organization Design

3.5.1 Construction infusion

The water-related buildings of this project are arranged to be constructed during the non-flood period (October to April), and the diversion standard is taken as one in 10 years during the non-flood period. The cofferdam is considered to be not less than 50cm high, mainly involving landscape weir, part of the shore protection construction, part of the stack construction, pipeline relocation and so on. According to the actual characteristics of the project, a diversion weir is set for the section from Caiyuan Road to Zhongzhou Avenue.

(1) River construction diversion: The river diversion is divided into Phase I construction diversion and Phase II construction diversion, with Phase I construction diversion for the construction of the left bank or right bank of the river and Phase II construction diversion for the construction of the other bank of the river. A longitudinal cofferdam is arranged along

the river, and a transverse cofferdam is arranged every 300~500 meters between the longitudinal cofferdam and the shoreline, and the cofferdam adopts woven bagged soil cofferdam.

(2) Weir dam construction diversion: Weir dam construction diversion adopts phased diversion, the first phase of construction diversion for the construction of the left or right section of the weir dam, the second phase of diversion for the construction of the other end of the weir dam.

(3) sluice gate construction diversion: sluice gate construction diversion is divided into a construction diversion and the second phase of construction diversion, a construction diversion for the left half or right half of the sluice gate construction, the second phase of construction diversion for the other half of the sluice gate construction.

(4) Bridge pile construction diversion: the bridge construction diversion is divided into the first phase construction diversion and the second phase construction diversion, the first phase construction diversion is for the construction of the left bank or right bank of the bridge, the second phase construction diversion is for the construction of the other bank of the bridge. After the bridge construction is completed, the cofferdam will be dismantled and transported out.

(5) pumping stations, interceptor pipelines and drainage outlets, bridge bottom penetration and other projects using the river diversion project, and embankment construction synchronization.

3.6 Associated Facilities

According to AIIB's Environmental and Social Framework (ESF), “associated facilities" are defined by the following principles: (a) directly and substantially related to the Project; (b) concurrent with or planned for the Project; and (c) necessary for the viability of the Project, which would not be constructed or expanded if the Project did not exist.

According to the above definition of associated facility, based on the feasibility study report submitted by East China Survey and Design Institute Co., Ltd. in March 2022, Guojiazui Reservoir, South Interception Ditch and Integrated Jinshui River Management Sub-project together constitute the Jinshui River flood control and drainage system. Therefore, Guojiazui Reservoir is an associated project of the whole Integrated Jinshui River Management Sub-project. Since the South Interception Ditch Project are at planning stage and does not meet the three requirements for associated facilities in the Environmental and Social Management Planning Framework (ESMPF), it cannot be considered as an associated project of this project.

According to the "Zhengzhou Guojiazui Reservoir Dam Inspection Report" (Yellow River Survey, Planning and Design Institute Co., Ltd., 2021), the dam of Guojiazui Reservoir, was severely damaged due to the impact of heavy rainfall washing. In addition, there are obvious transverse cracks in the hardened road surface at the top of the dam, and some of the land inside the dam body is loose and uncompact. The Development and Reform Commission of Erqi District, Zhengzhou City, approved the preliminary design of Guojiazui Reservoir Restoration and Construction Reinforcement Project in January 2022. According to the Preliminary Design of Guojiazui Reservoir Restoration and Construction Reinforcement Project in Erqi District (Yellow River Survey, Planning and Design Institute Co.), the restoration works include:

a) Dam: the original dam body and temporary filling part was excavated and refilled, and

the surface layer of the dam was filled with 1m post-colluvium soil. Dam top elevation 165.0m, width 10m, new asphalt concrete pavement, 313m long.

b) Spillway: the spillway inlet section for masonry, new spillway control gate, the bottom of the gate elevation is 159.0m, a total of 3 holes gate, gate size is 5.4m × 3.5m. the spillway a bright channel section, a steep slope section, a level of dissipation pool section, two steep slope section, two dissipation pool section, three steep slope section, three dissipation pool section, tailwater channel section for masonry.

c) Flood release passage: a new flood relief cave is built at the temporary spillway on the right side of the dam, with a total length of 331.4m.

d) Traffic road: the reservoir set up a permanent external traffic road, from Songshan South Road connecting the reservoir dam to the right bank of the spillway, the length is 1.15km.

e) New reservoir management room: 300 square meters, flood control warehouse 200 square meters, and additional reservoir monitoring and surveillance system

f) Additional automated monitoring facilities: rainwater automatic monitoring system, reservoir monitoring system, monitoring the operation of the dam, and spillway.

g) Reservoir area restoration and dredging: the average depth of excavation in the reservoir area is 12m, with a total of 3.53 million square meters of earth excavation. The bottom of the reservoir is dredged to an elevation of 147.0m, with a dredging volume of 500,000 cubic meters.

The construction unit of Guojiazui Reservoir Restoration Construction Reinforcement Project is Erqi District Agricultural and Rural Working Committee, and the contractor is China Water Conservancy and Hydropower Twelfth Engineering Bureau Limited, which entered the construction site on March 4, 2022. Supervision unit is Henan Zhongshang Engineering Consulting Co., Ltd, responsible for construction quality and progress supervision. By the end of May 2022, the completed works include: the dam has been filled to 163.5m elevation, the concrete block slope protection at the upstream of the main dam section is basically completed; the inlet section, cave section, outlet energy dissipation and open channel section of the flood relief tunnel are basically completed, the maintenance platform of the opening and closing tower is basically completed; the spillway is dredged, the reservoir area has been dredged and expanded by about 1.2 million m^3, with about 2.4 million m^3 remaining. It is expected that the Guojiazui Reservoir restoration and reinforcement project will be completed in the second half of 2022.

The permanent land acquisition of 524 mu for the Guojiazui Reservoir Restoration and Construction Reinforcement Project has been completed by the Agricultural and Rural Working Committee of Erqi District by the end of October 2021 in accordance with the comprehensive area land price standard published by Henan Province ([2016] No. 48), and the compensation for land acquisition has been compensated. No housing demolition is involved. The construction of the project temporarily occupies 25 mu of state-owned river bank land and deserted beach land, which does not involve compensation. At present, land acquisition compensation and other compensation has been completed, no residual problems and representations complained of occurrence.

Because Guojiazui Reservoir is currently under intense construction process, and the implementation unit of the project (Erqi District Agricultural and Rural Work Committee), project management agency (Water Resources Bureau), project funding sources

(domestic financial allocation funds), etc. are not associated with the Integrated Jinshui River Management Sub-project, related land acquisition compensation and other immigration implementation information is temporarily difficult to collect so Guojiazui Reservoir restoration construction reinforcement project due diligence of resettlement survey, will be organized by the Zhengzhou Urban and Rural Construction Bureau during the monitoring period of the project implementation (before the end of December 2022). This action is included in Chapter 6.3 Implementation Plan and Table 6-3 of the RAP, and in Table 9-2 Social Management Plan of this report.

The Flood Control and Drought Relief Command of Erqi District, Zhengzhou City issued the "Emergency Plan for Flood Control of Guojiazui Reservoir in Erqi District" on May 30, 2022. When the reservoir level is lower than the design flood level, it is dispatched by the Erqi District Rural Working Committee, and when the reservoir level is close to or exceeds the design flood and there is an emergency situation, it is dispatched by the Erqi District Flood and Drought Control Command. During the construction period, the reservoir will remain empty and the flood level will be 152 meters. The operation and scheduling plan of Guojiazui Reservoir after the completion and operation of the reinforcement project is as follows.

（1） Flood within design standard

The water level before the flood exceeds 152 meters, through the flood release tunnel to open the gates and release water to ensure that the reservoir area is running empty. The main flood water level exceeds 152 meters, through the flood relief hole to open the gates to release water, so that the reservoir water level back down to below the flood limit level.

（2） Design over standard flood

When encountering a flood of more than 1 in 100 years, the water level exceeded 160.65 meters, the spillway caverns and spillway gates will be fully opened to release flood water. After the flood, the water level of the reservoir is restored to 152.0 meters.

Guojiazui reservoir daily engineering maintenance, hydraulic observation, inspection and other work will be conducted by Erqi District Agricultural and Rural Work Committee. According to the "reservoir dam safety appraisal" (Water Construction Management (2003) No. 271), Article 5 of the provisions of "the dam to implement a regular safety appraisal system, the first safety appraisal should be carried out within 5 years after the completion of acceptance, and later should be carried out every 6-10 years. Operation encountered a major flood, a strong earthquake, engineering accidents or anomalies affecting the safety of the project, should be organized after the special safety appraisal". Guojiazui reservoir restoration construction reinforcement project is expected to be completed in the second half of 2022, is expected in 2023 by the Erqi District Rural Working Committee to organize the dam safety appraisal. The construction quality and dam safety appraisal of the Guojiazui Reservoir restoration and reinforcement project will be monitored and reported in the environmental monitoring report during the implementation period.

Figure 3-21 Construction site of Guojiazui reservoir restoration and construction reinforcement project (March 2022

4 Environmental and Social Baseline

4.1 Regional Background

4.1.1 Geographical location and administrative division

Zhengzhou is the capital of Henan Province and an important transportation hub in the country. It is located in the central and northern part of Henan Province and belongs to the middle and lower reaches of the Yellow River and the transition zone from the northeast Hebei to the Yellow and Huai Plain in the Fuyu Mountain Range. It is connected to Kaifeng in the east, Luoyang in the west, Xinxiang and Jiaozuo in the north, and Xuchang and Pingdingshan in the south. Its geographical location is between 112°42′-114°14′ East longitude and 34°16′-34°58′ North latitude.

Zhengzhou City has 6 municipal districts (Zhongyuan District, Erqi District, Guancheng District, Jinshui District, Shangdi District, Huizi District, of which Shangdi District is an enclave), 1 county (Zhongmou County), and 5 county-level cities (Gongyi City, Xingyang City, Xinmi City, Xinzheng City, Dengfeng City) under its jurisdiction. The built-up area is 549.3km2, and the built-up area of the city is 830.97km2, with an urbanization rate of 82%. By the end of 2020, the total population of the city will reach 12.45 million, including 10.25 million urban population.

4.1.2 Topography

Zhengzhou City is located in the eastern part of the Qinling Mountains and the transition zone between the second and third geomorphic terraces of China. The general topography is high in the southwest and low in the northeast, with a step-like descent, from the tectonic erosion of low and middle mountains in the west and southwest, gradually descending into tectonic denudation hills, loess hills, inclined (post) plains and alluvial plains, forming a more complete geomorphic sequence. Among them, the western and southwestern low and middle mountains are composed of Songshan and Minshan respectively, both of which are spread in an east-west direction nearly parallel to each other in the western middle zone and southwestern edge. The topographic elevation of Songshan Mountain is generally 500-1200 meters, with a relative height difference of 30-600 meters, forming the natural boundary between Dengfeng, Xinmi, Gongyi and Xingyang, and its highest peak, Yuzhai Mountain, is 1512.4 meters above sea level. The topographic elevation of Minshan is generally 500-800 meters, with a relative height difference of 200-400 meters, forming the southwestern boundary of Zhengzhou City; the tectonic denudation hills are located in the front of the middle and low mountains, with topographic elevation of 200-500 meters and relative height difference of 100-200 meters. Due to the influence of stratigraphic lithology, the distribution area of general tuff and sandstone often forms the positive terrain of garden hill and bald ridge, while the distribution area of shale and mudstone mostly forms the negative terrain of relative lowland; loess hills are located in the northwestern and north-central areas of the region, with the terrain elevation of 200-300 meters, relative height difference of 30-150 meters, the ground gully is crisscrossed, and the terrain is fragmented; inclined (post) plains are located in front of the hills, nearly north-south strip Spread in the central area. The topographic elevation is 100-150 meters, from west to east, longitudinally inclined from the front of the hill to the downstream, with a general slope of 3-10 degrees, from south to north, and laterally in the form of undulating waves between the hills; the alluvial plain is widely distributed in the eastern area, formed by the alluvial deposit of the Yellow River, with flat terrain, the ground elevation is 80-100 meters, inclined from northwest to southeast.

The project starts from Erqi District in the southwest of Zhengzhou City, and passes

through Zhongyuan District, Jinshui District and Zhengdong New District from southwest to northeast in order to reach the intersection of Jinshui River and Dongfeng Canal. The geomorphological type is the alluvial plain area of the Yellow River, with small topographic undulations and elevations between 106m and 132m.

4.1.3 Soil

The soil of Zhengzhou City belongs to the brown soil zone of deciduous broad-leaved forest and dry forest and grassland in the warm temperate zone - the hilly loess zone in northwest Henan. The surface is widely covered with alluvium and floodplain of the fourth system, and locally with wind deposits. Its soil characteristics to sandy tide soil most, in the north of the Longhai line to soft and hard plastic sub-clay, sub-sand soil; in the south of the Longhai line to slightly wet sandy soil and moist, semi-dry hard loess-like sub-sand soil, sub-clay soil; local riverbed, river floodplain and fish ponds in the distribution of silt sub-clay soil. The entire surface soil is loose. The northern and eastern areas are connected with the modern floodplain of the Yellow River, and the soil is more fertile, and the surface is mostly used as farmland and fish ponds; the soil in the southern area is relatively poor, and the surface is mostly used as dry land and orchards. The depth of permafrost in winter is less than 20cm.

4.1.4 Climate

Zhengzhou city has a continental warm tropical monsoon climate with large temperature variations. It is hot and rainy in summer and cold and dry in winter, with four distinct seasons. The average annual temperature is 14.9℃, the average temperature in July is 27.8℃, and the extreme maximum temperature is 43.3℃; the average temperature in January is -0.3℃, and the extreme minimum temperature is -17.9℃. The average annual rainfall is 640mm, with most of it falling in summer. The maximum annual rainfall is 866.8mm and the minimum annual rainfall is 439.3mm. the maximum snowfall thickness is 150mm and the maximum snow thickness is 230mm. the maximum annual freezing depth is 270mm. the average annual evaporation is 2048.8mm, the maximum in June is 341.4mm and the minimum in January is 80.5mm. the frost period is from October to April, but in the plains, the frost-free period can reach 200mm. In the plains, the frost-free period can be more than 200 days. The average wind speed is 2.5m/s, and the maximum wind speed is 24m/s. The number of sunshine hours is 4430.7h, and the average sunshine hours is 2189.5~2352.2h.

Precipitation in Zhengzhou is unevenly distributed in time and space, with a multi-year average rainfall of 644.55mm and a maximum of 990.6mm (1983), with rainfall mostly concentrated in June to September, accounting for about 60% of the annual rainfall; spatially, precipitation is unevenly distributed, with a general trend of decreasing year by year from southwest to northeast; the multi-year average evaporation is about 1850mm.

4.1.5 Geological structures and earthquakes

The project area is located in the southwest of the Yellow Huaihai Depression (I2) of the North China Quasi-Terrane (I), and the new tectonic zone belongs to the Yuwan Uplift-Depression Zone (III). The main tectonic line is north-west or near east-west. The main fracture structures in the area are: Jiangang Fault, Zhengzhou-Kaifeng Fault, Lao Cao Chen Fault and Sushui Fault Zone.

4.1.6 Hydrology

There are 35 rivers of various sizes in Zhengzhou, which belong to two major water

systems, the Yellow River and the Huai River. Among them, the Yellow River system includes the Yiluo River, the Sishui River, the Kusui River, etc., with a basin area of 1878.6 km^2 , accounting for 25.2% of the total area of the whole territory; the Huai River system includes the Ying River, the Shuangji River, the Jialu River, the Sosu River, the Qili River, the Chao River, the Xiaoqing River, the Jinshui River, the Xionger River and the Dongfeng Canal, etc., with a basin area of 5567.6 km^2, accounting for 74.8% of the total area of the territory.

The Jialu River belongs to the Huaihe River system, and is a tributary of the Shaoying River, a tributary of the Huaihe River. It originates in the Sanshuiyu Village, Yangshugang Village, Baizhai Township, Xinmi City, and flows northeast through Houzhai and Xiliu Lake in Zhengzhou City to Laohu Chen in the northern suburbs. 137km long, with a basin area of 2750km^2 . The upper reaches of Jialu River have two medium-sized reservoirs, Jiangang and Changzhuang, controlling a basin area of 195km^2 .

Jinshui River is the main secondary tributary of Jalu River, which originates from the source of Jinshui River in Houzhai Township, Erqi District, Zhengzhou, and flows from southwest to northeast through Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District.

There is one reservoir in the upper reaches of Jinshui River - Guojiazui Reservoir, which is located in the upper reaches of Jinshui River, a tributary of Jialu River, in Guojiazui Village, Houzhai Township, Erqi District, southwest of Zhengzhou. The reservoir controls a watershed area of 13.15km2, with a main stream length of 5.27km and a river channel ratio of 6.25‰. It is a small category I reservoir mainly for flood control, taking into account the comprehensive use of agricultural irrigation, groundwater connivance and aquaculture, etc. The design flood control standard is one in 50 years and one in 1000 years.

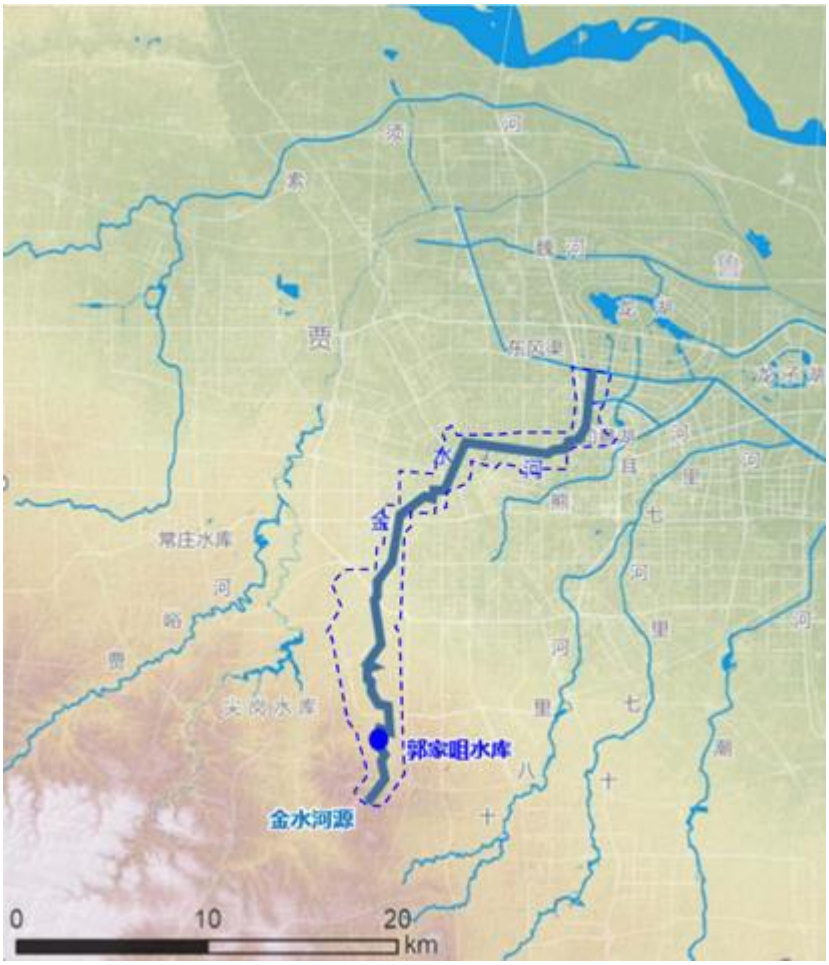


Figure 4-1 Water system map of Zhengzhou city

4.1.7 Groundwater

According to the characteristics of groundwater media and burial and storage conditions, the groundwater type in Zhengzhou is mainly loose rock pore water. The shallow aquifer group refers to the groundwater in which the depth of the bottom plate of the aquifer is less than 60m. The medium-deep aquifer group refers to the groundwater with the top plate buried at a depth of 50-100m and the bottom plate buried at a depth of 220-280m.

The increase and decrease of the funnel in the urban area is directly related to the amount of groundwater extraction, and the larger the amount of extraction, the larger the area of the funnel will be. Under the current conditions, the shallow groundwater landing funnel is located in the urban area of Zhengzhou City, Sushui and Gouzhao, with the 85 m water table line as the distribution area of the funnel, covering an area of about 153.65 km2. The natural flow direction of shallow groundwater is from southwest to northeast. However, due to the influence of mining, the direction of runoff is locally changed. The discharge mode is mainly by mining and underground runoff.

The formation and development of the middle and deep groundwater landing funnel in the central city of Zhengzhou is mainly controlled by the mining volume. The landing funnel formed by middle and deep groundwater mining is distributed in the central city of Zhengzhou, from the fourth ring road in the west to the 107 national highway in the east, from the Lianhuo expressway in the north to the third ring road in the south, and the central area of the funnel is located in the automobile manufacturing plant on Longhai East Road.

The center of the funnel is located in the Longhai East Road Automobile Manufacturing Plant, the lowest water level in the funnel area is 17.5m, and the funnel area is about 72 km.^{2} The middle and deep groundwater receives cross-flow recharge and lateral runoff recharge from shallow groundwater. The discharge is mainly by mining and runoff, and the direction of discharge is from the non-falling funnel area to the falling funnel area.

4.1.8 Water Resources Status

According to the 2018 Zhengzhou Water Resources Bulletin, the total water resources in Zhengzhou in 2018 were 727.82 millionm^3 , of which the surface water resources were 364.24 millionm^3 , the groundwater resources were 545.16 millionm^3 , and the double counting of surface water and groundwater was 181.58 millionm^3 . The total water supply in Zhengzhou in 2018 was 2,070.64 millionm^3 , of which the surface water supply was 1,105.03 millionm^3 , groundwater supply is 701.07 millionm^3 , other water sources (sewage reuse and rainwater use) supply 264.55 millionm^3 . 2018 total water consumption is 2,070.64 millionm^3 , of which domestic water consumption is 659.96 millionm^3 , agricultural water consumption is 423.18 millionm^3 , industrial water consumption is 526.69 millionm^3 , ecological environment water consumption is 460.81 millionm^3 .

4.1.9 Flora and fauna resources

There are 84 plant species in the main and secondary roads in the central city of Zhengzhou, including 44 species of trees, 27 species of shrubs, 12 species of ground cover plants and one species of vines. There are 35 species of street trees native trees, and the life type spectrum shows that street trees are dominated by tall trees, especially deciduous tall trees. There are 13 species of shrubs native plants. The main and secondary road greening plants in the central city of Zhengzhou are the keystone tree species of Yingtong, the backbone species of acacia, lady's mantle, ash, hairy poplar, purple leaf plum, full marginal leaf luan, thousand-headed toon, maple poplar, acacia. The largest number of hedge shrubs in the road green space is golden-leaved maidenhair, followed by holly weed, loblolly cypress, small-leaved maidenhair, red-leaved heather, purple-leaved berberis; the largest number of other shrubs is city flowering moon, followed by violet, loblolly cypress, holly weed; the largest number of ground cover is onion lily, followed by cool-season lawn grass, red-flowered edelweiss, etc.; vertical greenery plants are climbers.

4.1.10 Soil erosion

The project area is located in a plain area, the soil erosion type is hydraulic erosion, the erosion form is mainly surface erosion, the erosion intensity is slight, the average soil erosion modulus in the project area is 190t/(km^2-a), and the project area belongs to the provincial key area of soil erosion control in Zhongtiao Mountain of Fuyu Mountain.

4.1.11 Jinshui River Basin Drainage System

(1) Status of the Jinshui River Basin Wastewater System

Drainage system: In the Jinshui River basin, except for a small amount of combined flow of rainwater and sewage in the old city, all new roads have separate flow of rainwater and sewage. According to the results of on-site research, the area with more serious combined flow is mainly near the North Gate, where interceptor wells and interceptor pipes have been built at the end of the current situation to ensure that sewage does not enter the river during the dry season. Other areas have sporadic mixed flow phenomenon.

a) Guojiazui Reservoir ~ South-North Water Diversion Section

The current situation of sewage in this area belongs to the collection area of South Third Ring Sewage Treatment Plant, and according to the planning, this area belongs to the collection area of planned Nan Cao Sewage Treatment Plant, which is currently under construction. At present, we mainly rely on Huangguo Road and South University Road to collect sewage from the surrounding areas to the South Third Ring Sewage Treatment Plant.

b) South-North Water Transfer ~ Jinshui Road Section

This area belongs to the collection area of Zhengdong New District Sewage Treatment Plant, and the sewage network system in this area is better, but there are problems such as old and damaged pipes and insufficient capacity of pipes at local locations. The current situation of some sewage pipes is located in the opening line of the river, and the appearance is poor, and there is a risk of water blockage and backflow.

c) Jinshui Road ~ Dongfeng Canal

This area belongs to the collection area of Matougang sewage treatment plant. The sewage collection network in this area has been formed, and it is mainly discharged to the north to Matougang sewage plant through the main sewage pipe of Jing San Road - Zhong Zhou Avenue. Some of the sewage pipes are located in the opening line of the river, with poor appearance and risk of water blockage and backflow.

Figure 4-2 Sewage system zoning along the Jinshui River

(2) Status of the drainage outfalls in the Jinshui River basin

At present, there are various types of outfalls along the Jinshui River, with a total of 329 round outfalls, ranging in size from DN100 to DN1800, and 55 square outfalls, with a maximum size of 8.5m×3.8m. According to the site survey, the current outfalls along the river are relatively simple, and the coordination with the landscape is poor.

Figure 4-3 Part of the mixed flow outlet along the Jinshui River and the sewage pipeline in the river

(3) The basic situation of the current sewerage network along the Jinshui River

Sewage pipes along the river are mainly distributed in the section from Hanghai Road to Ruhe River, the future road to Zhongzhou Avenue section, for the interception of sewage pipes on both sides of the river. Some of the current sewage pipes and their ancillary structures (sewage wells, etc.) are staggered in the current Jinshui River channel, the slope of the river, seriously affecting the landscape of the Jinshui River channel. At the same time, due to the age of the construction of the pipeline, in the current river in the sewage east trunk pipe there are difficulties in the management and maintenance of the pipeline during the operation of sewage accidents occur frequently, there have been broken sewage pipes, sewage from the broken pipe overflow into the river, rainfall, sewage backwash to the river, etc., pollution of the water quality of the Jinshui River.

4.2 Socio-economic baseline

The project involves three districts in Zhengzhou: Jinshui District, Erqi District, Zhongyuan District and Zhengdong New District.

(1) Social and economic situation of Jinshui District

Jinshui District, under Zhengzhou city of Henan Province, is located in the northeast of Zhengzhou city, east of Zhengdong New District, south of Guancheng Hui District, Erqi District, west of Zhongyuan District, north of Huiji District. It is between 113°40' e to 113°47' e and 30°50' N to 34°57' N. The maximum distance between east and west is 22.9 kilometers, the maximum distance between north and south is 17.2 kilometers, with a total area of 136.66 square kilometers.

In 2020, the GDP of Jinshui District was 175.25 billion yuan, up 6.7% year on year. Revenue in local governments' general public budgets increased by 7.1% to 6.58 billion yuan, of which tax revenue accounted for 94.5%.The per capita disposable income of urban residents rose 7.8 percent to 49,601 yuan and that of rural residents rose 8.5 percent to 28,224 yuan.

In October 2021, it was selected into the list of "top 100 Smart Cities in China 2021".

(2) Social and economic situation of Erqi District

Erqi District is one of the central urban areas of Zhengzhou city, Henan Province, located between 113°30 '~ 113°41' EAST longitude and 34°36 '~ 34°46' north latitude, located in the southwest of the downtown center of Zhengzhou, the total area under its jurisdiction is 156.2 square kilometers, the built-up area is 36.25 square kilometers. Erqi district has a warm temperate continental monsoon climate and transitional climate characteristics, with frequent alternation of warm air masses. Up to 220 years, Erqi district jurisdiction 15 streets and 1 town, district government resident Huaihe road streets.

In 2020, the annual GDP of Erqi District reached 76.02 billion yuan, with a year-on-year growth of 0.8%.Among them, the added value of the primary industry was 300 million yuan, down 2.6% year on year; The added value of the secondary industry was 17.87 billion yuan, up 5.0% year on year; The total industrial added value was 6.49 billion yuan, up 2.9% year on year; Construction industry added value of 11.41 billion yuan, up 6.7% year on year; The tertiary industry added 58.14 billion yuan, down 0.7% year on year, and the transportation, storage and postal services added 6.57 billion yuan, down 6.3% year on year. Wholesale and retail added value 6.98 billion yuan, down 2.8% year on year; The added value of accommodation and catering industry was 1.84 billion yuan, down 12.4% year on year; The added value of the financial industry was 9.78 billion yuan, up 3.8% year on year; The added value of real estate industry was 9.35 billion yuan, down 5.4% year on year; The added value of for-profit services reached 14.54 billion yuan, up 3.8% year on year; The added value of non-profit services was 9.06 billion yuan, up 1.3% year-on-year. Tertiary industrial structure 0.1:23.5:76.4.

In September 2021, it was selected as one of the "2021 National Top 100 Comprehensive Strength Regions".

(3) Social and economic situation of Central Region

Zhongyuan District is one of the central urban areas of Zhengzhou, Henan Province. It has 14 sub-district offices and covers an area of 193 square kilometers. In 2020, the GDP of The Central Region reached 70.93 billion yuan, with a year-on-year growth of 1.2%.Revenue in the general public budget reached 5.44-billion-yuan, 101.25 percent of the annual target. Investment in fixed assets reached 36.99 billion yuan, up 10.2%;Per capita disposable income increased by 3 percent.

In January 2021, Zhongyuan District was rated as the fourth batch of Food safety demonstration counties (cities and districts) in Henan Province.

(4) Social and economic situation of Zhengdong New Area

As of October 2021, Zhengdong New Area has jurisdiction over 10 streets, 1 town, 1 township, and 3 industrial agglomeration areas or professional parks. The district management Committee is located at 86 Zhonghuan South Road, Longhu. The management scope starts from Zhongzhou Avenue in the west, Wansan Road in the east, Yellow River in the north and Longhai Railway in the south. The planned control area is 370 square kilometers and the jurisdiction area is 260 square kilometers. In 2020, The total GDP of Zhengdong New Area is 1,1396265 million yuan, among which the primary industry is 386.09 million yuan, the secondary industry is 1,584.963 million yuan, and the tertiary industry is 9,772693 million yuan.

Table 4 -1 List of main indicators of socio-economic development in the project impact area (2020)

City and County	Land area (square kilometers)	Per capita disposable income of urban residents (yuan)	Per capita disposable income of rural residents (yuan)	GDP per capita (yuan)	Total fiscal revenue (billion yuan)	Gross Production Index (%)
Jinshui District	136.66	49601	28224	116152	65.80	106.7
Erqi District	156.2	45946	27778	73893	32.71	107.4

Zhengdong New District	370	45991	23443	134395	97.80	106.0
Zhongyuan District	193	42479	26459	77521	76.68	106.7

Data source: Statistical yearbooks or statistical reports on national economic and social development collected by the social assessment survey team from each district.

4.2.1 Demographics

According to the Zhengzhou Statistical Yearbook 2020, by the end of 2020, Zhengzhou had a total household population of 3,085,000 households and 10,352,000 people, including 5,281,000 males (51.0%) and 5,071,000 females (49.0%). The ratio of men to women is 104.1:100. 7.721 million people, or 74.6%, are in agriculture, and 2.631 million people, or 25.4%, are in non-agriculture. The population density was 407.7 persons/square kilometer.

According to the statistical report on national economic and social development of each district, as of the end of 2020, there were 285,000 households and 848,000 people registered in Erqi District, including 432,000 males, accounting for 50.5%, and 416,000 females, accounting for 49.5%. The ratio of men to women is 104:100. 76,000 people, or 9%, are in agriculture, and 772,000 people, or 91%, are in non-agriculture. The population density is 5426.5 people/square kilometer.

Zhongyuan District has a total household population of 258,000, 795,000 people, including a male population of 402,000, accounting for 49.8%; female 393,000, accounting for 50.2%. The ratio of men to women is 102:100. 67,000 people, or 8%, are in agriculture, and 728,000 people, or 92%, are in non-agriculture. The population density is 4118.4 people/square kilometer.

Jinshui District has a total registered population of 452,000 households and 1,333,000 people, of which 686,000 are male, accounting for 51.1%; 647,000 are female, accounting for 48.9%. The ratio of male to female is 106:100. 104,000 people are in agriculture, accounting for 8%; 1,229,000 people are in non-agriculture, accounting for 92%. The population density is 9,976.3 people/square kilometer.

Zhengdong New District has a total household population of 239,900 households, 741,300 people, of which 394,900 are male, accounting for 53.27%; 346,400 are female, accounting for 46.73%. The ratio of men to women is 114:100. 182,700 people, or 24.65%, are in agriculture, and 753,500 people, or 29.8%, are in non-agricultural areas. The population density is 2841.3 people/square kilometer.

Table 4- 2 List of population in project counties and districts Units (million) (2020)

Demographic indicators	**Erqi District**	**Zhongyuan District**	**Jinshui District**	**Zhengdong New District**
Total number of households at the end of the year (10,000 households)	28.5	25.8	45.2	23.99
Total population at the end of the year (10,000 people)	84.8	79.5	133.3	74.13

Male (10,000)	43.2	40.2	68.6	39.49
Female (10,000)	41.6	39.3	64.7	34.64
Population density (persons/km²)	5426.5	4118.4	9976.3	2851.3
Agricultural population (10,000 people)	7.6	6.7	10.4	18.37
Urban population (10,000 people)	77.2	72.8	122.9	54.77

Source: Population data are obtained from the statistical yearbook of 2020 or the statistical report on national economic and social development of each project area.

4.2.2 Ethnic minority population in the project area

Zhengzhou is a typical city with scattered and mixed minority populations, and is the third batch of demonstration cities in China for the service management of minority migrant populations. By the end of 2020, there were 53 ethnic minorities in the city, including Hui, Manchu, Mongolian, Zhuang and Tujia, with a resident minority population of 155,000, including 109,000 in urban areas. There are 6 counties (cities and districts) with minority populations above 10,000, and 51 townships (towns and offices) with more than 1,000 people. There are 14 ethnic primary and secondary schools. Halal food production and operation units more than 3000. These are not in the project area.

The Zhengzhou Urban and Rural Construction Bureau and the social survey team conducted a series of public participation activities by conducting special on-site surveys on the situation of ethnic minorities from February 7 to 18, 2022, and from March 8 to 15, 2022. In accordance with the identification criteria established in AIIB's Environmental and Social Framework ESS3 - Ethnic Minority Guidelines, detailed information was obtained on the population and ethnic composition of each project area, identification of ethnic minority villages, and whether ethnic minorities live together.

The beneficiary area of this project involves towns/streets and communities along Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District of Zhengzhou City, etc. The direct beneficiary population along the project line is about 1,768,000 people, with 2,105 ethnic minorities.

Among them, ethnic minorities are mainly the scattered Hui (98.9% of the minority population in the project area), Mongolian, Manchu and Tu, accounting for 0.89% of the total population. There is no minority population living in the project area. The minority population is small and scattered, and most of them are Hui, Mongolian, Manchu, Tu and other minority populations who entered the project area due to marriage and work transfer.

Ethnic minorities in the project implementation area enjoy the same social and public services as Han Chinese. In terms of social welfare, rights, security, cultural customs and living habits, there is no difference from the Han Chinese, the mainstream group in the project area.

Minorities are the indirect beneficiary population of the project construction, not the directly affected population. The proposed project will have little to no negative impact on minority populations.

Table 4-3 List of minority populations in the project area

Project Area	Total population	Ethnic Minority Population	Percentage of ethnic minority	Ethnic Minority Population

	(10,000 people)	(People)	population (%)	Composition
Erqi District	84.8	476	0.05	Hui, Mongolian, Manchu, Tu, etc.
Zhongyuan District	79.5	544	0.07	Hui, Mongolian, Manchu, Tu, etc.
Jinshui District	133.3	674	0.05	Hui, Mongolian, Manchu, Tu, etc.
Zhengdong New District	58.5	411	0.07	Hui, Mongolian, Manchu, Tu, etc.
Total	1356.1	2105	0.02	Hui, Mongolian, Manchu, Tu, etc.

Source: Population data are obtained from the statistical yearbook of 2020 or the statistical report on national economic and social development of each project area.

The ethnic minority survey found that:

(1) Four project impact areas and no minority groups that trigger the ESS3 guidelines.
(2) The four projects have very small minority populations, no traditional territories, no minority languages or traditional cultures, and no self-identified minority groups in the area of construction and implementation.

Therefore, a minority development plan is not required for this project.

Table 4-4 Ethnic Minority Identification (ESS3)

Screening criteria	Yes	No	Remarks
1. self-identifies as a member of a distinct indigenous cultural group and is recognized by others?		X	All respondents, including both ethnic minorities and Han Chinese, believe that local ethnic minorities are indistinguishable from Han Chinese and are fully integrated with Han Chinese.
2. collective attachment to geographically distinct habitats or ancestral territories within the project area and to the natural resources of these habitats and territories?		X	-
3. a customary cultural, economic, social or political system that differs from the dominant society and culture.		X	-
4. a distinct language, usually different from the official language of the country or region.		X	They have no language or role of their own. They speak the local dialect and Chinese Mandarin, and are fully integrated with the Han Chinese.

4.2.3 Project socio-economic baseline data

The socio-economic baseline data for each project implementation area are detailed in Table 4-5 below.

Table 4 -5 Socio-economic baseline data for the project area (2020)

No.	Statistical indicators	Erqi District	Zhongyuan District	Jinshui District	Zhengdong New District	Total
1	Total population (10,000 people)	84.8	79.5	133.3	58.5	1356.1
2	Of which women (10,000)	41.6	39.3	67.4	28.5	176.8
3	Sub-project direct beneficiary population (people)	84.8	79.5	133.3	58.5	1356.1
4	Number of women benefiting from subprojects (persons)	41.6	39.3	67.4	28.5	176.8
5	Low-income population (people)[4]	1027	1096	911	481	3515
6	Number of people who have been lifted out of poverty (10,000)	1.93	2.35	3.98	0.99	9.25
7	Per capita disposable income of residents in subproject sites (yuan)	45946	42479	49601	45991	\
8	Number of jobs driven by the project	152	175	147	165	643
9	Number of jobs for women driven by the project (pcs)	46	56	45	50	197
Economic Structure	GDP (0.1 billion yuan)	754,8	688.6	1752.5	654.8	3850.7
	Agriculture (10,000yuan)	0.05	\	0.5	0.4	0.95
	Industry (10,000 yuan)	177.8	230.4	264.2	159.6	832
	Service industry (10,000 yuan)	576.9	458.2	1487.8	484.8	3007.7
Energy mix	Coal (10,000 tons)	\	\	\	\	\
	Oil (10,000 liters)	\	\	\	\	\
	Natural gas (million cubic meters)	156187	\	\	\	\
	Nuclear Energy (Mew)	\	\	\	\	\
	Electricity generation (billion kWh)	\	\	\	\	\
	Renewable energy (wind, solar, biomass) (billion degrees)	\	\	\	\	\

Data source: from the project feasibility study report, and the industry and basic situation data provided by each project site and relevant government agencies, see the project feasibility study report for research methodology and coverage.

4.3 Environmental Quality Baseline

4.3.1 Surface Water

The Zhengzhou Ecological Environment Bureau has set up routine monitoring sections at the Jinshui River Zhongzhou Avenue section and the Jinshui River into the Dongfeng Canal. According to the water quality ranking data of Zhengzhou rivers in 2021 released by Zhengzhou Ecological Environment Bureau[5] , the water quality of the Jinshui River shows

[4]By the end of 2021, there will be no poor villages in the project area, no poor households or poor population under the current standard. However, the poverty phenomenon will still appear in many forms such as relative poverty and low-income population, and the poor population is equivalent to the low-income population, which mainly refers to the low-income population that will be transferred after the poor households are removed from poverty in 2019, hereby, the same below.

[5] http://sthjj.zhengzhou.gov.cn/hlszpm/index.jhtml

obvious seasonal changes. January-May of 2021, the water quality is good, satisfying the standard of Surface Water Environmental Quality Standard (GB3838-2002) II-III. After June, the water quality starts to deteriorate, and the main exceeding factors are ammonia nitrogen and total phosphorus. Under the condition of stable water replenishment, the water quality of Jinshui River is generally good in the dry season. Because of the current situation of the river local overflow of sewage wells, rainwater pipe network misconnection sewage and surface pollution in the rainy season and other external sources of pollution, after the rain, the lack of ecological recharge part of the time the water quality is not good.

Table 4-6 Jinshui River water quality monitoring results in 2021

Monitoring section	Month	pH	DO (mg/L)	COD (mg/L)	NH_3-N (mg/L)	TP (mg/L)	Cross-section composite index	Water quality category
Jinshui River into the Dongfeng canal	Jan	9	14.3	11.2	0.13	0.048	2.6	Class II
	Feb	8	12.1	10.5	0.13	0.054	2.5	Class II
	Mar	8	11	10.8	0.7	0.098	2.68	Class III
	April	8	11.5	10.5	0.23	0.042	1.9	Class II
	May	8	15.1	11	0.11	0.05	1.74	Class II
	June	8	11.1	14.1	1.5	0.188	4.1	Class IV
	July	8	7.7	15.7	2.85	0.296	6.26	Worse than V
	Aug	8	10.1	16.6	1.91	0.246	4.97	Class V
	Sep	8.71	6.8	19	0.214	0.43	4.9	Worse than V
	Oct	8	11.4	15.3	1.76	0.231	4.62	Class V
	Nov	8	12.6	13.3	1.49	0.197	4.04	Class IV
	Dec	8	10.6	11.2	1.73	0.222	4.37	Class V
Jinshui River Zhongzhou Avenue	Jan	8	14.1	11	0.16	0.039	2.1	Class II
	Feb	8	10.4	13.5	0.36	0.074	2.75	Class II
	Mar	8	9.2	10	0.84	0.102	2.89	Class III
	April	8	10.1	9.1	0.41	0.063	2.18	Class II
	May	8	8.9	8.2	0.36	0.093	2.3	Class II
	Jun	8	7.8	11.7	0.67	0.109	2.9	Class III
	July	7	6.2	21.8	2.71	0.35	6.36	Worse than V

	August	8	8.1	34.7	3.5	0.389	8.3	Worse than V
	Sep	8.32	8.1	20	0.204	0.35	4.23	Class V
	Oct	8	8.4	34	3.89	0.552	9.45	Worse than V
	Nov	8	7.8	28.8	3.59	0.424	8.29	Worse than V
	Dec	8	10.1	23.1	1.56	0.237	4.9	Class V

4.3.2 Acoustic Environment

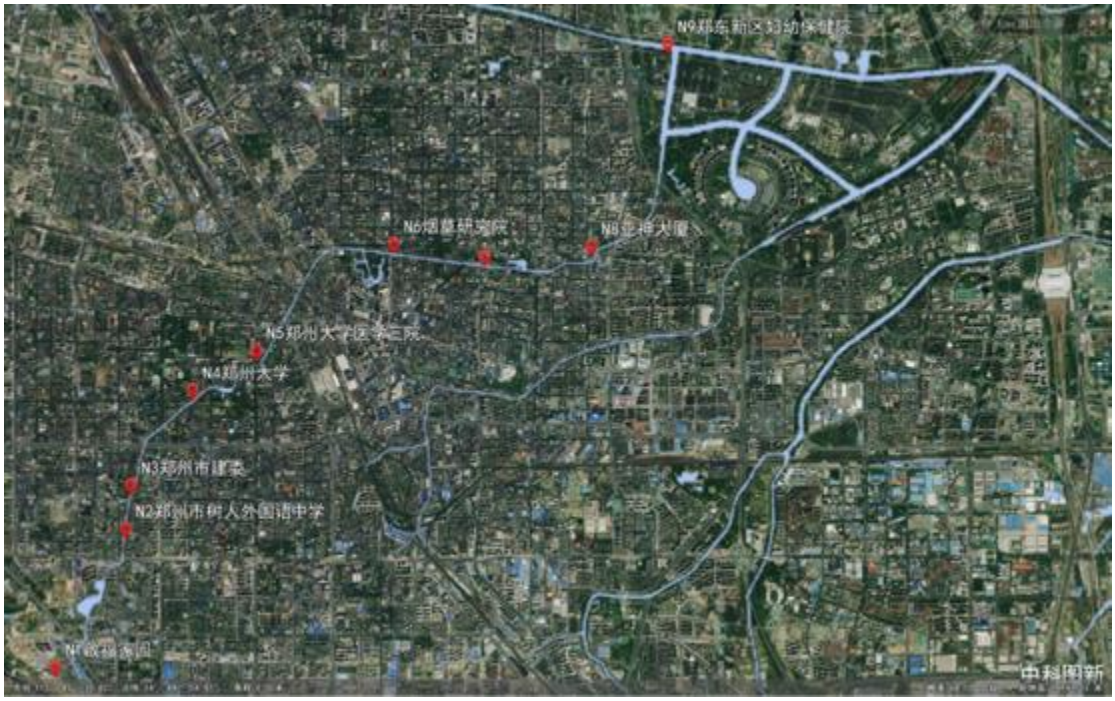
According to the report on Zhengzhou Environmental Quality in 2020, 60.5% of the total points of Zhengzhou functional areas have reached the standard[6]. Compared with the previous year, the total point attainment rate of functional areas increased by 4.3%. The arithmetic average of daytime regional sound environment quality equivalent sound level is 55.4dB(A), grade three, level is general, compared with the previous year, the sound environment quality grade is the same. 2020, the weighted arithmetic average of daytime road traffic sound environment quality in Zhengzhou is 68.5dB(A), grade two, the sound environment quality is better.

In order to understand the current situation of the sound environment quality in the project area, Zhengzhou Urban and Rural Construction Bureau commissioned Henan Province Shuoyuan Metrology Engineering Technology Research Center Co., Ltd. to monitor the status quo of acoustic environment quality in the Project area of Jinshui River comprehensive regulation project from November 9 to November 10, 2021.Figure 4-4 shows the monitoring points.

Table 4-7 List of acoustic environment quality monitoring points along the Jinshui River

Serial number	Location	Function
1#	Qifu community	Residential
2#	Zhengzhou Shuren Foreign Language Middle School	Education
3#	Zhengzhou Construction Committee	Administrative Office
4#	Zhengzhou University	Education
5#	Zhengzhou University Medical College No.3 Hospitals	Health Care
6#	Community of Zhengzhou Tobacco Research Institute	Residential
7#	Yellow River Middle School Affiliated Primary School	Education
8#	Yashin Building	Administrative Office
9#	Zhengdong New District Maternal and Child Health Center	Health Care

[6] Zhengzhou City Environmental Quality Status Bulletin 2020 - Zhengzhou Ecological Environment Bureau (zhengzhou.gov.cn)



Note: N stands for noise monitoring, and the red icon indicates the monitoring point.

Figure 4-4 Sound environment monitoring location map

Monitoring factor: Equivalent continuous A sound level.

Monitoring frequency: 2 days of continuous monitoring, 1 time each day and night.

All the monitoring points can meet the requirements of Class 1 standard limit value of Sound Environmental Quality Standard (GB3096-2008).

Table 4-8 Monitoring results of sound environment quality along the Jinshui River

Sampling time	Sampling points	Daytime measurements	Standard value (daytime)	Nighttime measurements	Standard value (night)
2021.11.9-2021.11.10	1#	53.0	55	42.3-43.2	45
	2#	52.8-53.5	55	43.2- 43.4	45
	3#	53.0-53.5	55	42.0-42.9	45
	4#	53.4	55	43.1-44.0	45
	5#	52.4-53.1	55	42.7-42.8	45
	6#	52.5- 52.8	55	42.9-43.4	45
	7#	52.1- 52.7	55	42.7-43.2	45
	8#	52.3- 52.4	55	42.5- 42.9	45
	9#	52.5-53.2	55	42.6-43.9	45

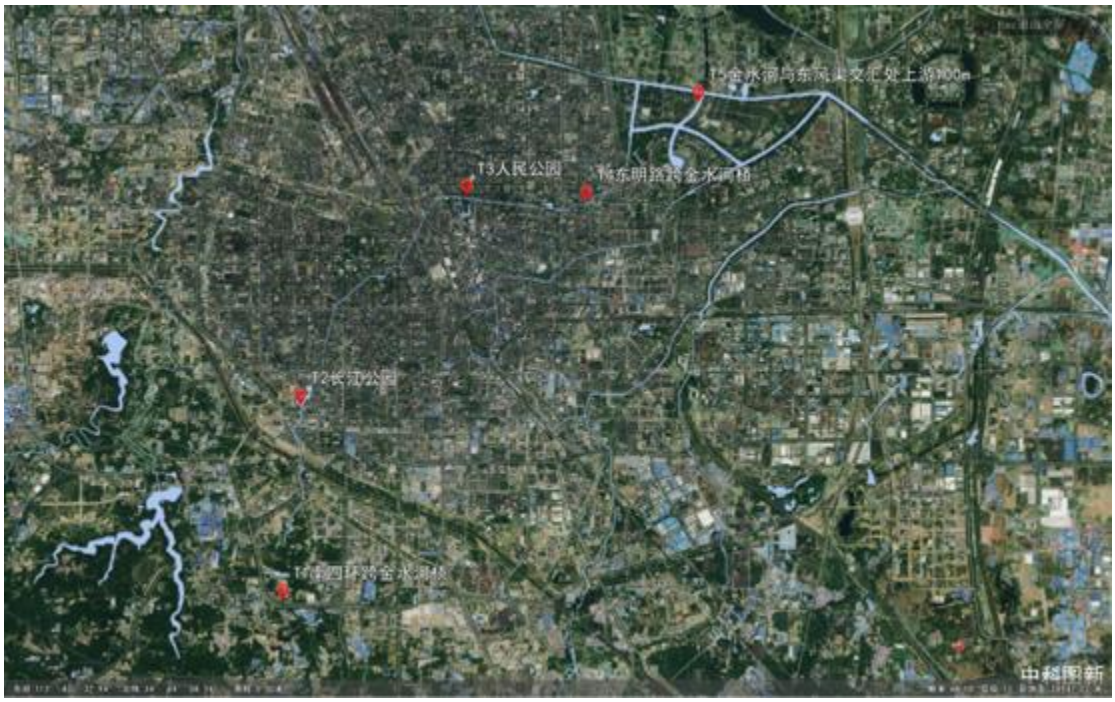
4.3.3 Air Quality

According to the "Zhengzhou Environmental Quality Status Bulletin 2020" published on the website of the Zhengzhou Ecological Environment Bureau in 2020, the air environmental quality in the urban areas of Zhengzhou City continued to be improved, with annual average concentrations and specific daily average percentile concentrations of $PM_{2.5}$, PM_{10}, SO_2 , NO_2, CO, and ozone of 86 μg/m^3 , 51 μg/m^3 , 9 μg/m^3 , 39 μg/m^3 , 1.4 mg/m^3, 182 μg/m^3. Compared with the previous year, the six major pollutants in addition to sulfur dioxide concentration remained similar, the remaining five pollutants respirable particulate matter, fine particulate matter, nitrogen dioxide, carbon monoxide and ozone concentrations are declined by 15.2%, 12.1%, 13.3%, 12.5% and 6.2%. The number of days with good air quality is 230 days, 62.8% compliance rate, 53 days more than the previous year; heavy pollution days 11 days, 15 days less than the previous year.

4.3.4 Substrate

In order to understand the quality of sediment of Jinshui River, Zhengzhou Urban and Rural Construction Bureau entrusted Henan Shuoyuan Metrology Engineering Research Center Technology Co., Ltd to set five sampling points for sediment of Jinshui River within the scope of comprehensive regulation on November 9, 2021 (Figure 4-4). T1 is located at the Jinshui River bridge across the South Fourth Ring Road near Guojiazui Reservoir, the starting point of the Jinshui River comprehensive regulation project, and T5 is located at the Dongfeng Canal, the end point of the regulation project.

Monitoring factors: pH, mercury, arsenic, lead, cadmium, copper, zinc, chromium, nickel.



Note: T stands for bottom sediment sampling location, red icon indicates monitoring point

Figure 4-5 Location map of substrate monitoring points

Table 4-9 List of monitoring results of river bottom sediment Unit: mg/kg (except pH)

Sampling time	Detection factor	T1# South 4th ring bridge over Jinshui River	T2# 100m upstream of the confluence of Jinshui River and Imperial Lake (Yangtze River Park)	T3# People's Park	T4# Dongming Road Bridge over Jinshui River	T5# 100m upstream of the intersection of Jinshui River and Dongfeng Canal	Soil Environmental Quality - Risk Control Standards for Soil Contamination of Agricultural Land (Trial) (GB15618-2018)) Risk Screening Values		Soil Environmental Quality-Soil Risk Control Standards for Construction Land (GB36600-2018) Risk Screening Value	
November 9, 2021	pH	7.95	7.66	7.04	7.87	8.01	6.5 <pH≤ 7.5	pH > 7.5	Class I sites	Class II sites
	Mercury	0.014	0.018	1.26	0.207	0.548	2.4	3.4	8	38
	Arsenic	8.72	7.17	9.14	7.43	7.31	30	25	20	60
	Lead	12.5	12.0	15.8	30.2	19.4	120	170	400	800
	Cadmium	0.10	0.11	0.44	0.30	0.32	0.3	0.6	20	65
	Copper	17	11	53	26	26	100	100	2000	18000
	Zinc	55	33	37	11	97	250	300	/	/
	Chromium	39	24	56	41	44	200	250	3.0 (Hexavalent chromium)	5.7 (Hexavalent chromium)
	Nickel	19	22	27	17	20	100	100	150	900

Comparing with the Soil Environmental Quality - Soil Risk Control Standards for Construction Land (GB36600-2018), the monitoring results of all sampling points in Table 4-4 are lower than the soil contamination risk screening values for Class I land and Class II land, indicating that the risk of soil contamination of subsoil used for construction purposes such as greenery and squares is small.

If the sediment is used for agricultural purposes, the standard of Soil environmental Quality - Soil pollution Risk Control Standard for Agricultural Land (Trial) (GB15618-2018) shall be implemented. The pH value of river sediment in People's Park at T3 point is 7.04, and the screening value and control value corresponding to soil pollution risk of agricultural land in Table 1 of GB15618-2018 (6.5 < pH≤7.5) should be implemented. The pH values of sediment at other detection points were (7.66-8.01), and the criteria for soil pollution risk screening values of agricultural land (pH > 7.5) in Table 1 of GB15618-2018 were referred to. The test results showed that except T3 People's Park, the monitoring results of heavy metals at other monitoring points all met the requirements of Soil pollution risk screening values in Table 1 of Soil Environmental Quality-Agricultural Land Soil Pollution Risk Control Standard (Trial) (GB15618-2018).The cadmium content of T3 monitoring points exceeds the requirements of Soil Environmental Quality -- Risk Control Standard for Soil Pollution in Agricultural Land (Trial) (GB15618-2018), and the risk control value of soil pollution in agricultural land (3.0 mg/kg). If agricultural products are used, there may be the risk of soil

pollution that does not meet the quality and safety standard. There is no industrial pollution source in the upstream of people's Park at T3 point, and the river section where the monitoring point is located has not been dredged in the past five years, which may be the result of long-term accumulation and precipitation.

4.4 Ecology

The Jinshui River runs from south to north from Guojiazui Reservoir through several administrative districts of Zhengzhou. Based on the type of land and the characteristics of the site and surrounding habitats, the entire section is divided into an upstream countryside section and a middle and lower urban section based on the intersection of the South-North Water Transfer Canal and the Jinshui River. The project area has long been affected by human activities, and there are no endangered species or protected species in the project area.

1） Rural Section

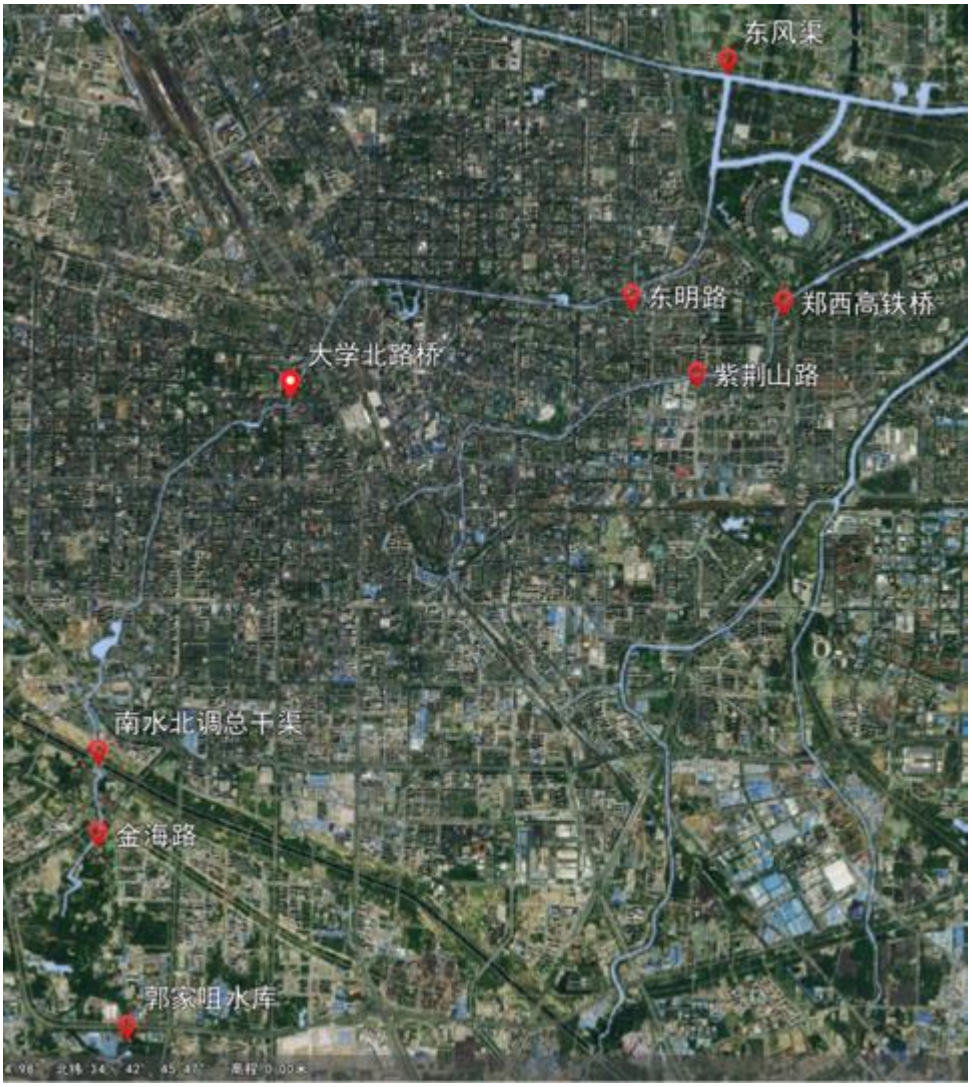
The rural section is located at the southernmost end of the Jinshui River, from Guojiazui Reservoir in the south to the South-North Water Diversion Trunk Canal in the north, with a total length of about 5.1 km. Plovers and geese and ducks are mainly distributed in and around the area, but the current site lacks stable water surface, shallows and other foraging sites in the countryside, and the single habitat type is not conducive to the survival and breeding of surrounding birds.

2） Urban section

The middle and lower reaches from the South-North Water Diversion Office to the north to the Dongfeng Canal, which passes through the main urban area of Zhengzhou with dense housing construction, have an average ecological substrate. Due to the early flood control needs, the riverbed barge in the middle and lower reaches of the town section is highly hardened and the lateral connectivity of the river is poor, while the surface of the riverbed is flat and lacks fish habitat and shelter.

The pollution interception capacity outside the river channel and the self-purification capacity of the water body inside the river channel are both insufficient. The number and distribution of aquatic plants in the river channel are small and sparse, and the biodiversity of aquatic plants is poor.

The water bodies in the parks along the perimeter of People's Park, Zijingshan Park and Meihu Park are relatively closed and have insufficient circulation. The self-purification ability of the closed water bodies is weak.



Upstream section of the Jinshui River

Jinshui River Crossing Zhengxi High Speed

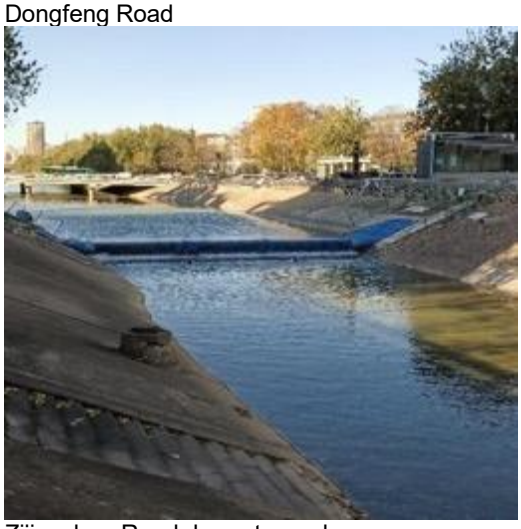
Dongming Road Section

Railway Bridge

Cross South-North Water Diversion Trunk Canal

Dongfeng Road

North University Road



Zijingshan Road downstream barrage

Confluence of Jinshui River and Dongfeng Canal

Jinhai Road

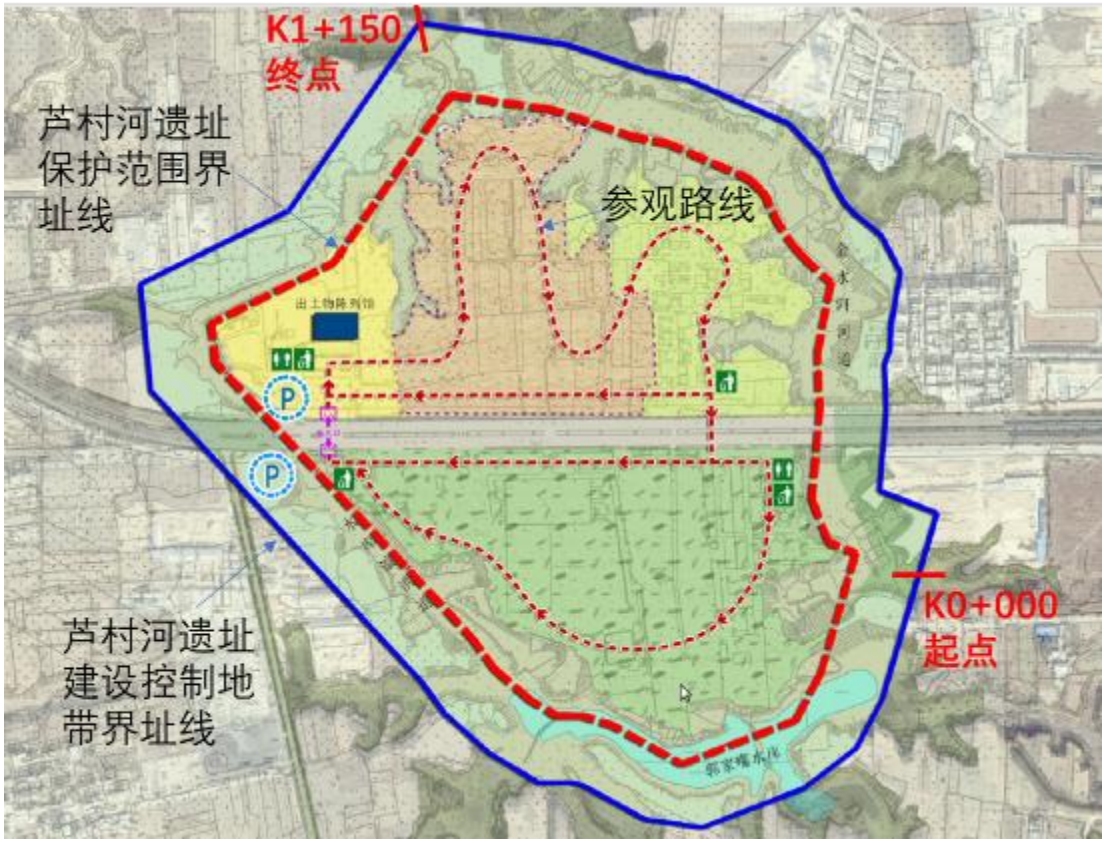
Imperial Lake

Figure 4-6 Ecological status along the Jinshui River

4.5 Protected areas and physical cultural resources

The Lucunhe site is located in and around the west of Lucunhe heritage site in Guojiazui administrative village, Houzhai Township, Erqi District, Zhengzhou City, Henan Province, with the Jinshui River flowing north around the south, east and north sides of the site, with the Guojiazui Reservoir spillway in the west and the South Fourth Ring Road running east-west through the middle of the site, which is a provincial cultural relic protection unit. Lucunhe site is a site of the Erlitou culture period, discovered in 2006. Cultural layer 0.8-1.5 meters thick, yellow-brown soil, hard soil, containing objects such as pottery pieces. Lucunhe heritage site protection scope boundary is defined by the Jinshui River channel and Guojiazui reservoir spillway boundary. The construction control zone is 100 m from the protection scope of the boundary. Jinshui River channel left bank and Lucunhe site protection scope have some overlap. The right bank of the river is located in Lucunhe construction control zone range. The starting section of the project (K0+000-K1+150) is located within the construction control zone of the Lucunhe heritage site (see Figure 4-7). The Lucunhe heritage site has not yet been excavated and developed archaeologically.

The primary protection zone of the South-North Water Transfer Canal extends 50m from the edge of the channel management area (protective fence) to each side; the secondary protection zone extends 1000m from the edge of the primary protection zone to each side (Figure 4-8).


K1+150
终点
芦村河遗址
保护范围界
址线
参观路线
K0+000
起点
芦村河遗址
建设控制地
带界址线

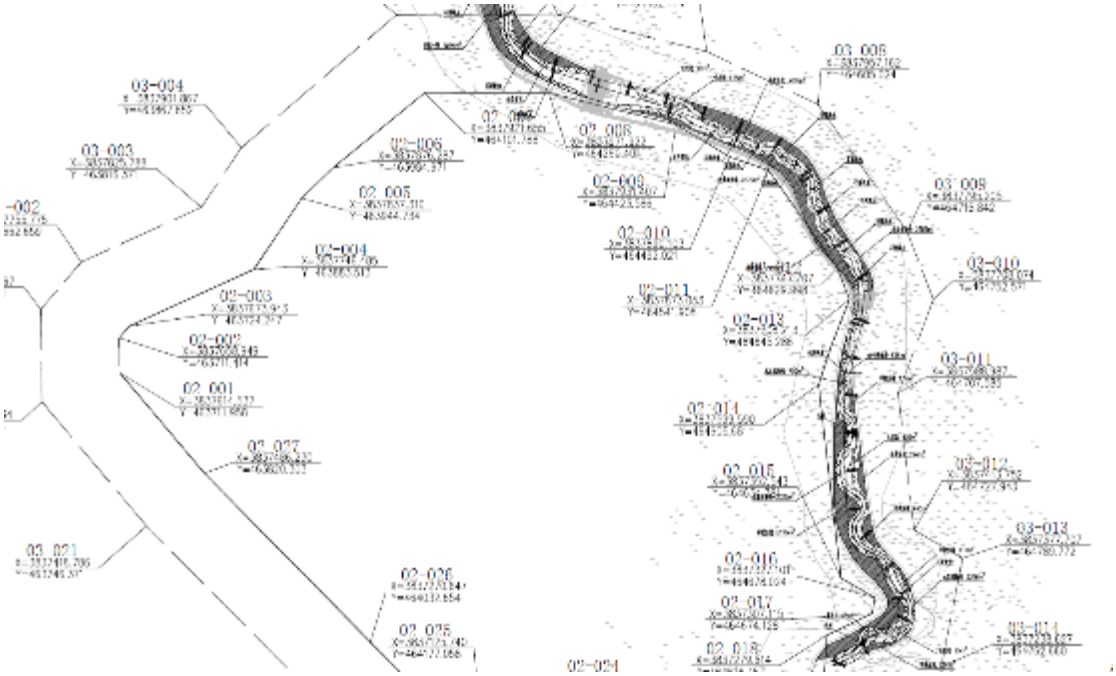


Figure 4-7 Location map and status of the project in relation to the scope of the Lucun River site

Figure 4-8 Location map and status of the project in relation to the boundary of the South-North Water Transfer Central Trunk Canal Protection Zone

Note: The red line indicates the section of the Jinshui River within the secondary protection zone of the South-North Water Transfer Trunk Canal

5 Environmental and social impact assessment and mitigation measures

5.1 Environmental Protection Goals

According to the construction characteristics of the project and site investigation, the environmentally sensitive points are the residents near the construction site within 200 meters (Table 5-1), the Jinshui River, the South-North Water Diversion Central Trunk Canal and the Lucun River site. The Jinshui River implements "Environmental Quality Standard for Surface Water" (GB3838-2002) Class IV, and the South-North Water Diversion Central Trunk Canal implements Class III water quality standard.

Table 5-1 List of environmentally and socially sensitive sites and representative photos

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
Zhengmi Road - South 4th Ring Road	Landscape node renovation, weir removal	Lucunhe heritage site	Left Bank	Located in the Lucun River site control construction zone	1
Huancui Road - Zhengmi Road	South side of the South Water Transfer Bridge demolished and rebuilt, removing a weir	South-North Water Diversion Trunk Canal			
West Third Ring Road - Huancui Road	Landscape node renovation	Qifu Community	Left Bank	20	1
Changjiang Road - West	Weir removal	Youzhi Foreign Language Kindergarten	Right Bank	65	1
		Youzhi Experimental High School	Right Bank	68	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
Third Ring Road					
South Binhu Road - Changjiang Road	Weir restoration, landscape node renovation	Qifu City Phase I Community	Right Bank	12	1
Binhu South Road - Binhu North Road	Dredging, Imperial Lake gate construction, Imperial Lake in-situ purification project	Dihu Garden Milan City	Right Bank	22	1
		Dihu Garden Longin Villa	Left Bank	9	1
		Dihu Garden Laiyin East County	Right Bank	35	1
		Rongchuang Yuhu Chengyuan	Left Bank	69	1
					
North Binhu Road - West Haohai Road	Ecological transformation of the bank slope + riverbed walkway, rubber dam removal, weir restoration, demolition	Emile Kindergarten	Right Bank	35	1
		Dihu Dongwangfu	Right Bank	14	1
		Dihu Xiwangfu	Left Bank	142	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
	and reconstruction of the pedestrian bridge north of Dihu North Road				
West Hanghai Road-West Huaihe Road	Upper bank ecological transformation + left bank lower vertical retaining wall riverbed walkway, sewer pipe relocation, rubber dam removal, Huaihe Road bridge and Qinhe Road bridge beautification and upgrading	Binhe Mingjia community	Right Bank	180	1
		Zhengmi Road Community	Right Bank	32	1
		Nanxi Yaotai Community	Left Bank	65	1
		Zhengzhou Shurian Foreign Language Middle School	Right Bank	65	1
		Tailong Chaishui community	Left Bank	16	1
		Xiangxieliyuan community	Left Bank	107	1
		Qizhi Kangaroo Kindergarten	Right Bank	34	1
		Zhengzhou Institute of Agriculture and Forestry Science	Right Bank	106	1
		Jinhuai Garden	Left Bank	10	1
		No.336/338, Workers' South Road	Left Bank	9	1
		No. 37/40, Zheng Mi Road	Right Bank	38	1
		Jinlong community	Left Bank	12	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
					
Ruhe Road - West Huaihe Road	Landscape Greening	Little impact on the surrounding environment			
Longhai	New	Xigenghe Home	Right	40	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
Road - Ruhe Road	construction of sequential park sluice gate, the removal of a rubber dam, Longhai Road and Ruhe Road bridge beautification and upgrading	community	Bank		
		Kangqiao Xishan Imperial Mansion Community	Left Bank	45	
					
Songshan South Road - Longhai Road	Removal of a rubber dam, landscape node renovation, Longhai Road bridge beautification	Fifty-seventh High School Xing Hua branch	Right Bank	35	1
		Henan University of Technology	Left Bank	58	1
					
Xinghua North Street - Songshan South	Rubber dam removal, Xinghua North Street Bridge beautification	Changcheng community	Right Bank	60	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
Road					
University North Road Bridge - Xinghua North Street	Meihu Lake water project, rubber dam demolition weir dam new construction, landscape node transformation	Zhengzhou University	Right Bank	23	1
		Jiaotong Xinyuan Community	Left Bank	28	1
		Duizhou Community	Left Bank	31	1
		Duizhou Mosque	Left Bank	28	1
		Fifty-seventh Middle School	Left Bank	40	1
					
Construction Road - University Road	Rubber dam removal, removal of a weir dam, water-friendly walkway, greening	Zhengzhou University School of Medicine	Right Bank	35	1
					
Jingguang Railway Bridge - Construction Road	Removal of a rubber dam, urban habitat creation project	Jianbei Community	Left Bank	50	1
		No.41 Tiegongli community	Right Bank	50	1
Minggong Road -	Demolition of a rubber	Xiangshuiwan Community	Left Bank	150	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
Beijing-Guangzhou Railway Bridge	dam, the north side of the Beijing-Guangzhou line pedestrian bridge demolition and reconstruction	No 83 block, Jinshui Road	Right Bank	45	2
Erqi Road - Mingong Road	People's Park Bridge new construction, People's Park live water project, a rubber dam removal, sewage pipe relocation project	Xingda Tongyuan	Left Bank	45	1
		Friendship Four Seasons Plaza	Left Bank	30	1
		Hualian Guangzhou Hotel	Right Bank	30	1
		Datang Water Restaurant	Crossing the Jinshui River		
					
Duling Street - Erqi Road	Erqi Road beautification and upgrading	Replacement of the existing bridge fence, bridge cleaning and greening, the environmental and social impact on the surrounding residents is minimal.			
Renmin Road - Duling Street	New construction of a weir, the provincial party committee two trick bridge demolition and reconstruction, Duling Street Bridge beautification and	No. 115 block, Dulingzhong Street	Right Bank	9	1
		Provincial Party Committee Family House	Right Bank	8	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
	upgrading				
Renmin Road - Zijingshan Road	Greenway, water-friendly walkway through, removal of a rubber dam, People's Road Bridge and Zijingshan Road Bridge beautification and upgrading	Yellow River Academy of Sciences	Right Bank	76	1
Shunhe North Street - Zijingshan Road	Zijingshan Road bridge beautification and upgrading, greenway, water-friendly walkway through	Yellow River Middle School Affiliated Primary School	Right Bank	28	1
		No.43 block, Shunhe Road	Right Bank	39	1
		Yellow River Museum	Left Bank	40	1
					
Shunhe North Street - Chengdong Road	Zijing Mountain Park live water project, Zijing Mountain Park pedestrian bridge upgrade	Shunhe Road Community	Right Bank	192	1
Dongming Road - Chengd	East side of Chengdong Road pedestrian	Shunhe Road Third Community	Right Bank	11	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
ong Road	bridge demolition and reconstruction, removal of a rubber dam, Chengdong Road bridge beautification and upgrading				
Jinshui Road - Dongming Road	Dongming Road bridge beautification and upgrading, Yanzhuang new willow landscape node	Replacement of the existing bridge fence, bridge cleaning and greening, the environmental and social impact on the surrounding residents is minimal.			
Future Road - Jinshui Road	Removal of a rubber dam, Jinshui Road Bridge beautification and upgrading	Dongming Road Campus of Henan Provincial College of Traditional Chinese Medicine	Left Bank	21	1
					
Wujiazhuang Road - Future Road	Removal of a rubber dam, future road and bridge beautification and upgrading	Family House of Henan Provincial Department of Justice	Right Bank	38	1
		Guangfa Garden community	Right Bank	47	1
Wei Si Road - Wu Jia Zhuang	Sewage pipe relocation project (Future Road	The first column of Jinshui Garden East near Jinshui River	Right Bank	37	1

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
Road	- Zhongzhou Avenue section), Wujiazhuang Road bridge beautification and upgrading				
Zhongzhou Avenue - Weixi Road	Removal of rubber dams, beautification and upgrading of Zhongzhou Avenue Bridge and Weixi Road Bridge	Tianlun Star Diamond community	Left Bank	45	1
East Huanghe Road - Zhongzhou Avenue	Newly constructed Junglim Moon Watch Bridge, Junglim Moon Watch Node, Greenway and Waterfront Walkway	 Surrounded by city parks, no residential sites			
Dongfeng Drainage - East Huanghe Road	Retain the original barge, only the Dongfeng Road Bridge, Agricultural Road Bridge, Longhu Outer Ring Road South Bridge and Yellow River East Road Bridge beautification and	Replace the existing bridge fence, the bridge cleaning, and the environmental and social impact on the surrounding residents is minimal.			

Work section	Works involved	Sensitive point	Relative Location	Distance (m)	Acoustic environment functional area (class)
	upgrading				

5.2 Environmental impact analysis and mitigation measures during construction period

5.2.1 Construction camp management

The Preliminary Design Report of Zhengzhou Integrated Jinshui River Management Sub-project (March 2022) is divided into 5 construction zones and 1 advanced section according to the construction content and construction conditions of this project (Figure 5-1). Construction zone 1 considers renting the temporary parking lot at the intersection of Qifu Avenue and West 3rd Ring Road, which is under the jurisdiction of Erqi District and serves the construction within the area of Guojiazui Reservoir of about 6.3km upstream. Construction zone 2 considers the temporary undeveloped vacant land near the intersection of Jingguang Expressway and East Construction Road, which is under the jurisdiction of Erqi District, and serves the construction work within about 6.78km from West 3rd Ring Road to downstream Construction Road. Construction zone 3 (from Construction Road to Minggong Road, length about 1.3 km), construction zone 4 (from Minggong Road to Chengdong Road, length about 3.2 km), construction zone 5 (from Chengdong Road to Dongfeng Canal, length about 4.6 km) and advance section are densely built, no suitable location for construction camp, houses nearby will be rented and construction auxiliary facilities are scattered on both sides of the Jinshui River embankment. Construction camps need to meet the following requirements:

a) The construction site should provide the necessary living facilities for construction personnel, including offices, dormitories, canteens, toilets, showers, etc.

b) Emergency evacuation and escape signs and emergency lighting should be installed at the passages and staircases of living and office areas and should comply with the provisions of the Technical Specification for Fire Safety at Construction Sites (GB50720-2011) and fire safety signs (GB13495-92).

c) Set up closed garbage containers in offices and living areas. Classified storage and timely removal of domestic garbage to reduce the breeding of mosquitoes and insects.

d) The construction site is equipped with commonly used drugs and first aid equipment such as bandages and tourniquets.

e) Dormitory to ensure the necessary living space, indoor net height shall not be less

than 2.5 meters, the width of the channel shall not be less than 0.9 meters, to facilitate the normal activities of personnel and evacuation in the event of an emergency, the accommodation per capita area shall not be less than 2.5 square meters

f) Installation of heat protection facilities such as air conditioners or electric fans in construction site dormitories.

g) Canteen facilities grease traps, which are cleaned regularly.

h) Construction site dormitory and office area set flush or mobile toilets, toilet ground hardening, doors and windows complete and well ventilated. Toilets set up a person responsible for regular cleaning and disinfection. Domestic sewage is connected to the municipal sewage network nearby.

Source: "Preliminary Design Report of Zhengzhou Integrated Jinshui River Management Sub-project" (March 2022)

Figure 5-1 Division of construction working area

In addition to the advance section, the river project is divided into five sections that has works within the river bed and five sections with works on the bank. As of June 2022, a total of seven bidding sections from the West Third Ring Road to the Dongfeng Canal are

ready for bidding. The work areas are set up to take into account both in-shore and out-shore works as well as the available space around, so the bidding sections and work areas are not one-to-one correspondence. The sections of the river in-shore works and the work zones serving the section are as follows.

a) Guojiazui Reservoir to the downstream of the Lucun River site (2666.26m) - Work Area 1.
b) Lucun River site downstream to West 3rd Ring Road (3633.74m) - Work Area 1.
c) West 3rd Ring Road to Zhongyuan East Road (5911m) - Work Zone 2.
d) Zhongyuan East Road to Zijingshan Road (4452.2m) - Work Area 3 and Work Area 4.
e) Zijing Shan Road to Dongfeng Canal (5598.4m) - Work Area 4 and Work Area 5.

The out-shore bidding sections and the work area serving the sections are as follows.

a) Guojiazui Reservoir to West Third Ring Road (6300m) - Work Area 1.
b) West Third Ring Road to Longhai Road (3485.95m) - Work Zone 2.
c) Longhai Road to Minggong Road (4606.47m) - Work Zone 2 and Work Zone 3.
d) Minggong Road to Jinshui Road (4177.25m) - Work Area 4 and Work Area 5.
e) Jinshui Road to Dongfeng Canal (3041.93m) - Work Area 5.

5.2.2 Exhaust gas

During the construction period, the exhaust pollutants are mainly the dust generated during the construction of the original building demolition, earthwork, foundation construction, material transportation, etc.; welding fumes from the welding process of pipes and steel; fuel exhaust from various construction machinery and transportation vehicles; and bad odor from the dredging and dredging process of the river.

1) Construction dust

Construction dust is an important source of air pollution during the construction period, and studies have shown that about 30-40% of the respirable particles in the atmosphere come from direct or indirect dust from construction sites. The main sources of construction dust are.

- Excavation dust from earthworks and wind erosion dust from on-site piles.
- Dust from on-site loading and unloading of construction materials (white ash, cement, sand, stone, bricks, etc.) and stacking.
- Construction waste removal and dust deposition.
- Road dust caused by traffic.

2) Welding fume

Welding is required during the process of pipeline laying and steel fixing, and welding fume is generated. The construction area is open and dispersed, with good atmospheric dispersion conditions, so it will not have a detailed impact on the air environment in the construction area.

3) fuel machinery and transport vehicle exhaust

Fuel exhaust from construction machinery and vehicles, the main pollutants are CO, NOx and HC.

The construction area of the project has open terrain and good atmospheric diffusion

conditions, the number of pollutants generated by construction machinery and vehicle fuel is small and the emission is dispersed, so the impact on the air environment in the construction area is not obvious and is temporary, and the impact will be eliminated after the construction is completed.

(4) sediment odor

The organic matter in the river sediment is fermented and decomposed under anaerobic environment for a long time, forming ammonia, hydrogen sulfide and other malodorous gases. When dredging, the sediment is disturbed or directly exposed to the air, releasing these malodorous gases to the surrounding environment. In the process of river dredging, in order to reduce the emission of small amount of odor, the upstream section is mainly to remove obstacles, and the dredging of substrate is mainly concentrated in Dihu section, surrounded by Dihu Garden and other communities with dense residents, a fence with a height of 2.5~3m should be built around to avoid the impact of odor Direct diffusion of odor to residents.

5.2.3 Wastewater

The wastewater during the construction period of this project mainly includes construction production wastewater and construction personnel's domestic sewage.

(1) Pit drainage

The pollutants of foundation pit wastewater are mainly SS, and this part of wastewater is discharged into the municipal network after the sedimentation treatment to reach the secondary standard in the "Comprehensive Sewage Discharge Standard" (GB8978-1996). According to the construction arrangement, the initial drainage adopts the model 150QW210-7-7.5 submersible sewage pump for forced drainage, and the construction will be carried out according to the construction sequence along the line, with a total of 60 sets of sewage pumps along the initial drainage line and 20 sets of spare pumps of the same model. Regular drainage requires excavation of water collection pits at the most downstream position within each section of the pit. 40 pumps are arranged for regular drainage, and 10 sets of the same type of standby pumps are allocated. In case of heavy rainfall or the number of pumps cannot meet the pumping and drainage demand, additional drainage pumps will be temporarily installed to ensure the dry working environment of the working surface. The number of pumping and draining shifts in this project is 5500 shifts.

(2) Construction wastewater

All sand and gravel materials used in this project are purchased, and the concrete used for pouring is commercial concrete, so no sand and gravel processing wastewater and mixing and rinsing wastewater are generated. The construction production wastewater is mainly the washing wastewater of construction vehicles, and the main pollution factors are petroleum and SS.

According to the summary table of construction machinery provided by the preliminary design of the project, about 280 sets (vehicles) of construction machinery and equipment need to be washed regularly in this project, the average daily washing water of each machinery and equipment is calculated by 0.05 m^3, and the wastewater generation coefficient is calculated by 0.8, then the vehicle washing wastewater generation is 11. $2m^3$ /d (about $3.8m^3$ /d for each construction site). Compared with similar projects, the main pollutants and their concentrations in vehicle washing wastewater are: SS 5000mg/L, petroleum 6mg/L. The construction unit sets up construction vehicle washing area in construction camp, and constructs wastewater grease trap and sedimentation tank, and

the sedimentation wastewater is used comprehensively without external discharge.

(3) domestic sewage from workers

The domestic sewage of construction personnel mainly comes from the daily life of construction personnel. The average number of construction workers during the construction period of this project is 820, and the domestic water consumption is 158L/person.d, and the sewage coefficient is 80%, so the domestic sewage generation is 103.65 m^3 /d. The domestic sewage is integrated into the nearby municipal sewage treatment system for unified treatment.

5.2.4 Water environment

Jinshui River is a seasonal river, with little or no water during the dry season. The river construction work surface is wide, which is conducive to the operation of large construction machinery and can complete the river dredging and other construction operations in a non-flood period. The hydrological situation during the construction period affects the local river section, and the impact will disappear gradually as the construction is completed.

According to the construction diversion scheme, half construction and half diversion can be used during the river dredging and slope protection construction, and the diversion ditch is excavated on one side of the river. The hydraulic dam is arranged in the main river channel, and the upstream and downstream cofferdams are filled, the diversion ditches are excavated and the diversion culverts are buried during the construction of the hydraulic dam.

During the construction of the diversion and cofferdam, the river will be disturbed to a large extent and the suspended matter will increase in the short term. In addition, both the diversion ditch and the diversion pipe will greatly change the natural hydrological situation of the river, and the river channel cleaning and excavation will greatly change the river morphology and destroy the river organisms and vegetation.

In order to protect the river environment and ecology, construction waste should be transported to the dumping site in time to landfill, is strictly prohibited to throw in the river; river management construction process must ensure that the construction machinery without failure, to eliminate the phenomenon of running, bubbling, dripping, leaking, etc., once the failure occurs, should be prohibited to use; if the use of the process of failure, should immediately drive back to the shore repair; can not move the machinery, found dripping, leaking phenomenon should be immediately used containers Collect and transport back to the shore for proper treatment.

5.2.5 Noise

The noise during the construction period is mainly from machinery and traffic noise of transportation vehicles, which are intermittent noise sources. This evaluation predicts the noise contribution value of noise sources at different distances.

a) Prediction model

According to the characteristics of the equipment sound sources and the surrounding sound environment, each equipment sound source can be regarded as a continuous steady-state point source, and the sound field is a semi-free sound field, the prediction model uses the non-directional point source geometric dispersion attenuation model recommended in the Technical Guidelines for Environmental Impact Assessment - Sound

Environment (HJ/T2.4-2009). The prediction formula is as follows.

$$L_p(r) = L_p(r_0) - 20\lg(r / r_0)$$

Where: Lp (r) - sound pressure level on the radiating surface at a distance of r meters from the source, dB (A).

Lp (r0) - sound pressure level on the radiating surface at r0 m from the source, dB (A).

R - the distance of the prediction point from the sound source, m.

r0 - reference position, take 1m.

b) Forecast results

This prediction only considers the attenuation factor of spatial distance, and does not consider the difference of air absorption attenuation, vegetation noise reduction and topography.

Table 5-2 Predicted results of stationary sources in the construction area at different distances

Name of sound source	**Noise level**	**Sound intensity at different distances (dB(A))**								
		10m	**20m**	**50m**	**100 m**	**130 m**	**170 m**	**200 m**	**300 m**	**500 m**
Scrapers	96	76	66.5	62	56	53.7	51.4	50	46	42
Excavator	95	75	65.5	61	55	52.7	50.4	49	45	41
Bulldozers	94	74	64.5	60	54	51.7	49.4	48	44	40
Tampers	100	80	70.5	66	60	57.7	55.4	54	50	45
Road grader	94	74	64.5	60	54	51.7	49.4	48	44	40
Road Roller	92	72	62.5	58	52	49.7	47.4	46	42	/
Air compressor	92	72	62.5	58	52	49.7	47.4	46	42	/
Transportation vehicles	85	65	62.5	61	45	42.7	40.4	39	/	/

From Table 5-2, it can be seen that the noise limit value requirements of "Environmental Noise Emission Standards for Construction Site Boundaries" (GB12523-2011) can be met at 31m from the construction machinery during daytime and 200m at night; compared with the requirements of "Sound Environmental Quality Standards" (GB3096-2008) for Class 1, the farthest distance to meet the standard in Class 1 is 182m during daytime and 500m during nighttime. The actual distance is much greater than the distance listed in the table because the construction site is often operated by multiple machines at the same time.

The project involves Erqi District, Zhongyuan District and Jinshui District, and there are many households in the surrounding area, especially kindergartens, schools and hospitals and other sensitive points with high requirements for sound environment. In order to reduce the impact of bridge demolition and reconstruction project, river project, pipeline relocation in foundation excavation, pile construction, concrete pouring and material transportation and other construction machinery and traffic noise on the sensitive points along the 200m range along the construction site, the construction unit should reasonably arrange the

construction time, prohibit the construction transportation from 22:00 to 6:00 at night and 12:00 to 2:00 during lunch break, and set up noise barriers if necessary. Sound barriers should be installed if necessary to reduce the noise impact. When vehicles pass through residential areas, it is advisable to limit the speed of transport vehicles, prohibit the sounding of loud horns, and reasonably arrange the transport time to avoid vehicle noise affecting the rest of residents. In accordance with the "Zhengzhou Environmental Noise Pollution Prevention and Control Measures" (2015), if damage is caused to the surrounding units and individuals due to noise pollution, compensation for the damage will be made in accordance with the law. The amount of compensation will be supervised and managed by the competent environmental protection department or other noise pollution prevention and control departments.

5.2.6 Solid waste

Construction solid waste is mainly construction waste, construction waste, dismantled waste rubber dams and recycled sewage pipes and construction personnel's household waste.

The total amount of excavation (natural) is 872,700 m^3 , backfill (natural) is 796,000 m^3 , disposal (natural) is 415,200 m^3 , which is converted into 552,200 m^3 (loose). The original building demolition (natural square) is 157,600,000m^3 , which is converted into loose square of 20,600,000m^3 (loose square). The amount of piling platform filling work is 21,500,000m^3 (natural square), and the amount of piling platform demolition work is 21,500,000m^3 . The amount of river dredging is 137,500m^3 , which is converted into 182,900m^3 (loose square). A total of 10 closed tankers were deployed on site to remove the dredged silt in time. Based on the load of 15t, approximately 8 trips per tanker per day were transported.

Table 5-3 Jinshui River earth and rock balance table (unit: 10,000 square meters)

Activity	Hydraulic works	Municipal Engineering	Building construction	Ecological Engineering	Bridge Engineering	Cofferdam and other temporary works	Total
River Dredging	13.75	0	0	0	0	0	13.75
River Dredging (natural status	18.29	0	0	0	0	0	18.29
Earth excavation (natural status)	50.67	14.18	0.89	0.34	0.75	20.44	87.27
Earth backfill (compacted)	32.62	12.56	0.68	0.27	0.23	21.30	67.66
Disposal of soil (natural status)	0.00	1.95	0.00	0.00	0.00	10.33	41.52
Disposal of soil (loose status)	0.00	2.59	0.00	0.00	0.00	13.74	55.22

Activity	Hydraulic works	Municipal Engineering	Building construction	Ecological Engineering	Bridge Engineering	Cofferdam and other temporary works	Total
Original building demolition (natural status)	10.94	0.03	0	0	0.2	4.32	15.49
Building demolition	14.55	0.04	0.00	0.00	0.27	5.75	20.6

There are 14 disposal sites around Zhengzhou, and the person in charge of the environmental assessment of this project of Henan Jiayu Environmental Technology Co., Ltd. and the executive deputy director of the Zhengzhou Integrated Jinshui River Management Sub-project Department conducted on-site inspection and consultation on March 15, 2022 for the four disposal sites with remaining capacity greater than 1 million square meters together with the preliminary screening, and the Zhengzhou Integrated Jinshui River Management Sub-project Department and Zhengzhou Yijia Technology Industry Co. Ltd. signed an agreement of intent to receive the waste and construction waste of the project. The selection of the disposal site is shown in Chapter 6: Alternative Analysis.

Zhengzhou Yijia Technology Co., Ltd. was established in December 2019, with a registered capital of 30 million yuan, jointly invested by Zhengzhou Metro Group Yijia Industrial Co., Ltd, Xuchang Jinke Resource Recycling Co., Ltd and Henan Guokong Guangde Network Technology Co., Ltd. The company's major business is recycling of construction waste and has a capacity of 1 million tons per year. The company's first phase site is about 30 mu, with recycled aggregate production line, one recycled stabilized crushed stone production line, one recycled concrete production line and one recycled brick/block production line. The main equipment is imported from abroad, and the process technology is developed independently. It can make use of construction waste to produce various specifications of renewable subgrade materials, renewable permeable brick, wall materials, renewable hydraulic products.

The Chedagou dump site of Yijia company was constructed in August 2021 and located in the eastern part of Chedagou Village, Guangwu Town, Rong Yang City, which belongs to the sub-basin of Maijian ditch, with east longitude 113°42'2093~113°24'50.75", north latitude 34°5543.42"~34°56'14.07". The designed total landfill capacity is 6,868,900 square meters, and 230,800 square meters have already been filled. After backfilling, the site will be planted. The average distance from the construction site to the dumping site of Chedagou is considered as 25 kilometers, and the transportation path is shown in Figure 5-3 for the section of Dihu Lake as an example.

Figure 5-2 Spoil and sediment transport route

The project will demolish 17 waste rubber dams, according to the average weight of each rubber dam 1.5t, a total of 25.5t of waste rubber dams. waste rubber dams are sold to scrap collection stations for resource utilization.

The project will relocate sewage pipes, with a length of 6.71km, and 24.6t of waste pipes will be recycled. the waste pipes will be sold out for resource utilization.

The average number of construction workers in this project is 820, and the per capita domestic garbage generation of construction workers is 1.0kg/person, which means the domestic garbage generation is 0.82t/d. The area where the project is located has complete municipal facilities, and the domestic garbage will be collected by the sanitation department and incorporated into the local sanitation system.

5.2.7 Ecological impact

According to the Report on Soil and Water Conservation Program of Integrated Jinshui River Management Sub-project (Zhengzhou Water Conservancy Construction Survey and Design Institute, January 2022), the background value of soil erosion modulus in the project area is 230 t/km^2-a. The predicted soil erosion period is 3 years for the construction period and 3 years for the natural restoration period. The soil erosion modulus during the construction period is 3000 t/km^2-a. The soil erosion modulus during the natural recovery period is 2000 t/km^2 -a, 1000 t/km^2-a and 200 t/km^2-a in the first, second and third years respectively. The prediction of new soil loss is calculated by the following formula.

$$W = \sum_{j=1}^{2} \sum_{i=1}^{n} F_{ji} \times M_{ji} \times T_{ji}$$

Eq.

W - amount of soil loss, t.

i - prediction cell (1, 2, 3, ..., n-1, n).

j - the forecast period, j = 1, 2, refers to the construction period (including the construction preparation period) and the natural recovery period.

Fji - predicted area of soil erosion for the jth prediction period and the i-th prediction unit, km^2 .

Mji - soil erosion modulus for the jth prediction period, ith prediction unit, t/km^2-a.

Tji - the forecast period length of the jth forecast period and the i-th forecast cell.

It is expected that the total amount of soil erosion for the construction of this project is 20309.48t, which is increased by 18608.84t compared with the background value.

Table 5-4 Summary table of soil erosion prediction

Prediction unit	Background value (t)			Perturbation value (t)			New value added (t)		
	Construction Period	Natural recovery period	Subtotal	Construction Period	Natural recovery period	Subtotal	Construction Period	Natural recovery period	Subtotal
River Engineering	1366.61	205.00	1571.61	17825.40	950.72	18776.12	16458.79	745.72	17204.51
Building process	103.78	10.35	114.13	1353.60	48.00	1401.60	1249.82	37.65	1287.47
Construction camps	7.45	7.45	14.90	97.20	34.56	131.76	89.75	27.11	116.86
Total	1477.84	222.80	1700.64	19276.20	1033.28	20309.48	17798.36	810.48	18608.84

The impact on plants during the construction period mainly occurs in the construction area within the planned river blue line. The plant types within the construction area of the existing river mainly include common green trees and irrigation and grasses, among which herbs are dominant and mostly distributed within the existing river; trees are mainly concentrated in the country section upstream of the treated river section and mostly distributed in the herbaceous periphery. The dominant herbaceous species are dogbane, dogwood, lettuce, etc. The accompanying plants are dandelion, tumbleweed, artemisia, reed, etc. The dominant species of trees is small-leaved poplar, with scattered distribution of willow, pickleweed, arborvitae, etc. The river side slopes are dominated by hard river banks.

The terrestrial plants occupied by the project construction are mainly artificial plants, the destroyed plants are widely distributed in the surrounding areas, and there are no rare and endangered species of protected wild plants in the damaged natural vegetation. In general, the vegetation community structure in the project construction area is relatively simple, and the plant species are all common species. Through the construction of supporting greening

and ecological landscape projects on both sides of the river later, the loss of biomass will be compensated to a certain extent, and its ecological service function will be increased compared with that before the construction.

The area of responsibility for water and soil erosion prevention and control is 213.0327 hm^2 , of which 213.1045 hm is permanent land acquisition^2 and 1.08 hm is temporary land acquisition^2 . The permanent land acquisition includes river safety protection project, bridge restoration and upgrading project, water quality protection and ecological upgrading project, greening improvement project, etc.; the temporary land acquisition is mainly for temporary construction sites. The temporary land occupation is mainly for the construction temporary site, the construction temporary road and part of the construction temporary site are located in the scope of permanent land acquisition of the main project, no new land occupation. According to the construction characteristics, construction time sequence, project layout and soil erosion characteristics, the project is divided into three prevention and control zones, namely, main project zone, construction temporary road zone and construction temporary site zone. The scope of responsibility for the prevention and control of soil erosion and the prevention and control partition of the project are shown in the following table.

Table 5-5 Project erosion control zoning table

Prevention and treatment zoning	**Total (Unit: hm^2)**			**Remarks**
	Permanent land acquisition	**Temporary occupation**	**Subtotal**	
Main engineering area	213.1045	/	213.1045	
Construction temporary road area	(6.12)		(6.12)	All are located within the red line area
Temporary construction site area	(1.48)	1.08	1.08	The area of land located within the red line is indicated by ()
Subtotal	213.1045	1.08	213.0327	

Table 5-6 Project erosion control zoning table

Prevention and treatment zoning	**Soil erosion control measures system**	
Main engineering area	Temporary measures	① temporary drainage, sedimentation measures; ② temporary soil protection (temporary blocking, thatching, greening); ③ temporary thatching of bare ground; ④ temporary thatching of pipeline construction; ⑤ protection of pipe jacking work well (temporary drainage, temporary blocking, temporary thatching)
Construction	Engineering	①Stripping topsoil; ②Mulching

temporary road area	Measures	
	Temporary measures	temporary drainage, sedimentation measures; ② temporary protection of topsoil (temporary blocking, temporary greening)
	Plant measures	①Sowing grass seeds
Temporary construction site area	Engineering Measures	①Stripping topsoil; ②Mulching
	Plant measures	①Sowing grass seeds
	Temporary measures	① temporary drainage, sedimentation measures; ② temporary protection of topsoil (temporary blocking, pro-greening); ③ temporary greening of construction camps

Note: The main design has considered measures such as river slope drainage, permeable pavement, landscape greening, etc. From the perspective of soil and water conservation, it mainly supplements temporary measures during construction.

The vegetation restoration and construction project mainly focuses on the restoration of the temporary occupation site. After the temporary occupation area is dismantled, the temporary construction facilities will be restored according to the original land type. According to the Soil and Water Conservation Engineering Design Specification (GB51018-2014), the greening standard of the temporary occupation area adopts level 3 vegetation construction project, and the greening standard is generally based on meeting the requirements of soil and water conservation and ecological protection. 6:3, the density of grass seed mix is 80kg/hm^2 , and it is recommended to implement planting measures in spring.

5.2.8 Impact on the South-North Water Transfer Trunk Canal

This project is located in the South-North Water Transfer Central Trunk Canal (Henan section) drinking water source of the river section of the main construction content South-North Water Transfer south side of the flyover, greenway and landscape greening. The primary protection zone of the South-North Water Diversion Main Canal extends 50m from the edge of the channel management range (protective fence) to each side; the secondary protection zone extends 1000m from the edge of the primary protection zone to both sides. According to "Henan Province South-North Water Diversion Drinking Water Source Protection Regulations" (effective from March 1, 2022) Article 17: The following acts are prohibited in the secondary protection zone of drinking water source.

(1) To install sewage outlets;
(2) new, rebuilt or expanded construction projects that discharge pollutants;
Mining mineral resources;
(4) laying new pipelines for conveying toxic and harmful substances;
(5) Construction of livestock and poultry farms;
(6) use pesticides, discard pesticides and pesticide packaging or clean pesticide application equipment;
(7) To build tombs;
(8) discarding or burying animal carcasses and other wastes containing pathogens;
(9) Transporting oil, excrement and other toxic and harmful substances by means of transport that do not meet the anti-pollution requirements prescribed by the State;
(10) releasing animals, swimming and fishing;
(11) Other acts prohibited by laws and regulations. Completed construction projects that discharge pollutants shall be dismantled or closed down by the people's governments at or above the county level in accordance with law.

This project is located in the South-North Water Diversion Central Trunk Canal (Henan section) drinking water source of the river section of the main construction content for the South-North Water Diversion south side of the flyover, greenway and landscape greening, does not involve the above activities prohibited in the secondary protection zone, in line with the "Henan Province South-North Water Diversion Drinking Water Protection Regulations.

The south side of the South-North Water Diversion Flyover is far away from the main canal, and the vibration generated by the construction machinery will not affect the structural safety of the South-North Water Diversion Main Canal inverted siphon. Construction dust may affect the water quality of the South-North Water Diversion Canal, and the accumulation of construction debris will have a negative impact on the South-North Water Diversion Water Source Protection Zone. Improper disposal of construction wastewater may pollute the water quality of the South-North Water Diversion.

In order to reduce the impact on the middle route of the south-to-North Water Transfer project, the construction unit shall take the following measures during construction within the scope of the protection zone:

(1) Construction is prohibited in the first-level protection zone;
(2) During earthwork, measures such as covering and sprinkling should be taken to suppress dust generation;
(3) The abandoned slag generated by bridge demolition shall not be piled up within the scope of the protection zone;
(4) Strengthen equipment maintenance and shall not wash construction machinery within the scope of the protection zone;
(5) During the reconstruction of the bridge, the mud wastewater generated by the construction shall be introduced outside the protection area by closed tank truck for treatment, and temporary facilities for wastewater treatment such as mud pool and sedimentation tank shall not be set up in the protection area;
(6) In the construction of the top of the inverted siphon of the greenway project, it is strictly prohibited to dig deep and arrange large machinery, and environmental protection materials should be used for slope protection and green layout to avoid secondary pollution of the main canal of the south-to-north water transfer;
(7) The footpath in the protected area shall be set up on one side, and dustbins shall be set up on the bank slope. Special personnel shall be arranged to clean them regularly during the operation period, so as to avoid domestic garbage from entering the main channel of south-to-North water Transfer under adverse meteorological conditions;
(8) Seasonal broad-leaved trees should be avoided as far as possible to prevent dead leaves in autumn and winter from entering the main canal of the south-to-North Water Diversion project; Green planting uses slow-release fertilizer, organic fertilizer and biological control, no high toxic pesticides.
(9) The construction road should be set to minimize the width of temporary roads, small transport vehicles should be selected to enter and exit the protection zone, and special personnel should handle the construction enclosure safely to avoid irrelevant personnel entering the main canal protection zone of the south-to-North Water Transfer;
(10) The construction unit shall obtain the approval of the administrative department of the south-to-North Water Transfer before construction, formulate emergency plans for environmental emergencies, and ensure the safety of water quality and engineering safety of the middle route of the south-to-North Water Transfer project. At the time of the preparation of this report (June 2022), the preparation of the emergency plan has not yet begun, which will be drafted after the construction site. At the same time, the construction unit shall strengthen environmental protection education and training for construction personnel. It is forbidden to fish or swim in the river within the protected area, and it is

forbidden to move, cover, alter or damage markers. It is forbidden to occupy or damage water channels (pipelines and rivers), embankments and bank protection, etc.
(11) The import and export and vehicle washing facilities of the construction site of the water source protection zone shall be set outside the water source protection zone.

5.2.9 Heritage Conservation

The starting section of the Jinshui River project (pile number K0+000 to K1+150) overlaps with the protection scope of the Lucunhe heritage site on the left bank, and the right bank of the river is located within the construction control zone of Lucunhe heritage site. According to the "Cultural Relics Protection Law of the People's Republic of China", Article 17 "no other construction works or blasting, drilling, excavation and other operations within the scope of protection", Article 18 "construction works within the construction control zone of cultural relics protection units, shall not damage the historic landscape" and Article 19 "within the scope of protection of cultural relics and construction control zone, shall not build facilities that pollute cultural relics and their environment, and shall not carry out activities that may affect the safety of cultural relics and their environment", this section of the project is a river improvement project, the construction content and Cultural preservation land does not conflict. According to the reply letter on this project issued by Zhengzhou Cultural Relics Bureau (January 2022), the construction plan of this project is agreed in principle.

郑州市文物局

郑州市文物局
关于金水河综合整治工程项目建设意见
的复函

郑州市城乡建设局：

你局《关于征求郑州市金水河综合整治工程项目建设意见的函》（郑建函〔2022〕8号）收悉。经研究，我局原则同意金水河综合整治工程中的环境整治及景观绿化等相关内容，并提出如下意见：

1、如有爆破、钻探、挖掘等相关建设工程涉及芦村河遗址建设控制地带，请按照程序履行文物报批手续；

2、施工过程中请施工单位主动与二七区文物部门做好沟通，自觉接受业务指导，做好相关文物保护工作。

郑州市文物局

2022年1月13日

（联系人：张智君　联系电话：[illegible]）

Figure 5-3 Zhengzhou Cultural Relics Bureau’s endorsement letter

The project pile number K0+000 to K1+150 includes:

a) Embankment bank protection: set up a retaining wall at the foot of the slope, the retaining wall is 0.5m above the flood level, set up a 3.5m wide walkway on top of the retaining wall to realize the greenway penetration in the river, and reserve a 5m wide greening space between the walkway and the soil slope.

b) Weirs: a new multi-stage drop weir is built at K0+510 pile number of Jinshui River. The design width of the weir is 23m, the height of the weir is 1m, and the top elevation of the weir is 144.01m. The weir at K0+978 is demolished and rebuilt.

c) Laying ecological water replenishment pipes under the right bank walkway.

d) Habitat creation and landscape greening.

There are two construction access roads K0+520 (length: 600 meters, road width: 6 meters) and K1+108 (length: 400 meters, road width: 6 meters) in this construction section, which are arranged outside the construction control belt on the right side of the bank.

a) The adverse impact of the project on The Lucunhe site is mainly during the construction period. During the construction within the protected zone of the Lucunhe site, the following measures should be taken to avoid damaging the Site:

b) Shall not exceed the construction zone of the project design, shall not occupy the Lucunhe site which has been built, and shall not extend the construction activities to the protected area of the Lucunhe Site;

c) During earthwork excavation, it is strictly forbidden to use large machinery to dig earth, and the method of manual construction with small machinery should be adopted for earthwork excavation;

d) During concrete construction, large concrete trucks, material trucks and pump trucks are strictly prohibited from entering the protection area of Lucunhe Site;

e) The construction site to arrange a person to carefully check, strictly prohibit unrelated to the construction of personnel into the construction site, regularly on the construction road scattered materials for cleaning, sprinkling dust suppression;

f) Pipeline laying and construction of weir DAMS involve excavation. The construction unit shall assign special personnel to communicate and connect with Zhengzhou Municipal Bureau of Cultural Heritage. In the process of construction in the construction area, once cultural relics are found, the construction should be stopped immediately and the relevant cultural relics department should be notified for disposal. Construction can be resumed only after the construction permit of the cultural relics department is obtained.

g) When carrying out greening construction in the control zone, the approval of the cultural relics protection department shall be sought for the project arrangement, surrounding greening, water storage height, river bank construction and other engineering contents, and no green plants with roots deeper than 0.2m shall be planted.

When the project is completed, it is conducive to the flood control on both sides of the river, avoiding the possible slope collapse and bank erosion on both sides of the existing river, and can protect the safety of The Lucunhe site. The project construction has little influence on the Lucunhe site.

5.2.10 Traffic Impact

The traffic impact caused by this project involves 11 bridges and 2 road construction. The Dihu pedestrian bridge, the north side of the Beijing-Guangzhou line pedestrian bridge and the east side of Chengdong Road pedestrian bridge are built in a staggered manner, and the old bridge will be demolished after completion to ensure access; the Shengwei Erzhao bridge adopts a temporary steel bridge to ensure access; the bridge of University North Road is impassable during construction, and corresponding traffic mitigation measures will be taken. If the road along the river is impassable during construction, corresponding traffic relief measures shall be taken; University Road and Yangtze Road are half open during construction, and corresponding traffic relief measures should be taken.

Temporary closure of part of the road will be conducted if necessary. Specific measures are as follows.

(1) Security isolation

Separate construction and access roads with colorful steel plate isolation wall to avoid mutual interference between construction and access.

(2) Traffic guidance

By setting up road signs at intersections, lane changes, overhead passages, temporary occupation of the front of the road and other locations to inform the vehicle to enter the construction site required road conditions, lanes, speed limits, warnings and other information to guide vehicles safely through.

(3) Construction road traffic signs set

During the construction period at both ends of the construction site, the right side of the motorway vehicle direction of travel set the front construction slow travel safety (reflective paint) signs and warning signs, etc.

(4) Traffic wardens

The contractor shall send additional personnel to direct and clear the traffic at major traffic junctions and special work sites in the construction area. Where temporary enclosure is needed, movable tool enclosure and safety warning labels shall be set up, and isolation measures shall be taken at dangerous places of the project.

5.3 Environmental impact analysis during operation

5.3.1 Ecological impact

The entire Jinshui River crosses the countryside and towns, and the flora and fauna of the corresponding areas and the surrounding residents have a high demand for a high-quality water ecological environment. In order to improve the interaction between biology, habitat and human-nature, this project combines the river background, the characteristics of both sides of the river and biodiversity needs, and will carry out biological restoration and habitat creation.

5.3.2 Water Environment Impact

5.3.2.1 Hydrological impact analysis

(1) Analysis of changes in the hydrological situation

After the operation of the project, the flow direction basically does not change, and the water source of the upstream section of the river is mainly ecological replenishment by a new replenishment pumping station, and the total water replenishment of the river does not change. Through river desilting and river widening, the water storage capacity of the area where the project is located will increase significantly, the water surface area will increase, the water depth will deepen, the flow velocity will slow down, the shape of the water body shoreline will change, and the hydrological situation of the river section will change to a certain extent. In general, the flood discharge capacity of this river section is strengthened and the water storage capacity is enhanced in normal years.

(2) Analysis of the impact of the weir project on the hydrological situation

The project proposes to remove 17 abandoned rubber dams, remove 4 weirs, remove and reconstruct 6 weirs, build 6 new weirs in combination with the landscape nodes along the route, and retain 4 weirs with good functions in the current situation, which ensures the greenway penetration along the whole route of the river and changes the overall ecological appearance of the river. The construction period of the project will not affect the surface water, but the operation period will have a greater impact on the hydrological situation of the local river section.

The new weirs will mainly raise the water level, to increase the water surface area and slow down the flow velocity in the local river section above the dam.

(3) Analysis of the impact of the sluice gates on the hydrological situation

This project proposes to build 2 new sluice gates. The location of Dihu sluice is located at the lower outlet of Dihu Lake (pile number K7+530), the main function is to control the landscape water level of Dihu Lake. The main function of the sequence garden gate is landscape water storage, the site is located at the sequence garden landscape node (pile number K9+708).

The new sluice gate is conducive to upstream water storage and has a certain impact on downstream ecological water.

(4) Analysis of the impact of the bridges on the hydrological situation

This project mainly includes bridge upgrading, demolition and reconstruction of six pedestrian bridges, a new greenway bridge, demolition and reconstruction of two vehicular bridges, under the condition that individual bridges and culverts do not meet the flood clearance requirements, dredging and excavation of the river to improve the bridge clearance height and flood control standards, the impact on the water flow will not change significantly. The flow, water level and velocity will not be changed by the bridge construction. Therefore, the bridge project has little impact on the hydrological situation.

5.3.2.2 Environmental impact analysis on surface water

Through the engineering and plant measures such as the renovation of the discharge outlet

along the river, relocation of the sewage network, renovation project of the waterlogging point, the in-situ strengthening purification and the ecological restoration, the water quality of the Jinshui River will be fundamentally improved and the ecological and environmental benefits of the river have been increased.

In order to ensure the ecological replenishment of the upstream section of the Jinshui River, it is proposed to implement the Jinshui River diversion to Guojiazui Reservoir water pipeline to carry the clear water from the Jinshui River diversion to the upstream, so as to realize the ecological replenishment of the upstream, with the ecological replenishment flow scale of 0.8 m^3 /s and the replenishment water quality of Class III surface water. Due to the upstream ecological replenishment, supplemented by the construction of Yongshui weir and other projects, the upstream water ecological environment of the Jinshui River has been enhanced, improving the unfavorable situation of the river drying up and water depletion, and also providing a reliable guarantee for the downstream water quality standards.

5.3.2.3 Analysis of environmental impact on groundwater

After the completion of this project, the regional water surface will increase and the surface water quality will improve through the renovation activities and through the implementation of water ecology and water quality improvement projects, and there will be a weak recharge to the regional shallow groundwater due to the construction of water storage projects and sponge city projects.

The project does not involve the groundwater drinking water source protection zone, and the flow direction of shallow groundwater in the area is from south to north, which does not belong to the runoff recharge area of underground water source, and the project implementation has little impact on groundwater.

5.3.3 Atmospheric environment

(1) Vehicle exhaust

The project has a total of 1132 motor vehicle parking spaces, all of which are 832 above-ground parking spaces and 300 underground parking spaces. The above-ground parking spaces are located in the nodes of Dongfeng East Road, Zhongzhou Avenue, Jinshui Road and other main roads, which are more scattered and have a shorter start time, smooth ventilation, easy to diffuse in the open air, and the project area is green, which has a certain purification effect on the regional air environment; the underground parking spaces are distributed in Yangtze River Park, the greenery around the parking lot is better, and the exhaust gas is pumped out by the induced draft fan, which is easy to diffuse, and the automobile exhaust gas has little impact on air quality.

(2) Odorous exhaust gas

The domestic garbage bins and public toilets will produce a small amount of malodorous exhaust gas. The evaluation requires that a person be responsible for garbage removal and treatment during the operation period to ensure that the garbage is transported to the town garbage transfer station in time; strengthen the cleaning and management of public toilets to prevent malodorous gas from affecting the park and the surrounding environment. According to the layout of the project, the green area around the public toilets is large, which has a certain purifying effect on the regional atmosphere, so the impact of malodorous exhaust gas on the environment is extremely small.

5.3.4 Sound Environment

With the increase in the number of tourists, the traffic flow increases accordingly, and the noise of tourist activities and traffic noise also increases. The noise generated by tourist vehicles and the noise of tourists will affect the quality of the sound environment along the landscape of the Jinshui River.

The evaluation suggests that the impact of traffic noise on the surrounding environment can be effectively reduced after the measures such as no sound and speed limit are carried out for vehicles entering the landscape belt or the parking lot of the park. In addition, the landscape belt and the park green area is large, which has a certain barrier rent to noise, and there is no high-noise equipment in the project area, it is expected that the project operation period has a small impact on the regional sound environment quality.

5.3.5 Solid Waste

(1) Household waste

The solid waste during the operation period mainly comes from the food waste (fruit cores, fruit shells and peels, food waste), food bags, paper scraps, etc. generated by tourists and park staff. 2.21t/d, and the annual generation is 807.3t/a based on 365 days.

(2) River floating objects

During the operation period, the floating materials in the river channel are mainly domestic garbage accidentally dropped into the water body by tourists and the residues of leaves, aquatic plants and fish dying in the river channel after the greening along the river. The amount of domestic garbage generated in the river channel is 1.5% of the amount of domestic garbage generated by tourists; the amount of residue generated after the death of leaves, fish and aquatic plants in the river channel is 6.59t/km with reference to the salvage number of floating materials in the river channel in Guangzhou, due to the difference of climate factors and vegetation types of water bodies, the floating materials generation factor of this evaluation is 4.5t/km. 112.3t/a.

Domestic garbage and salvaged floating materials are collected and transported to the nearby waste transfer station for unified treatment. The design sets up sorted garbage bins in each functional area in the project area and equips garbage removal equipment, so the landscape zone and park solid waste can be properly disposed of with little impact on the environment.

5.4 Social impact assessment

According to the Asian Infrastructure Investment Bank's Environmental and Social Framework (ESF) and the Environmental and Social Management Planning Framework (ESMPF), which has been made public in November 2021, the objective of the social impact assessment is to avoid or minimize adverse environmental and social (ES) risks and impacts; where unavoidable, in accordance with relevant Chinese laws and regulations and the AIIB's Environmental and Social Policy (ESP), identify these risks and impacts, and develop and implement necessary mitigation measures.

Therefore, the social impact evaluation of this project aims to identify the positive and negative impacts of the project through social participatory methods such as literature collection, field survey, questionnaires, symposiums, in-depth interviews and institutional

interviews, and to avoid potential social risks of the project through social management plan, improve the project design, protect the basic rights and interests of all stakeholders, and promote the fair participation of all stakeholders in the project. As a result, the main tasks of this social impact assessment are.

(1) Identify the key stakeholders of the project and understand the interests and needs of each stakeholder through extensive participation.

(2) Understand the potential social impacts of the project, including positive and negative impacts, and identify the potential social risks of the project in accordance with the AIIB Environmental and Social Framework and the relevant requirements of the Environmental and Social Management Plan Framework (ESMPF), which has been reviewed and made public by the AIIB in November 2021.

(3) To understand the attitudes of women, poor groups, etc. towards the project and to identify the impact of the project on them.

(4) To strengthen broad public participation, propose project optimization design, establish information disclosure and complaint complaint mechanisms.

(5) Develop social action plans as well as gender plans to avoid project risks and promote project goals.

In addition, in the process of consultation with the general public in the project area, public awareness of the project background, objectives and activities is raised and public participation is expanded through dissemination of project information, sharing of experiences, and selection of pros and cons.

5.5 Object and scope of social impact assessment

5.5.1 The object of social impact assessment

The social impact assessment of the project is aimed at the main stakeholders of the project and the secondary stakeholders of the project. Among them, the main stakeholders of the project are the direct beneficiaries within the influence area of the project and the groups negatively affected by the construction of the project, including the residents of Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District involved in the whole section of Jinshui River, disadvantaged groups, those affected by land acquisition and relocation, school teachers and students, doctors and patients of the hospital, etc.

The secondary stakeholders include the Integrated Jinshui River Management Sub-project Department of Zhengzhou Urban and Rural Construction Bureau, Zhengzhou City Housing Acquisition Service Center, Erqi District Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological and Environmental Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Bureau0, Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Civil Affairs Bureau, Transportation Administration, Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street street offices, design units, construction units, supervision units, etc. Also, focus on vulnerable groups, women in livelihood recovery and public participation.

5.5.2 Scope of social impact assessment

The scope of social impact evaluation of this project is the five sub-projects (river safety, bridge restoration and enhancement, water quality and ecological enhancement, greening and intelligent management project) of the whole section of Jinshui River comprehensive management project[7] .) The implementation unit of the associated project Guojiazui Reservoir is the Agricultural and Rural Working Committee of Erqi District, because Guojiazui Reservoir is currently under intense construction, and the implementation unit (Agricultural and Rural Working Committee of Erqi District), project management organization (Water Resources Bureau), project funding source (domestic financial allocation funds), etc. are not associated with the Integrated Jinshui River Management Sub-project, and relevant information on land acquisition compensation and other immigrant implementation is temporarily difficult to collect; therefore, the due diligence on resettlement of Guojiazui Reservoir restoration and construction reinforcement project will be organized by the Zhengzhou Urban and Rural Construction Bureau during the monitoring period of the project implementation (before the end of December 2022).

5.6 Social Impact Analysis

For this project, with the close cooperation of the Integrated Jinshui River Management Sub-project Department of Zhengzhou Municipal Bureau of Urban and Rural Construction, Zhengzhou City Housing Acquisition Service Center, Zhengzhou City and Erqi District, Jinshui District Natural Resources and Planning Bureau, Erqi District Housing Acquisition Service Center, Jinshui District Housing Acquisition Service Center, the social assessment survey team conducted questionnaire surveys in Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District of Zhengzhou City from February 7 to 18, 2022 through on-site methods with 520 valid questionnaires in close cooperation with relevant street offices, housing owners, communities/village groups and individuals. Respondents covered different age groups, different education levels and different occupations, including 318 men and 202 women. The survey results show that about 95% of the respondents know about the comprehensive improvement project of Jinshui River through different ways, and 92.59% of the respondents support the construction of the early section of the project. At the same time, the social assessment survey team conducted 76 interviews and talks with 435 people from institutions, of which 141 were female participants and 32.4% were female participants.

On the whole, combining the results of the on-site field survey and the statistical analysis of 520 questionnaires conducted on residents in the project areas of Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District, it can be found that residents in the project areas of Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District believe that the implementation of the project will have positive impacts mainly in the following aspects: (1) 70.37% of residents believe that the construction of the project will make (2) 62.96% of the residents think it will reduce the impact of flooding; (3) 51.85% of the residents think it will make travel more convenient; (4) 50% of the residents think it will improve the surrounding natural environment (including suppressing dust and improving the landscape); (5) 48.15% of the residents think the construction of the project will improve the traffic congestion along the river; ((6) 48.15% of the residents believe that the project construction will improve soil erosion and water pollution; (7) 33.33% of the residents believe that the project construction will beautify the scenery along the river and increase tourism-related income; (8) 7.41% of the residents believe that the project construction will increase job opportunities *(during the interviews,*

[7]The social impact assessment report has been submitted separately for the three bottlenecks in the advance section of Jinshui River. For the detailed social impact assessment of the advance section, please refer to "Zhengzhou Integrated Jinshui River Management Sub-project - Environmental and Social Impact Assessment and Management Plan for the Bottleneck Sections ".

residents along the river informed the social assessment survey team that they need mostly long-term labor opportunities, 1-2 Most of them are not willing to work for 1-2 months; mainly because the project cycle is short, temporary work is not sustainable, and when the construction period is over, their original permanent work opportunities will be lost).

Table 5-7 List of residents' perceptions of the positive impacts of project implementation

Statistical indicators / Specific options	What are the possible positive effects of the implementation of this project								
Resident Awareness	Safer living	Reducing the impact of flooding	More convenient travel	Improve the surrounding natural environment	Improve traffic congestion along the river	Improve soil erosion, water pollution, etc.	Beautify the scenery along the river and increase tourism and other income	Increase job opportunities	No idea
Sample size	366	327	270	260	250	259	173	39	10
Proportion (%)	70.37	62.96	51.85	50	48.15	48.15	33.33	7.41	1.85

5.6.1 Social benefits

5.6.1.1 List of expected social benefits of project implementation

According to the field survey of the social assessment team, the project will benefit 752,770 people in 16 street offices along Jinshui River in Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District of Zhengzhou City, of whom 376,007 are female beneficiaries, accounting for 49.95% of the female beneficiary population.

Table 5-8 Summary table of beneficiary population in the project area

Project City	Project Area	Township/Street Office	Population	Female beneficiary population	Percentage of female beneficiaries (%)
Zhengzhou	Erqi District	Houzhai Street, Houzhai Township	55000	7650	13.91
		Wulibao Street Office	63000	31122	49.40

		University Road Street Office	48581	29454	60.63
		Minggong Road Street Office	24919	12612	50.61
		Songshan Road Street Office	54800	24700	45.07
		Honeybee Zhang Street Office	26826	13853	51.64
	Zhongyuan District	Haixi Road Street Office	35500	19667	55.40
		Ruhe Road Street Office	86300	45238	52.42
		Linshanzhai Street Office	72960	36877	50.54
	Jinshui District	Dashiqiao Street Office	37645	24308	64.57
		Duling Street Office	12403	9507	76.65
		Jingba Road Street Office	79200	41221	52.05
		Renmin Road Street Office	37816	21003	55.54
		Future Road Street Office	70848	36229	51.14
	Zhengdong New District	Ruyi Lake Street Office	23900	11472	48.00
		Longhu Street Office	23072	11094	46.08
	Total	16	752770	376007	49.95

Data source: from the project feasibility study report, the statistical yearbook of Zhengzhou City in 2020, and the social and economic statistical statements of townships.

The social sensitive points are the residential points within 200 meters near the construction site and along the Jinshui River in the project area. The social benefits that can be brought by the implementation of this project are shown in Tables 5-9 and 5-10 below. (1) The social benefits that can be brought by the implementation of the Integrated Jinshui River Management Sub-project are shown in Table 5-9 below.

Table 5-9 List of social benefits of Integrated Jinshui River Management Sub-project

No.	Main construction content	Affected Streets	Social benefits
1	River safety and security project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan	1）Improve the river support facilities, living and living more safely a. Repair of collapsed bridges and damaged banks along the Jinshui River. b. Improve the management system of the Jinshui River basin to facilitate the people's supervision and community participatory management of the part of the basin along the

		Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	Jinshui River and improve the river safety along the Jinshui River basin (2) Improve the standard of river flood control and reduce the impact of flooding a. Flood control standard of Jinshui River basin reaches 100 years and flood control standard of 5 years b. Increased disaster emergency management capacity in the Jinshui River basin, especially for residents in and around the section of Dihu that suffered the most from the 7-20 floods, will avoid the impact of another flood that submerged homes, vehicles, schools, and communities. c. Reduce the post-disaster psychological burden of residents near the Jinshui River Basin and reduce the impact of flooding in the Jinshui River Basin 3) Enhance the landscape along the river, improve soil erosion and water pollution along the Jinshui River, and improve the surrounding natural ecological environment
2	Bridge restoration and upgrading project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui**	(1) Repair collapsed bridges and damaged banks along the Jinshui River, improve river support facilities, and make living safer 2）Improve the flood control standard of the river to reduce the impact of flooding, especially for the residents in and around Dihu, which suffered the most from the 7-20 flooding, will avoid the impact of flooding again by flooding houses, vehicles, schools and communities. 3) Improve the traffic congestion along the river and make travel more convenient. Especially the areas and bridges with high traffic flow for residents to travel (for example, the internal bridge of Dihu Garden, the section of North University Road and the section of West Nautical Road). a. Improve the efficiency of daily travel for residents along the Jinshui River. During the epidemic, the community along the Jinshui River going to residents can realize the internal passage of the community, shopping, schooling, medical treatment and travel will be more

		District. Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	convenient. b. To ensure the safety of bridge traffic along the Jinshui River and facilitate daily matters such as students going to school, residents going to work and patients going to the doctor c. Facilitate recreational activities for elderly residents along the Jinshui River Bridge d. Improve the traffic congestion around the Jinshui River Bridge and reduce the occurrence of safety hazards.
3	Water quality assurance and ecological enhancement project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake	1）Improve the river support facilities, living and living more safely 2) Improve the management system of the Jinshui River basin to facilitate the people's supervision and community participatory management of part of the basin along the Jinshui River and improve the river safety along the Jinshui River basin 3) Enhance the landscape along the river, improve the surrounding natural environment, and increase tourism and other income 4) Solve the problem of black odor of water bodies in the Jinshui River basin and reduce the probability of water pollution in the Jinshui River basin. Further rectify the problem of water pollution in the Jinshui River section within the resident communities and create a good living environment for the residents of the communities along the Jinshui River.

		Street, Long Lake Street	
4	Greening improvement project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	1）Improve the landscape along the river, improve the surrounding natural environment, increase tourism and other income; solve the problem of black odor of the water in the Erqi Road bridge section of the Jinshui River basin, while beautifying the landscape along the Jinshui River along the water restaurant; improve the natural ecological landscape along the Jinshui River along the water restaurant, residential communities, Zhengzhou People's Park, and bring good living for the residents in Jinshui District and near the Erqi Road bridge section along the Jinshui River living experience. 2) Promote regional development, increase employment opportunities, and attract more people to visit and tour along the Jinshui River and surrounding parks (e.g., Water Restaurant, Zhengzhou People's Park), providing more employment opportunities and driving the economic development of the Water Restaurant and along the Jinshui River. 3) Effectively enhance the drainage capacity of the Jinshui River, strengthen and upgrade the shore lift, and improve soil erosion and water pollution along the Jinshui River.
5	Intelligent Management Project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan	(1) Improve the management system of the Jinshui River basin to facilitate the people's supervision and community participatory management of part of the basin along the Jinshui River and improve the river safety along the Jinshui River basin 2) Increase the disaster emergency management capacity of the Jinshui River Basin, reduce the post-disaster psychological baggage of residents living near the Jinshui River Basin, and reduce

		Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	the impact of flooding in the Jinshui River Basin 3) Improve traffic congestion around the Jinshui River Bridge and reduce the occurrence of safety hazards.

5.6.1.2 Improve the river support facilities, residential life is safer

The survey results show that 70.37% of the residents believe that the construction of the project will make their residential life safer. During the on-site field survey and interviews with residents, the social assessment survey team found that after the 7-20 mega-flood, some bridges along the Jinshui River collapsed and the banks fell, making it easy for safety accidents to occur. Currently, the infrastructure of the river in the project area is not perfect, and many watersheds are occupied by private individuals and developers, and there are some illegal structures, resulting in an unattended state in some watersheds of the Jinshui River.

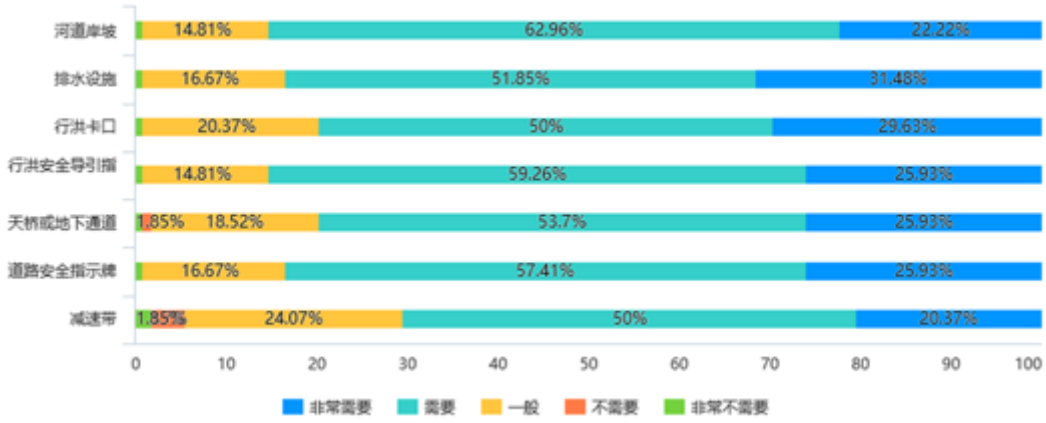


Figure 5-4 Demand for infrastructure on the Jinshui River by residents in the project area

The survey results show that more than 70% of the residents in the project area want to carry out the construction of supporting infrastructure implementation along the Jinshui River. Therefore, the construction of this project requires upgrading and renovation of relevant infrastructure along the Jinshui River, such as river bank slopes, flyovers or underpasses, speed bumps, etc. Enhance the safety of the Jinshui River basin, facilitate the residents' travel and life, and further reduce the occurrence of safety accidents. At the same time, the quality of life and leisure of residents will be improved, so that residents will be more satisfied with the infrastructure along the Jinshui River.

Interview Transcript 5-1: Mr. Zhang (35 years old), Wulibao Street, Erqi District
"After the floods last year, the bridges and pedestrian passages that we pass every day were damaged and have not been repaired, so it is very inconvenient for us to travel. There are also no guardrail facilities along the river, and there are many safety hazards."

5.6.1.3 Improve river flood control standards and reduce the impact of flooding

The Jinshui River has a 100-year flood control standard and a 5-year flood control standard; the current situation meets the 20-year flood control standard except for local chokepoints. 7-20 floods caused serious loss of life and property to the residents of Zhengzhou City and had a negative psychological impact on the residents. The social assessment survey team found in field talks and interviews that residents along the river reflected that the water flow in the Jinshui River basin is insufficient on weekdays and flooding rarely occurs; the flood control facilities and related supporting facilities along the river are not sound and there is a lack of flood control material reserves (sandbags, lifeboats, lifeboats, etc.). With the completion of the project construction, the flood control standard of Jinshui River will be improved, and after the flood control emergency drills are constantly drilled, the flood control standard of the river can be improved, the flood control awareness of the people can be enhanced, and the impact of flooding can be significantly reduced. Therefore, this project needs to improve the flood control standard of the Jinshui River, realize the optimized design of the whole section of the Jinshui River basin through the comprehensive improvement of the Jinshui River, and dredge the flood chokepoints to further improve the emergency management capacity of Zhengzhou City, so as to guarantee the flood safety of the main city of Zhengzhou.

Interview Transcript 5-2: Jinshui District, Dashiqiao Street Mr. Liu (54 years old)
"Usually there is no water inside our side of the Jinshui River, just last year as a mega flood, causing us too much damage, I hope the government to rectify as soon as possible."

5.6.1.4 Improve traffic congestion along the river and make travel more convenient

The survey results show that 48.15% of the residents think that the construction of the project can improve the traffic congestion along the river and make travel more convenient. There are a large number of residential areas, commercial areas, schools, hospitals and other places with high traffic flow along the Jinshui River, which are essential for residents to travel to work and recreation. There are 60 bridges across the Jinshui River, including 40 municipal bridges, 2 railroad bridges and 18 pedestrian bridges (1 bridge demolished). The July 20 flooding in Zhengzhou City exposed the problems of old bridges, failure to meet flood control standards, and lack of functionality. The social assessment survey team learned from field visits and questionnaires that the primary mode of travel for residents along the Jinshui River is electric vehicles, accounting for 61.11%; followed by walking, accounting for 59.26%; and in third place is public transportation, accounting for 46.3%. Most residents along the route pass along the Jinshui River every day to go to work and to buy biological materials. In the field interviews, most of the residents expressed that the current slow walking system along the river road of the Jinshui River is not connected, and the current status of the river along the Jinshui River has brought inconvenience to their daily lives and those of their families. Therefore, this project requires the reconstruction of damaged bridges, old demolition and reconstruction, restoration and upgrading, new construction of some pedestrian bridges and new construction of greenway bridges according to the real road section and actual situation, in order to meet the residents' daily life travel, unblock the traffic congestion along the road, and bring convenience to the life of the residents along the road.

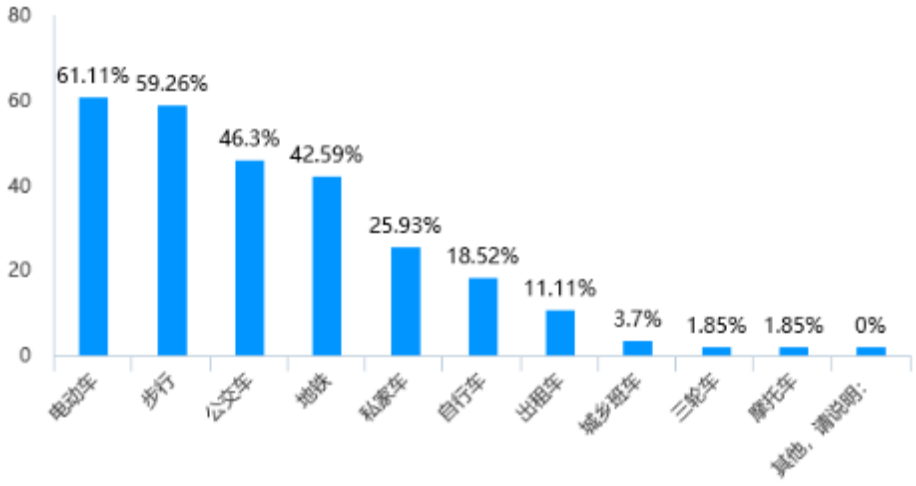


Figure 5-5 The mode of transportation of the residents in the project area in their daily life

Interview Transcript 5-3: Jinshui District, Jingba Road Street Mr. Li (65 years old)

"I go to the river every day for a walk, and in the evening, the place is very busy. Now some of the bridges and banks are damaged, and my son and daughter-in-law have to take a long detour to get home from work and so on."

5.6.1.5 Enhance the landscape along the river, improve the surrounding natural environment, and increase tourism and other income

The survey results show that 33.33% of the residents believe that the construction of this project will enhance the landscape along the river, improve the surrounding natural environment and increase tourism-related income. The social assessment survey team learned during the field visits that the river along the Jinshui River and the nearby park are the preferred recreational spots for residents. After work, a large number of residents, elderly people and children will go to the Jinshui River for walking, square dancing, listening to theater and other recreational activities. At present, there are problems of river collapse and insufficient greening function along the Jinshui River, which do not bring good resting experience to residents. Residents along the line envision that, with the completion of the project, the water surface of the Jinshui River will be widened and an open waterfront visual interface will be formed. At the same time, the waterfront landscape slow-moving green belt interacts with the Jinshui Road pedestrian space, providing residents with a good walking experience that will meet the diverse urban waterfront landscape needs of children, students, youth, the young, the young and the old. With the construction and completion of the project, several landscape points will be set up along the Jinshui River in combination with Zhengzhou People's Park, Wisdom Square, Yashin Building, and the viewing platform to improve the local tourism facilities, attract more people to visit the waterfront restaurant and Zhengzhou People's Park, provide more employment opportunities, and drive the economic development of the waterfront restaurant and the Erqi Road bridge section along the Jinshui River.

Interview Transcript 5-4: Dihu Garden, Zhongyuan District Mr. Zhang (51 years old)

"We hope that some greening facilities can be added around the Imperial Lake. Now this Imperial Lake water does not look very clean and the landscape along the route does not work, which cannot give us a good viewing experience."

5.6.1.6 Improve soil erosion and water pollution along the Jinshui River

After the 7.20 flood in Zhengzhou City, holes appeared in many river berms of Jinshui River and a large number of stones accumulated in the riverbed. The soil erosion type in the project area belongs to the northern soil and stone mountainous area, with thin soil layer and poor erosion resistance, which makes soil erosion very easy to occur when facing sudden rainfall and other situations. At the same time, both sides of the Jinshui River are hard barges, blocking microbial communication, resulting in a decrease in the self-purification capacity of the Jinshui River, which in the long run will lead to biodiversity loss and water pollution problems such as black smell. Some sections of the river were originally places for residents and tourists to enjoy the scenery along the river, but after the 7.20 flood, sewage invaded the top of the banks on both sides, leaving a lot of silt and garbage in the river, causing serious impact on nearby residents. The implementation of the project

will effectively enhance the drainage capacity of the Jinshui River, reinforce and upgrade the shoreline, and improve soil erosion and water pollution along the Jinshui River.

The survey results show that 48.15% of the residents believe that the construction of the project can improve the situation of soil erosion and water pollution along the Jinshui River. During the field visits, the social assessment survey team found that most of the embankments of the Jinshui River are earthen slopes, which are prone to soil erosion when faced with sudden rainfall and other conditions. At the same time, part of the watershed along the Jinshui River is used by developers to invest in the lack of dedicated management, resulting in some watersheds or sections (such as the Imperial Lake) exist in the "three regardless" state. In the long run, the river is polluted with water quality and yellowish odor, which brings negative impact to the daily life of residents. This project needs to further improve the infrastructure along the Jinshui River, strengthen the supervision of the Jinshui River basin, and further improve and solve the soil erosion and water pollution in the Jinshui River basin.

Interview Transcript 5-5: Dihu Garden, Zhongyuan District Mr. Zhang (51 years old)

"We can't say now who actually manages the Imperial Lake, the river is too polluted, I hope it will be rectified as soon as possible."

5.6.1.7 Promote regional development and increase employment opportunities

First of all, it is bound to promote the economic development of the project area. The Jinshui River, as the only urban river linking the four major urban service centers and the old and new urban areas in Zhengzhou, is a must for the residents of the four project areas in Zhengzhou to travel, live, work and play. The Jinshui River basin is surrounded by a large number of residential areas, commercial areas, work units, residential recreational areas and river landscape parks, which has a large flow of people. The comprehensive improvement project of the Jinshui River will enhance the infrastructure along the Jinshui River and become the benchmark of urban ecological function management in Zhengzhou, which will drive up the surrounding property prices and attract developers to develop and build along the Jinshui River. At the same time, with the widening and restoration of the bridges of the Jinshui River, it will be more convenient for residents to travel.

Interview Transcript 5-6: Long Lake Street, Zhengdong New District Ms. Kong (55 years old)

"We didn't even anticipate the huge flood that broke out last year, and my partner and I used to walk along the river after dinner. Now the river ditch has dried up, the water quality is not clean, there are fewer people along the river and it is not as lively as before. We are very supportive of this project and hope that the construction will be completed as soon as possible so that we can repeat the life here."

During the construction and operation of the project, some unskilled positions will be generated, such as transportation of construction materials, construction of houses and catering services for the construction team during construction; after the completion of the project, management and service staff positions within each Jinshui River management site, cleaning and security, river cleaning and maintenance, etc. Through discussions and

consultations with the Zhengzhou Urban and Rural Construction Bureau and the project owner, the Zhengzhou Urban and Rural Construction Bureau will urge the project construction unit and the operation and management department to give priority to such employment opportunities to the surplus labor force in the project area and the surrounding areas, especially to those with labor capacity among the disadvantaged groups including women, the elderly and the low-income population, so as to help the low-income groups increase their income.

However, the survey results also show that 7.41% of the residents believe that the project construction can increase employment opportunities, which shows that the local residents are cautious about the economic impact of the project (because the residents along the route informed the social assessment survey team during the interviews that they need more long-term labor opportunities, and most of them are not willing to do 1-2 months of work; mainly because of the short cycle of this kind of project, temporary work is unsustainable. (When the construction period is over, their original long-term employment opportunities will be lost).

5.6.1.8 Strengthen the river management of the Jinshui River across residential communities and enhance the river management capacity along the Jinshui River

As an urban river that runs through the four main urban areas of Zhengzhou, the Jinshui River has a large number of residential areas along its route. However, there is a bad phenomenon of unmanaged part of the Jinshui River basin flowing through residential areas, which brings negative impact on the water quality of the Jinshui River, the landscape along the Jinshui River and the governance of the communities along the river.

During the interview at Dihu Garden, the social comment team learned that Dihu Garden was supposed to be a large community with a beautiful environment and a great location. The internal section of the Jinshui River at Dihu Garden was supposed to be managed by the real estate company. However, in recent years, because the property has been negligent management of its three entrances, in fact, from the community was built to date without management, any personnel vehicles can enter, the community mixed vehicles, seriously affecting the quality of life of community owners. The property owner says it is the municipal road, the community says it is the internal road of the district, shifting management responsibilities to each other. In the case of unclear entrance management, there are always outsiders going to the Imperial Lake fishing and accompanied by littering, resulting in the original clear and beautiful Imperial Lake trash floating, smelly. At the same time, Dihu Garden community is the intersection to the Yangtze River Park, the small area vehicles parked at will, occupy the fire escape, not only affect the owners of traffic, but also generate a lot of safety hazards. With the Integrated Jinshui River Management Sub-project to promote more owners concerned about their rights and interests, the management of the river and residential areas along the Jinshui River has received the attention of the relevant departments, Zhengzhou City Jinshui River across residential areas of the relevant watershed will improve the river system, the formation of participatory river management model. By then, the river along the Jinshui River, the residential neighborhoods along the river, the parks along the river, and the beautiful scenery along the river will be better managed to form a virtuous cycle, guaranteeing safety while bringing a good living experience for the owners and residents along the river.

Interview Transcript 5-7: Dihu Garden Ms. Hu (33 years old)
"The management of the emperor lake is too poor, failing the emperor lake, failing the park, failing the beautiful scenery, I hope the relevant departments to improve the management along the emperor lake, and return us a blue wave of the emperor lake."

5.6.2 Social Risks

5.6.2.1 List of negative impacts of project implementation

The implementation of this project may have negative impacts as shown in Table 5-10 below.

(1) The negative impact of the implementation of the comprehensive improvement project of the whole basin of the Jinshui River is shown in Table 5-10.

Table 5-10 List of negative impacts of the implementation of the Jinshui River Basin-wide Comprehensive Improvement Project

No.	Main construction content	Affected Streets	Negative effects
1	River safety and security project	**Erqi District** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	**1）Immigration impact: The** land acquisition and demolition of **this** project affects four districts in Zhengzhou, including Erqi District, Jinshui District, Zhongyuan District and Zhengdong New District, affecting a total of 48 households and 210 people. Among them, 37 households and 145 people are affected by the permanent acquisition of collective land; 11 households and 65 people are affected by the demolition and relocation of houses. **2) Negative natural and social environmental impacts arising from construction.** A. Construction noise interferes with the learning of kindergarten children and the learning of school and university students. B. The dust, dirt and mud generated during the construction process will cause inconvenience to the residents, patients and travel in the surrounding area. C. The noise, dust and exhaust emissions from construction machinery and material transportation vehicles, domestic sewage discharge and domestic garbage disposal during the
2	Bridge restoration and upgrading project	**Erqi District** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District** Ruyi Lake Street, Long Lake	

		Street	construction period affect the community landscape of residential areas along the route and affect the rest of the residents. D. Due to the construction needs, there will be a temporary impact on the traffic phenomenon, the construction unit should be combined with the actual traffic diversion program to avoid traffic congestion. **3) Impact of foreign labor: Increased communication and contact between foreign labor and residents along the Jinshui River is detrimental to social stability** A. Health and sanitation risks, such as AIDS, New Coronavirus, influenza, etc., and construction by outsiders tend to put more pressure on community epidemic prevention B. Conflict of different social and cultural practices (including religious beliefs, graves, temples, wedding and funeral customs, etc.) **4) Gender-based violence: Gender-based** violence may arise during construction and in the day-to-day affairs of the site, including discrimination against women in the employment of workers, thereby causing physical, psychological or sexual harm to women, including gender-based violence such as threats, coercion or arbitrary deprivation of liberty.
3	Water quality assurance and ecological enhancement project	**Erqi District** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District** Ruyi Lake Street, Long Lake Street	
4	Greening improvement project	**Erqi District** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	
5	Intelligent Management Project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District** Ruyi Lake Street, Long Lake Street	

5.6.2.2 Land acquisition and demolition

According to the project migration impact identification survey statistics, it is found that the migration impact of this project is mainly caused by the land acquisition and house demolition involved in the project river training. The project land acquisition and demolition affects four districts in Zhengzhou, including Erqi District, Jinshui District, Zhongyuan District, and Zhengdong New District, affecting a total of 48 households and 210 people.

Among them, 37 households and 145 people are affected by permanent acquisition of collective land; 11 households and 65 people are affected by house demolition and relocation. The main immigration impact of this project is as follows (specific immigration impact is detailed in the "Henan Province Post-Storm Flood Recovery and Reconstruction Project - **Integrated Jinshui River Management Sub-project** Immigration Resettlement Plan").

1） Impact of land acquisition

The project permanently expropriates 507.35 mu of collective land, affecting 37 households and 145 people. The northern section (West Third Ring - Dongfeng Canal section) involves the expropriation of 180.98 mu of collective land in Zhongyuan District, Erqi District and Jinshui District, which does not affect households; the southern section (Guojiazui Reservoir - West Third Ring section) involves the expropriation of 326.37 mu of collective land in Zhongyuan District and Erqi District, affecting 6 communities/villages in Songshan Road Street and Houzhai Township in Erqi District, affecting 37 households and 145 people.

The project permanently occupies 2,662.61 mu of state-owned land. According to the project section, the southern section (Guojiazui Reservoir - West Third Ring Section) occupies 846.72 mu of state-owned land in Erqi District, while the northern section (West Third Ring - Dongfeng Canal Section) occupies 1,815.89 mu of state-owned land in four districts, namely Zhongyuan District, Erqi District, Jinshui District and Zhengdong New District.

The temporary land occupation impact of this project involves a total of 16.2 mu of temporary land, mainly the original river, the open space on both sides of the river, the original road and the river bank land. Among them, 13.12 mu of state-owned land is occupied and 3.08 mu of collective land is occupied.

2）The impact of house demolition and resettlement

This project involves the demolition and relocation of residential houses in the northern section (West Third Ring - Dongfeng Canal section) of 711 square meters, all of which are brick and concrete structures, directly affecting 6 households and 22 people, all of whom are urban residents.

The non-residential housing demolition of this project involves a total of 3796.98m2 of non-residential housing in the northern section (West Third Ring - Dongfeng Canal section), all of which are brick and concrete structures, directly affecting 5 households and 43 people. Non-residential housing demolition and relocation affects 3 enterprises and 4 buildings.

The socially sensitive areas for the implementation of the project are mainly land acquisition or demolition impact areas, involving four project areas, involving a total of 17 surrounding towns/streets and offices, and nine communities/villages.

5.6.2.3 Possible natural and social environmental impacts arising from project construction and operation

The noise, dust and exhaust emission from construction machinery and material transportation vehicles, domestic sewage discharge during the construction period, drying and cleaning of river bottom silt and transportation, and disposal of domestic garbage and other environmental problems during the project construction activities may have certain impact on the life and production of the residents around the project area, especially if the

construction site is close to residential communities and schools. For example, the construction site of Dihu section is close to the residential area of Dihu Garden and kindergarten, the construction and transportation process may disturb the normal rest and life of students, and even pose a threat to students' travel safety; some sludge will be generated during the construction period, and after accumulating and drying on the bank and slope of the construction river, it will be entrusted by the project construction unit to the sludge transportation company to transport the sludge to the Zhengzhou Gujia Technology Industry Co. Ltd. Che Dagou dumping ground (state-owned barren ditch, no residential area around) is piled up and landfilled. In the process of transporting the sludge, it may pass through the residential community and internal roads in the project area, generating environmental and noise pollution and disturbing the daily passage of residents.

This can be corroborated by the statistical analysis of 520 questionnaires. Residents in the project area believe that the implementation of the project may produce negative impacts mainly in the following ways: ① 92.59% of residents believe that the construction of the project will cause waste gas, waste water, noise and solid waste pollution during the construction period; ② 87.04% of residents believe that the construction period will cause short-term travel inconvenience; ③ 44.44% of residents think that the project construction will adversely affect the safety of life and property of local people; ④ 27.78% of residents think that the project construction period will lead to soil erosion and water pollution in some sections of the Jinshui River; ⑤ 22.22% of the project construction will have the impact of land acquisition and housing demolition. ⑥5.56% of the residents think that the project construction will cause the prevalence of AIDS or other infectious diseases. For details, see Table 5-12.

Table 5-11 Statistical table of negative impacts on residents' perceptions during project construction and operation

Indicator Category	Possible negative impacts during the implementation of this project						
Resident Awareness	Construction waste gas, waste water, noise and solid waste pollution	Short-term travel inconvenience during the construction period	The construction period is not good for the safety of local people's lives and property	Resulting in soil erosion and water pollution in some sections of the Jinshui River	Impacts caused by land acquisition and house demolition	Causing an epidemic of AIDS or other infectious diseases	No idea
Sample size	481	453	231	144	116	29	39
Proportion (%)	92.59	87.04	44.44	27.78	22.22	5.56	7.41

5.6.2.4 Impacts of project construction on community health and residents' daily travel safety

(1) The project is a linear project, and the construction site is located near a large number of residential houses, schools, hospitals and other places with dense movement of people. During the construction period of the project, the frequency of a large number of construction vehicles and dredging vehicles going in and out of the community will increase, which will not only cause inconvenience to the travel of residents to and from the community, but more importantly will cause safety hazards to the travel of residents. Especially children and elderly people with walking difficulties, who are not very agile in

avoiding vehicles, are prone to safety accidents. At the same time, the silt and dirt on the vehicles may fall off during the operation of the construction vehicles, causing adverse effects on the surrounding flow of vehicles and pedestrians coming and going. At the same time, the dust permeating the air is not conducive to the respiratory health of pedestrians coming and going in the community.

(2) During the implementation of the project, noise, dust and exhaust emissions from construction machinery and material transportation vehicles, domestic sewage discharge during the construction period, domestic garbage disposal and other environmental problems may cause certain impact on the life and production of the residents around the project area. Since the construction site of the project involves the living area of the main city with large flow of people, attention should be paid to the isolation of noise and dust during construction to minimize the impact on the residents of the surrounding communities/villages and schools during the construction process.

(3) The construction of the project also involves the treatment of rivers and the restoration of bridges in the main city of Zhengzhou. With the construction and operation of the project, the landscape along the rivers will be opened and the facilities will be improved. The traffic flow and traffic volume in the project area will increase greatly, and the huge traffic flow will pose a potential threat to the personal safety of the surrounding villagers, especially for the schools involved in the project area, which should implement safety education for students to prevent accidents.

5.6.2.5 Labor conditions

During the construction period of the project, the linear project along the Jinshui River involves a wide range, a deep degree and a large volume of work, which will require the organization of professional construction teams for construction, and once the professional construction teams cannot meet the qualification and construction requirements locally, a certain amount of labor will need to be imported from overseas (provinces, cities and counties), which is expected to be about 280 people (about 196 male workers and 84 female workers); from About 364 workers are recruited locally (about 246 male workers and 118 female workers). Among them, male laborers mainly work as big and skilled workers, and female laborers mainly work as small and unskilled workers. Particular attention should be paid to gender-based violence during the construction process and in the daily affairs of the construction site. Acts of discrimination against women in employment should be avoided, and physical, psychological or sexual harm to women, including gender-based violence such as threats, coercion or arbitrary deprivation of liberty, should be avoided. During the construction process, attention should be focused on the ratio of male to female laborers, which should reach 30%.

A large number of foreign laborers are stationed in the project area for long hours of operation, and to a certain extent the intensity of communication and interaction with local residents increases. At the same time, foreign laborers will move and consume in the residential communities and related street stores near the construction sites, thus triggering certain social and health risks. For example, in terms of residents' health and hygiene, some epidemic diseases (including AIDS, New Coronavirus, influenza, etc.) have the conditions to spread and spread; meanwhile, if the foreign workers lack understanding of the local social culture and traditional customs in the project area, they may cause unintentional offense to the local social and cultural customs (including religious beliefs, graves, temples, wedding and funeral customs, etc.), which will lead to potential crisis The potential crisis and disturbance will arise. In order to mitigate the risks associated with the influx of labor, appropriate procedures for managing worker camps need to be developed.

Table 5-12 List of the composition of the personnel and the types of work expected

to be invested in the construction of the project

Statistical indicators / Project Area	Field laborers (people) - The proportion of female laborers should reach 30%	Mainly engaged in the type of work	Local recruitment (people) - Female labor ratio should reach 30%	Mainly engaged in the type of work	Total
1.Erqi District	72	Project management, financial management, contract management, large machine operation, etc.	92	Construction workers, material transporters, caterers, cleaners, etc.	164
2. Zhongyuan District	75	Project management, financial management, contract management, large machine operation, etc.	8	Earthmoving, material transportation, construction workers, caterers, cleaners, etc.	162
3. Jinshui District	64	Project management, financial management, contract management, large machine operation, etc.	86	Earthmoving, material transportation, construction workers, material transportation, caterers, cleaning workers, etc.	150
4. Zhengdong New District	69	Project management, financial management, contract management, large machine operation, etc.	99	Earthmoving, material transportation, construction workers, material transportation, caterers, cleaning workers, etc.	168
Total	**28**	**/**	**364**	**/**	**644**

5.7 Comparative analysis of labor force and working conditions

A comparative analysis of the Chinese legal framework on labor security and the key requirements of the ESS1 labor and working conditions standards of the AIIB's Environmental and Social Framework shows that the Chinese legal framework on labor security is consistent with the AIIB requirements, and even more stringent than the AIIB requirements, such as the legal age requirement for employing child labor. Therefore, the existing Chinese legal framework is consistent with the key requirements of the AIIB ESS1.

However, in order to better guarantee the working conditions of the workforce, it is also recommended that construction units meet the following 5 requirements.

(1) Based on the principle of equal opportunity and fair treatment, the employment of project staff shall not discriminate against specific groups such as women, people with disabilities, migrant workers, and youth of legal working age.

(2) Provide appropriate protection and assistance measures to care for specific groups of workers, such as women, people with disabilities, migrant workers, and youth of legal working age.

(3) The right of workers to form and join workers' organizations of their choice and the guarantee of non-interference in their collective bargaining, in compliance with national law.

(4) To prevent the occurrence of sexual harassment, the contractor will set up sufficient separate facilities for men and women in the temporary toilets at the site according to the number of female staff; formulate rules and regulations related to the prevention of sexual harassment and assign special personnel to be responsible for them, and clearly inform all personnel of the relevant requirements; and include the prevention of sexual harassment in the contractor's daily management training.

(5) Establish and clarify the complaint mechanism for handling labor complaints and grievances, clarify the labor protection supervision mechanism, and protect personal privacy in accordance with the law when handling sexual harassment complaints. The labor complaint mechanism is consistent with the complaint mechanism of this project, see Chapter 8 of this report on the complaint mechanism.

5.8 Poverty (low income) status

5.8.1 Current status of poverty (low income) in Zhengzhou[8]

By the end of 2021, there will be no poor villages in the project area, no poor households or poor population under the current standard. However, the poverty phenomenon will still be revealed in many forms such as relative poverty and low-income population, and the poor population is equivalent to the low-income population, which mainly refers to the low-income population transferred after the poor households are removed from poverty in 2019, hereby, the same below.

Zhengzhou City has 181 villages out of poverty, 11,928 households with 44,892 people out of poverty, 3,421 households with 10,565 people in the three categories, including 167 households with 534 people who are prone to poverty on the edge, 49 households with 157 people who are unstable out of poverty, and 3,205 households with 9,874 people in sudden and serious difficulties. During the 13th Five-Year Plan period in Zhengzhou City, 1,421 households and 5,070 poor people will be relieved from poverty through relocation. In early 2021, the 13th Five-Year Plan for poverty alleviation in Zhengzhou City will be successfully completed, and the system for protecting the rights and interests of the poor and the severely disabled will be basically improved, and the basic public service system will be more perfect. The public service system will be improved, and the cause of persons with disabilities will develop in a coordinated manner with the economy and society. By the end of 2021, the per capita disposable income of farmers in households out of poverty reached RMB 15,035.19, an increase of 10.71% year-on-year; among the three types of

[8]By the end of 2021, there will be no poor villages in the project area, no poor households or poor population under the current standard. However, the poverty phenomenon will still appear in many forms such as relative poverty and low-income population, and the poor population is equivalent to the low-income population, which mainly refers to the low-income population that will be transferred after the poor households are removed from poverty in 2019, hereby, the same below.

households, 124 households with 422 people were eliminated from risk.

5.8.2 Current situation of poverty (low income) in the project area

There are no poor villages in the four project areas, and no poor households or poor people under the current standards.

According to the statistics of the original file card poor households, it is found that there are 2,105 households and 3,515 people in poverty in the project area, with a poverty incidence rate of 0.001% (If the following information is not specifically stated, the analysis of poor households and population in poverty follows the data and information of the original file card, which is hereby stated).

By project area, their respective profiles are as follows.

(1) Erqi District: As of the end of 2021, the population of Erqi District was 848,000, including 830 households and 1,027 special hardship cases, with a poverty incidence rate of 0.001%. from January to November 2021, the district issued 14,129,500 yuan in low income and various subsidized workers for the needy, and the minimum living standard for urban and rural residents was raised to 740 yuan per person per month.

(2) Zhongyuan District: As of the end of 2021, there were 795,000 people in the district, including 935 households and 1,096 people in the original documented poor households, with a poverty incidence rate of 0.001%.

(3) Jinshui District: By the end of 2021, there were 1,333,000 people in the district, of which 215 households and 911 people were formerly recorded as poor, with a poverty incidence rate of 0.0006%.

(4) Zhengdong New District: As of the end of 2021, there were 239,900 people in the district, including 138 urban and rural special hardship dependents, and 125 families with 481 formerly poor households. By the end of 2021, the district had issued 2,137,700 yuan for special hardship dependents and 47,500 yuan for temporary relief for 11 families in the district who encountered temporary difficulties in life due to disasters and diseases. The poverty incidence rate was 0.002%.

Table 5 -13 Distribution of poor population in the project area

Region	Number of former poor villages	Number of original poor households on file	The original number of poor people on the file	Original poverty incidence rate
Erqi District	0	830	1027	0.001%
Zhongyuan District	0	935	1096	0.001%
Jinshui District	0	215	911	0.0006%
Zhengdong New District	0	125	481	0.002%
Total (project area)	0	2105	3515	0.001%

5.8.3 Minimum living security

By the end of 2020, Zhengzhou City had 1.518 million registered recipients of minimum

living security, including 149,000 in urban areas and 1.369 million in rural areas; 188.973 million yuan of low-security payments were issued to urban low-security households; 416.892 million yuan of low-security payments were issued to rural low-security households.

There are 4,150 households and 5,315 people in the project area, including 2,450 households and 3,144 people in rural areas, and 1,700 households and 2,171 people in urban areas. 4 project areas with minimum living standards are shown in Table 5-14.

Table 5-14 Minimum subsistence guarantee population in the project area

Region	Rural Minimum Livelihood Security			Urban minimum living security		
	Number of households (households)	Number of people (persons)	Proportion of agricultural population (%)	Number of households (households)	Number of people (persons)	Proportion of non-agricultural population (%)
Erqi District	958	1246	1.64	600	781	0.10
Zhongyuan District	478	560	0.84	457	536	0.07
Jinshui District	835	1073	1.03	497	638	0.05
Zhengdong New District	179	265	0.14	146	216	0.04
Total project area	2450	3144	0.73	1700	2171	0.07

Source: Statistical Bulletin of National Economic and Social Development of Zhengzhou City in 2020, Statistical Yearbook of each county and district.

5.8.4 Analysis of the causes of low income

The project area is located in the urban area of Zhengzhou City for the following low-income reasons.

(1) Elevated cost of living. The modernity of lifestyle determines the expensive cost of living for residents in the project area. Housing prices, transportation, and education put enormous pressure on the urban living population and cost more expenses.

(2) Great difficulty in employment. Most of the low-income residents in the project area are older, less educated, lack of vocational skills, and cannot adapt to the needs of the rapid development of life, and their enthusiasm to participate in various types of training is low, which directly leads to the difficulty of employment for these groups. They lose their low economic resources and become poor.

(3) The poverty caused by disability due to illness is prominent. Disability due to illness is the most important reason for the low-income population in the project area to be included in the low-income insurance. Some of the low-income households are incapacitated and living on low-income insurance, some rely on the pension of their elderly parents, and some borrow money for treatment, resulting in high debts.

(4) High incidence of poverty due to disasters. 2021 Zhengzhou 7.20 mega-city floods

seriously affected local economic development and caused huge property losses to residents (house, vehicle damage, lack of materials), which brought a double blow to the people who were already at the front line of low income, and the relevant relief and support measures did not follow in time, which directly or indirectly led to the occurrence of low insurance.

5.8.5 Project area support measures

In general, the poverty alleviation measures in the project area are mainly in the following areas.

(1) Solidly carry out dynamic monitoring and assistance to prevent return to poverty. Establish and improve the three mechanisms of data sharing, regular investigation and precise help by industry departments, and build a perfect monitoring and help network to achieve early detection, early intervention and early help. For the low-income households in the project area, all of them have implemented one-to-one help measures.

(2) Consolidate the foundation of "two no worries, three guarantees". Focusing closely on improving the level of "two no worries, three guarantees", relevant industry departments improve policies and initiatives, strengthen work guidance, strengthen supervision and inspection, education, medical care, health, drinking water safety, housing security, bottom-up security and other policies have been effectively implemented.

(3) To strongly promote industrial revitalization and stabilize employment, we have carried out training under the "Rainbows Plan", deepened financial support and put in small credit loans. We have supported a number of supporting industries such as special breeding, garment processing and photovoltaic power generation, and carried out solid consumer support. Explore the implementation of the party building to lead, government guidance, trade unions to help, the postal platform, social participation in the new model of consumer assistance.

5.8.6 Demand for this project from low-income groups

As seen from the above analysis of the low-income situation in the project area, the low-income population affected and served by the proposed project area is only 3,515 people. Therefore, it is necessary to consider meeting the special needs of this part of the group, absorbing their good suggestions and avoiding the possible negative impacts of the project on their production and life, in order to truly respect their group needs, serve this part of the group and play a positive role in their stable prosperity.

Therefore, in the field survey, the social assessment survey team understood the needs of the former poor groups in the project area for the project in various aspects through agency interviews, neighborhood committee interviews, and the collection of relevant information from the Zhengzhou Rural Revitalization Bureau, and found that the needs of this part of the group for the proposed project are as follows.

a. Hope to be given **priority in obtaining employment and jobs.** From the results of the symposium and data analysis, it was found that 92% of the formerly poor households with file cards raised the hope that the project construction could provide them with some jobs to increase their sources of income from labor. Therefore, they are in urgent need of jobs that can absorb them, and it is better to give priority to poor groups when recruiting workers, so as to supplement their families and increase their family economic income. During the construction and later operation of the project, some non-technical positions will be created, such as cleaners, rangers and security guards in the management stations

along the Jinshui River, etc. If these jobs are suitable, they can be provided to the poor groups as a priority. Therefore, it is necessary to consider meeting the special needs of this part of the group, absorbing their good suggestions and avoiding the possible negative effects of the project on their production and life, in order to truly respect their group needs, serve this part of the group well and play a positive role for their stable wealth.

Interview transcript 5-8: Mr. Wang (63 years old), Songshan Road Street, Erqi District
"My partner can not move, I have to serve, so I can not leave home, can only find some odd jobs around the home to do. I hope that when the project is under construction, I will be recruited to do odd jobs, and I can do cleaning work along the Jinshui River."

b. Vulnerable groups such as poor and disabled people hope that the project construction can provide them with some vocational skills training. From the symposium and data analysis, it is found that the poor and disabled people in the project area have narrow income sources due to the lack of employment skills. With the continuous promotion of industrialization and urbanization and the continuous improvement of social security system, the income channels of urban residents today are becoming more and more diversified, including both wage income and property income, both personal income and government transfer income, etc. However, for disadvantaged groups such as low-income populations and people with disabilities, their income sources and livelihood patterns are still very single and limited. At the same time, due to the low education, poor labor skills and old age of such groups, they often suffer from discrimination in the labor market, resulting in insufficient space for their livelihoods. Therefore, during the construction and operation of the project, vocational skills training for disadvantaged groups such as poor people and people with disabilities should be increased, such as training of relevant vocational skills and norms for river caretakers, cleaners and administrators along the Jinshui River.

c. The project construction and operation process should reduce the impact on the disabled and other vulnerable groups of traffic travel. During the construction of the project, some road excavation and bridge restoration works will cause inconvenience to the daily travel of disabled people. Therefore, during the construction process, conspicuous detour signs for the disabled should be set up to provide transportation subsidies for the disabled along the Jinshui River. At the same time, after the completion of the project, special walkways for the disabled and other disadvantaged groups should be set up on both sides of the Jinshui River to reduce the safety impact on the disabled and other disadvantaged groups and to guarantee the safety of the disabled and other disadvantaged groups in traffic appear.

5.8.7 Impact of the project on low-income groups

The negative impacts of the project potentially hindering poverty alleviation and creating new poverty are mainly: the project involves land acquisition and relocation, and relatively low-income communities and populations are often at a disadvantage in taking advantage of compensation and resettlement, accessing project benefits, and actively adapting to the transition, thus potentially exacerbating inter- and intra-regional and intra-community low-income problems; the completion of the comprehensive improvement of the Jinshui River may cause an increase in local price levels, bringing low-income The completion of the comprehensive improvement of the Jinshui River may cause an increase in the local price level, bringing pressure on the daily consumption of low-income groups.

However, in accordance with the project's planning and design objectives and subsequent safeguards, it will be ensured that the implementation of the project will not deepen poverty

levels in low-income areas or lead to new poverty, and that the low-income population will be able to benefit equally from the project and escape poverty, as evidenced by.

(1) Provide direct and indirect employment opportunities and increase economic income. The employment opportunities brought by the project: one is the temporary or permanent jobs directly created during the construction and operation of the project. Some of the unskilled jobs will be provided during the construction period, such as construction laborers, sand and gravel haulers, and workers, etc. These jobs will be given priority to the local low-income population and disadvantaged groups such as women to increase their economic income. The other is the employment opportunities indirectly brought by the project. The improvement of infrastructure along the Jinshui River will create good transportation conditions, attract more foreigners to Zhengzhou, develop local tourism resources, and indirectly create more employment opportunities, such as catering, accommodation, sightseeing tourism, leisure experience, sanitation and cleaning, etc. Thus, it will help low-income groups and disadvantaged groups such as women to realize local employment and increase their economic income.

(2) Improve local transportation infrastructure conditions. Reduce traffic safety accidents. The repair and reconstruction of bridges along the Jinshui River will alleviate traffic congestion and traffic accidents to a certain extent, and ensure the personal safety of local residents. The implementation of this project can reduce the incidence of traffic accidents in the project area, thus reducing their unnecessary medical expenses.

(3) Promote social equity and allow poor groups to share the fruits of development. The proposed project will effectively improve the supply level of water transportation infrastructure and public services in four districts of Zhengzhou, which can provide more convenience for urban and rural residents to enjoy the high level of medical and educational resources in Zhengzhou, allowing them to share the fruits of social development. After the completion of the proposed project, it will not only provide a better living experience for a large number of low-income people, such as the beautiful water scenery along the Jinshui River; it will also bring more development opportunities for low-income people, such as achieving more opportunities for non-agricultural employment and entrepreneurship, etc. To a certain extent, it can be said that the construction of the proposed project can benefit local residents, including a large number of low-income people, and allow them to share the fruits of social development.

5.9 Gender Analysis

5.9.1 Demographic status of women in project area

According to the Zhengzhou City Statistical Yearbook 2020, in 2020, the household population of Zhengzhou City was 10,352,000, an increase of 177,000 over the end of the previous year. Among them, the male population is 5,281,000 and the female population is 5,071,000, with a male to female gender ratio of 104:100.

The total population of the four project areas is 3,717,300, of which 1,802,400 are female, accounting for 48.49% of the total population. Among the four project areas, the female population in Zhongyuan District has the highest proportion of the total population in its area, 50.2%, while the female population in Zhengdong New District has the lowest proportion, 46.73%. As for the sex ratio, Zhengdong New District has the highest sex ratio of 114; Zhongyuan District has the lowest sex ratio of 102. The status of women's population in the four project areas is detailed in Table 5-15.

Table 5-15 Basic information of women population in the project area

Region	Number of households (million)	Population (10,000 people)	Men (10,000)	Women (10,000)	Female share of total population	Sex ratio (female = 100)
Zhengzhou	308.5	1035.2	528.1	507.1	49.0%	104
Project Area	123.49	371.73	191.49	180.24	48.49	106
Erqi District	28.5	84.8	43.2	41.6	49.5%	104
Zhongyuan District	25.8	79.5	40.2	39.3	50.2%	102
Jinshui District	45.2	133.3	68.6	64.7	48.9	106
Zhengdong New District	23.99	74.13	39.49	34.64	46.73	114

Source: Statistical Yearbook of the project area and the National Economic Development Bulletin.

5.9.2 Status of women in the project area

In order to understand the development status of women in the project area, the social assessment survey team conducted questionnaires and interviews with women in the field survey. The number of female respondents in the questionnaire survey was 202, accounting for 38.89% of the survey sample.

5.9.2.1 Age composition

From the survey sample statistics, men and women accounted for 61.11% and 38.89% respectively. From the age distribution of the sample, the largest number of people in the age group of 25-34 years old, accounting for 27.69%; among the female sample, the largest number of people between 25-34 years old, followed by 35-44 years old, and the least number of people aged 65 and above. The details are shown in Figures 5-6 below.

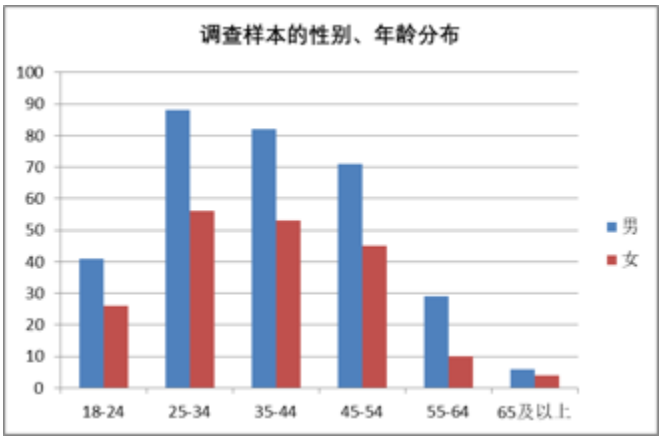


Figure 5-6 Gender and age distribution of the survey sample

5.9.2.2 Women have higher educational attainment

From the distribution of the education level of the survey sample, the education level of the survey respondents is mainly concentrated in the college level and above, with women and

men accounting for 68.56% and 67.32% of their group respectively; high school or secondary school education, women account for 12.38% of their group, lower than men's 16.35%; junior high school level, women account for 17.82% of their group, men account for 12.89%, women were significantly higher than men; for elementary school education, women accounted for 1.49%, while men only accounted for 1.26% of their group; whether at the junior high school level or elementary school level, women were significantly higher than men, and the education level was high.

From the above data, it can be seen that because the project area is in the main city of Zhengzhou, the survey sample is generally more educated for both men and women in terms of education level. The details are shown in Table 5-16.

Table 5-16 Educational attainment of the survey sample

Education level	Male		Women		Total	
	Number of people	Percentage	Number of people	Percentage	Number of people	Percentage
College and above	183	57.55%	173	85.64%	356	68.52%
High school/junior high school	52	16.35%	25	12.38%	77	14.81%
Junior High School	41	12.89%	36	17.82%	77	14.81%
Primary School	4	1.26%	3	1.49%	7	1.85%
Illiterate	3	0.94%	2	0.99%	5	0.01%
Total	318	100%	202	100%	520	100%

5.9.2.3 Occupational composition: gender differences between male and female practitioners are not too pronounced

From the overall distribution of the survey sample, in the occupational composition of both sexes, more than half of both men and women were personnel of institutions and enterprises and institutions, and the gender difference was not too obvious. Among other and freelance workers, there is no big difference in occupational composition. This indicates that in the labor market, men and women are relatively balanced.

Combined with the interviews, most of the survey respondents said that nowadays, gender equality is promoted, men also take up some household chores after work, and women also pursue their independence more and gain the status and voice of the family through work.

Table 5-17 Gender occupational distribution of the survey sample

Occupation	Male		Female		Total	
	Number of people	Percentage	Number of people	Percentage	Number of people	Percentage
Institutional staff	25	7.86%	23	11.39%	48	9.26%
Business unit staff	60	18.87%	46	22.77%	106	20.37%
Corporate Staff	54	16.98%	33	16.34%	87	16.67%

Self-employed	49	15.41%	38	18.81%	87	16.67%
Freelance	49	15.41%	47	23.27%	96	18.52%
Students	11	3.46%	8	9.41%	19	3.7%
Retirement	17	5.35%	12	14.36%	29	5.56%
Farmers	5	1.57%	5	4.95%	10	1.85%
Other	22	6.92%	17	19.31%	39	7.41%
Total	318	100%	202	100%	520	100%

5.9.2.4 Higher female support

(1) Women are more supportive of the project than men. When asked "Do you think this project is important for your family", the percentage of women who chose "very important" (58.20%) was higher than that of men (33.32%). According to the interviews, the improvement of the infrastructure along the Jinshui River is convenient for women to take their children to and from school, buy daily necessities, etc., which helps them better deal with family affairs, while men's views on the construction of the project are mostly focused on the convenience of going to work. For details, see Figures 5-7 below.

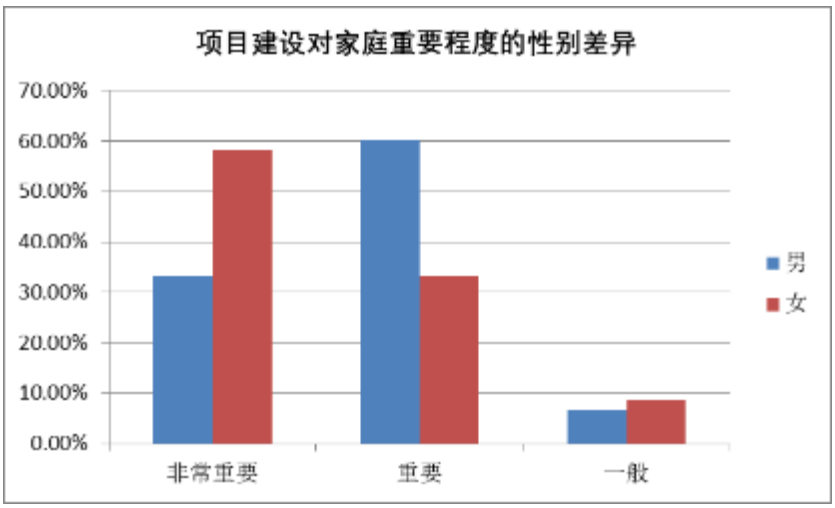


Figure 5-7 Gender differences in the importance of project construction to households

(2) Increased opportunities for women in the project area to participate in public affairs, contributing to the promotion of gender equality

In recent years, through the active efforts of government departments at all levels, women's federations and various public interest organizations (or international organizations), women in the project area have had more opportunities to participate in public affairs and to enjoy public services and various supportive policies.

The increasing number of women-oriented and women-involved public affairs activities in the project area will inevitably give local women more opportunities to participate in public affairs, improve their own ability to participate in social activities, increase women's technical, social and even physical capital, and provide women with the possibility to increase their economic income and improve their status in the family and society.

5.9.3 Women's needs and expectations

During the project preparation phase, the Zhengzhou AIIB Project Management Office, the four project areas, the project implementation unit, as well as the design unit and the social assessment survey team, understood the needs and suggestions of women in the project areas through discussions and interviews. The field survey found that women's needs for this project were as follows.

5.9.3.1 Women's needs and expectations for the treatment of the Jinshui River and the traffic along it

According to the survey statistics, the most important travel mode for women is walking (35.2%), and the second most important travel mode is by electric vehicle (30.0%) and subway (23.8%). In the process of field interviews, the social assessment survey team learned that women in the project area basically have to pass along the Jinshui River every day to make purchases of living materials, and they still rely more on electric vehicles, walking and bicycles to travel in their daily lives. Especially when picking up and dropping off children at school, they need to use electric vehicles. The statistics of people's daily travel mode by gender in the project area are detailed in Table 5-18.

Table 5-18 Survey sample travel mode statistics by gender

Statistical indicators	Statistical values for women			Statistical values for men		
	Transportation	Frequency	Percentage	Transportation	Frequency	Percentage
First place travel mode	Walking	81	35.2%	Walking	83	33.2%
	Electric Vehicles	75	30.0%	Electric Vehicles	71	28.2%
Second place travel mode	Buses	66	26.4%	Buses	71	28.2%
	Electric Vehicles	68	27.0%	Electric Vehicles	73	29.2%
Third place travel mode	Walking	60	24.0%	Walking	69	27.4%
	Subway	60	23.8%	Subway	72	28.8%

(1) We hope to rebuild or restore bridges and washed-out roads as soon as possible to facilitate traffic movement. From the actual situation of existing roads and infrastructures along the four project areas, some sections have problems such as poor road/bridge/pedestrian road conditions, congested traffic conditions on roads/bridges/pedestrian roads and serious water on the roads, especially during holidays, the existing Jinshui River has a high flow of people and pressure on traffic, which is far from meeting the daily travel and living needs of women in the project areas. In their daily lives, women are responsible for transporting their children to and from school and purchasing household goods, and the frequency of going out for these matters is relatively high. Therefore, women in the project area generally support the construction of the proposed project and have raised corresponding high expectations for the construction and reconstruction of water bridges, sidewalks, bridges and road quality along the river, and supporting infrastructure.

(2) Women believe that the infrastructure of the Jinshui River is old and in need of reconstruction after the disaster. The survey team found that 9.26% of women thought that "the road access facilities along the river are aging and there are potential safety hazards", and 35.19% thought that it was very serious. 5.56% of women thought it was very serious

and 29.63% thought it was serious; 5.56% of women thought it was very serious and 16.67% thought it was serious when it came to "roads/bridges/sidewalks are in very poor condition"; 5.56% of women thought it was very serious when it came to In terms of "traffic congestion on roads/bridges/sidewalks", 3.7% of women thought it was very serious and 24.07% thought it was serious; in terms of "inconvenient access along river roads in both directions", 9.26% of women thought it was very serious and 31.48 In terms of "inconvenience along the river road", 9.26% of women thought it was very serious and 31.48% thought it was serious.

In general, women in the project area perceived serious access problems along the Jinshui River. In conjunction with the interviews, most women believed that the main problems with the local traffic situation were old bridges, damaged bridges, and inadequate infrastructure along the Jinshui River.

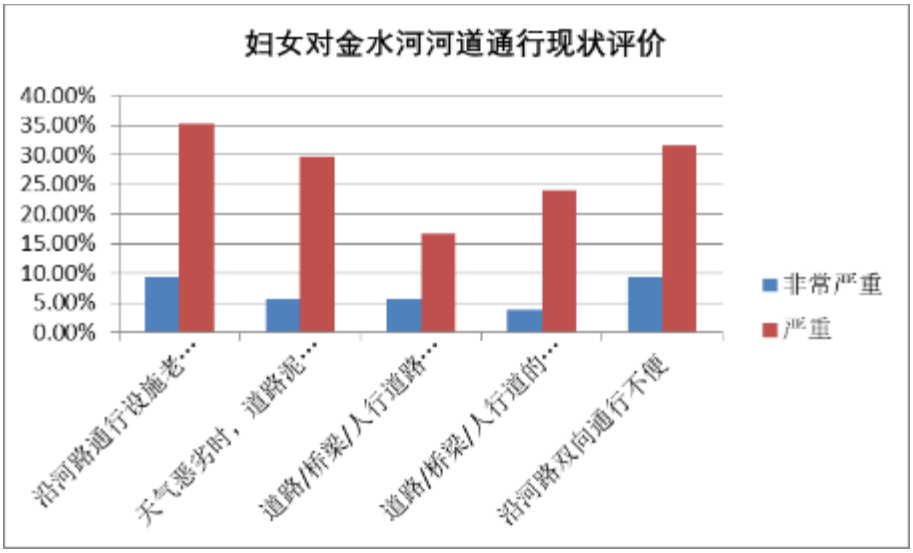


Figure 5-8 Women's evaluation of the current status of river passage in the Jinshui River

5.9.3.2 Women are more supportive than men to the project and are confident in project construction

When asked "do you support the construction of this project", the percentage of women who chose "very supportive" (75.42%) was higher than that of men (60.24%). From the interviews, the comprehensive improvement project of Jinshui River will solve the inconvenience of residents' daily life, improve the quality of life of residents along Jinshui River, and enhance the safety of residents' travel, so women are more supportive of the project than men. See Figure 5-9 below for details.

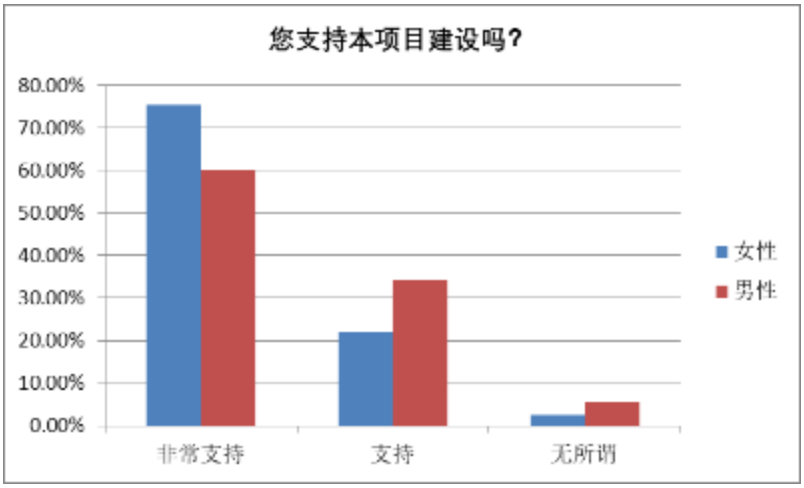


Figure 5-9 Project support motivation situation

Interview Transcript 5-9: Ms. Zhang (39), Renmin Road Street, Jinshui District, Zhengzhou City

"We women are definitely very supportive of the project construction, this side of the Jinshui River is well improved, we can often take the children to the river for a walk, shopping or something, certainly much more convenient."

5.9.3.3 Women want more opportunities for employment and income generation in the project

During the construction and later operation of the project, some unskilled jobs and service jobs will be created, and the corresponding people, especially women, will be needed to do the relevant work. In the field survey, the social assessment team learned that some women in the project area will move to live in the school district near the Jinshui River for the sake of their children's schooling. After the completion of the comprehensive improvement project of Jinshui River, there will be some unskilled jobs such as cleaning along the Jinshui River, from which women residents in the project area hope to get more employment and income opportunities, most of them do not want to go too far from home, and want to find a job near their homes to make a living.

Interview Transcript 5-10: Ms. Li (40 years old), Jinshui District, Zhengzhou City, Jingba Road Street

"We are for the children's school to move here from the village, the house are loans to buy, I usually engaged in some odd jobs in the community, a month thousand dollars, the comprehensive improvement along the Jinshui River is completed, want to clean and clean in it, anyway, close to home, I hope that we can give us some work."

5.9.3.4 Women have a strong need for public participation

During the field survey, it was found that although the project area is in the urban area of Zhengzhou, the social tradition of male domination and female domination still exists, and major decisions, skills training, flood prevention and drainage publicity and other activities are still dominated by men, and the proportion of female participation is still relatively small. When asked, "Have you ever participated in training related to flood prevention and drainage?" More than half of the women said they had not participated, as detailed in Figure 5-10 below.

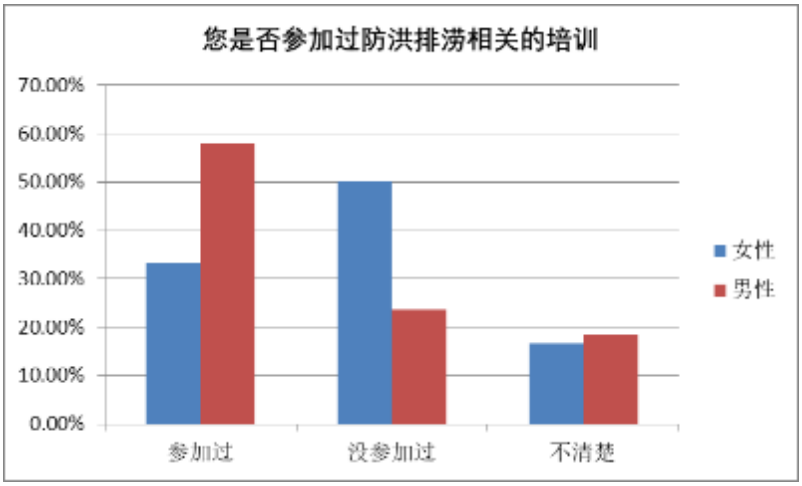


Figure 5-10 Have you attended training related to flood control and drainage

During the interviews, it was found that women in the project area generally expressed their willingness to participate in activities such as major decisions, skills training, and safety awareness campaigns, and their willingness to participate was generally high. They expect that in future flood control and drainage safety campaigns, skills training, and awareness activities, more attention will be paid to the needs (they have a much lower level of education) and interests of women, especially middle-aged and elderly women, in an easy-to-understand manner so that they are more likely to listen and understand and do so.

Interview Transcript 5-11: Ms. Liu, Houzhai Township, Erqi District, Zhengzhou City (35 years old)

"I am usually at home with the children cooking and housework, sometimes the community meeting to sign something, are my family men to go, in fact, I think some things we women can do, but no such opportunity. We would also like to go to meetings to give advice or something, I hope the government can give us women a little opportunity in the future."

5.9.4 Impact of the project on women

5.9.4.1 Positive impact

(1) Enhance the safety along the Jinshui River

The Jinshui River is the only urban river in Zhengzhou City that connects the four major urban service centers of Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District and runs through the old and new urban areas. A large number of residential areas are located along the Jinshui River. Commercial and recreational areas, is the residents to travel to work and daily recreation must go through the water channel, but also an important chokepoint of flooding and drainage in Zhengzhou. The dredging of the river along the Jinshui River, the restoration of the riverbank, the widening and restoration of the bridge and the improvement of the infrastructure along the river will improve the flood control and drainage standards of the river in Zhengzhou, reduce the residents' exposure to flooding, and improve the situation of soil erosion and water pollution along the river, making it more convenient for the residents to appear and improving the traffic congestion

along the river.

(2) Provide a safer and more convenient travel environment for women

After the completion of the comprehensive improvement along the Jinshui River, it will be more convenient and safer for women to go out, and the transportation along the Jinshui River will be more perfect, which will help reduce the time for residents to travel to work and facilitate their daily life, while avoiding the risk of riding on public transportation. In addition, the improvement of infrastructure and landscape along the Jinshui River will help residents to have a good leisure and entertainment experience; save women's travel time. Women in the project area ride electric bikes more often to take their children to school, and after the transportation mode is improved, it will reduce the burden of women to take their children to and from school every day, saving time for productive work or leisure and entertainment.

(3) Provide non-farm employment opportunities for women to increase economic income

During the project construction process, a certain number of temporary jobs will be provided for women, such as laborers with low technical requirements, cleaners, traffic maintainers, and cooks for the construction team, etc. These nearby temporary jobs can be provided to young and strong women and low-income groups, so that local women and low-income groups can increase their non-farm economic income; after the project construction is completed, a certain number of Non-technical jobs, such as cleaners, rangers and security personnel along the Jinshui River, will be provided to low-income households and women with working needs among the affected residents along the Jinshui River after the project is completed, so as to ensure that low-income groups can increase their economic income.

(4) Encourage women's participation and promote their own development

The AIIB project has always encouraged women's participation and paid attention to the protection of women's rights and interests. During the implementation of the project, the existing community resident committees and village committees will be used to encourage women to participate in public affairs and establish corresponding incentive mechanisms. In each project community or village committee, women will be encouraged to participate in project seminars and suggestion forums. This will allow more women to understand and participate in the project, giving women a full voice, recognizing their value, presenting their own needs, and seeking more opportunities for development. At the same time, providing women with special water safety awareness training and training related to flood prevention and drainage is beneficial to raising their awareness of participation, improving the overall quality of women, and promoting their long-term development. The results of the social evaluation survey show that female respondents have a higher willingness to participate in public activities; therefore, to achieve the community participation and public awareness campaigns set in this project priority should be given to the participation of female groups.

5.9.4.2 Negative impacts

Based on the results of the field survey, it was found that the implementation of the project will benefit women. However, a lack of gender sensitivity and neglect of women's project needs and suggestions during project design, implementation, and management can reduce project benefits and pose risks to women. The social risks to women from the project are mainly in the following areas.

(1) Low female public participation rate in the project and the corresponding

needs of women are easily ignored

In the project area, women's social status is still lower than men's due to factors such as traditional social culture and economic dominance, and men are mostly the ones who make decisions in major family matters and participate in public affairs. As a result, women's specific needs and suggestions are often overlooked during the design, implementation, and operation management phases of projects. For example, when asked, "Have you attended any safety training related to flood control and drainage?" More than half of the women said they had not participated, resulting in insufficient attention to women's needs in the project community, which makes it easy for women's needs to be ignored.

(2) Some rights such as compensation payments and access to job opportunities are difficult to secure

In the process of compensation payments for land acquisition and demolition, some women are unable to implement effective signatures to receive compensation payments for land acquisition and demolition because they are not the head of the household. As a result, they are vulnerable to passivity in terms of the right to dispose of the money later after the male head of the household receives the compensation money. During the construction and operation of the project, it will be difficult to eliminate the exclusion of female workers by construction teams and builders based on local social traditions; at the same time, it will be more difficult to guarantee women's rights when they are recruited into the construction site, whether they can receive equal pay for the same work as men, and whether they can receive effective job protection and non-discriminatory treatment.

Interview Records 5-12: Ms. Liu (48 years old), Haixi Road, Zhongyuan District, Zhengzhou City

"I am generally at home with the grandchildren, cooking, sweeping the floor, like those who sign meetings and so on, sometimes I want to go, but generally are men up, and then I'm used to not go."

(3) Land acquisition will lead to a reduction in the income that some women receive from the land

The land acquisition involved in the project may directly affect the standard of living of women in the household who have lost their land. When the land is expropriated, the income derived from the land is reduced accordingly. The opportunity to harvest crops (rice, orange fruits, vegetables, etc.) from the land is almost lost, and thus the income from subsistence staples, vegetables, orange fruits, etc. will be partially lost, and these products will have to be obtained by purchasing from the market. If women who lose their land are unable to obtain employment placement or do not find suitable jobs, the income of women who are mainly farmers will be reduced. This will increase the economic pressure on their families and reduce their standard of living.

(4) Need to strengthen traffic safety awareness education and publicity

Since women in the project area are generally less educated and lack traffic safety knowledge, they can largely create some safety hazards. In the symposium held, women and the elderly are relatively lack of traffic safety knowledge. And because of women's own low social status and low literacy, traffic safety training activities tend to ignore the participation of women and elderly groups. The existing traffic safety training is carried out by having village cadres find people to attend the training, or by distributing textual leaflets, which makes it easy to ignore women's participation. In addition, women may not have the

time or energy to participate because of their own farming and household workloads. The end result is that, in the face of improved roads, women are unable to use them safely because they lack certain traffic safety knowledge.

(5) Need to strengthen the protection of women's labor rights and interests and to be alert to gender violence.

Gender-based violence is any harmful behavior that is based on socially-attributed gender differences between people against their will. It includes acts that cause physical, sexual or mental harm or suffering, threats of such acts, coercion and other deprivations of liberty. These behaviors can occur publicly or privately. During the implementation and operation of the Project, the physical and mental well-being of female laborers at the site needs to be safeguarded. The construction company shall provide regular mental health counseling for female laborers, and at the same time, the construction company shall strengthen supervision at the site (to avoid harmful acts such as gender violence, sexual exploitation and abuse, and sexual harassment) and establish clear channels for complaints and grievances. The site shall establish a grievance team, including at least two female members, and ensure the safety of the members of the grievance team (to avoid prejudice and fear of reprisal against the team members).

Based on full communication and consultation with the implementing agencies, project district women's federations, and relevant agencies, a social management plan for this project was developed, as detailed in Table 9-2 in the Social Action Plan and Implementation section of Chapter 9.

6 Alternative Analysis

6.1 “No project”

Through the implementation of this project, it will restore the damaged river function, improve the flooding capacity of the river, enhance the emergency management capacity of the city, improve the ecological environment quality of "one river and two banks", achieve the overall goal of "river safety, water clarity, road access, bank beauty", and make the Jinshui River a happy river for the benefit of Zhengzhou people. At the same time, through the comprehensive improvement of the Jinshui River, it will be able to effectively drive the organic renewal of the old city and the vitality of the new city, and fully assist the construction of Zhengzhou as a national center city. Without this project, none of these benefits can be realized, so the no-project option will not be considered.

6.2 Dredging method

The dredging is mainly located in the urban built-up area, combined with the applicability of dredging equipment to different terrains, the following four kinds of sediment dredging tools and ways are screened out, respectively: environmental protection winch dredger, high concentration mud pump, amphibious excavator, excavation tools for comparison.

Figure 6-1 Sediment dredging construction machinery diagram

Environmentally friendly winch boats

High concentration sluge pump

Amphibious excavators

Excavators

1) Environmentally friendly winch dredger

The environmental protection suction dredger is suitable for open water dredging construction, with a draught depth of about 1.5m, featuring high dredging accuracy, long-distance transportation, no leakage of pipeline closed transportation, and the ability to prevent the spread of mud disturbance during the dredging process. After the vessel is precisely positioned by DGPS, the dredging construction is carried out and the dredged bottom mud is transported to the designated area through the dredge's own high-power centrifugal mud pump via the mud discharge pipeline.

2) High concentration sludge pump

High concentration sludge pump is suitable for construction in closed area, suitable working condition water depth 0~0.5m, the process has the advantages of high precision of dredging, high concentration of dredging, long distance transportation, closed transportation without leakage, etc. The construction principle of high concentration mud pump is to excavate, transport and fill the soil with the help of hydraulic action. Through the dense high speed water column sprayed by the high-pressure pump, the soil is cut and crushed to form mixed high concentration mud, and then the vertical high concentration mud pump is transported to the designated area through the mud delivery pipe. At the same time, the high concentration mud pump is also equipped with various types of amphibious excavation equipment.

3) Amphibious excavator

The amphibious excavator is suitable for excavation in long and narrow waterways and water or marsh areas, and has the characteristics of flexible operation, multiple types of adaptable working conditions and diversified functions, mainly including multifunctional amphibious environmental protection dredging boat and amphibious excavator.

The multifunctional amphibious environmental dredger is a multifunctional dredger

specially developed for ecological dredging in narrow water, with compact design, integrating backhoe dredging, winch dredging and piling capacity. It is suitable for construction in super shallow waters, rivers, lakes, channels, ponds and industrial sedimentation ponds, and the whole vessel can be transported on the road with a standard size trailer without assembly or assistance from other equipment. It can be operated and anchored independently without winches and cables, and it takes only about 30 minutes to switch between different operating methods.

Amphibious excavator, is a multi-purpose excavator for land, shallow water and deep-water operating environment. Its emergence solves the problem that excavators cannot operate in the water, but also allows excavators to achieve excavation, floating navigation, dredging greatly improve the efficiency. The amphibious excavator uses its own drainage crawler to navigate on the water surface, uses DGPS to precisely locate the starting point of trenching in the construction area, fixes the point for excavation, and conveys the dredged soil to the designated area through ships and vehicles.

4) General earth moving machinery

General earthmoving machinery is suitable for dredging construction in areas with easy drainage and convenient traffic, with high market prevalence and easy handling, and is commonly used as excavators and bulldozers. Earthmoving is realized by ships and vehicles.

Table 6-1 Dredging method comparison

Serial number	Dredging method	Advantages	Disadvantages	Cost	Adaptability
1	Environmentally friendly winch boats	High accuracy of dredging and Low risk of secondary pollution	Complex process and Dewatering and residual water treatment required	High	Selection
2	Sludge pumps	High construction accuracy	Inefficient construction in localized areas, requiring dewatering and residual water treatment	higher	Selection
3	Excavators	Simple process and precision High and low cost	Substrate transportation is prone to secondary contamination Contamination, unsuitable for open water Need for precipitation operation	Low	Recommend
4	Amphibious excavator	Simple process and precision High and low cost	Substrate transportation is prone to secondary contamination Contamination,	Low	Recommend

			unsuitable for open water Need for precipitation operation		
5	Water Dredger	Simple process, low cost	Need to reverse the operation	Low	Selection

Considering that the Dihu section is open water and the overall span is long, there is no direct interception of the river dry dredging conditions, amphibious excavator is selected for dredging. The midstream section of the river from West Changjiang Road to Zhongzhou Avenue has siltation and a lot of garbage and collapsed stones, and needs to be cleared, so we choose to set up weirs in sections and use excavators to clear the siltation by dry digging.

6.3 Disposal site comparison

There are 14 disposal sites in Zhengzhou City, the details are shown in the following table. The project's disposal volume is 415,200m^3 , the original building demolition is 57,600m^3 , the piling platform demolition project volume is 21,500m^3 , the river dredging volume is 137,500m^3 , total 631,800 square meters. Considering that the disposal site may also receive residues from other projects during the construction cycle of the project, the disposal site with the remaining capacity less than 1 million square meters is not considered. There are only four dumping sites with the remaining capacity of more than 1 million square meters (due to the construction cycle, those with the remaining capacity of less than 1 million square meters are not considered for the time being), namely Zhang Dingbang, Tangxiang, Che Dagou and Magou dumping sites. These four dumping sites are far from the construction site, and the remaining storage capacity of Che Dagou dumping site is the largest, so Che Dagou dumping site managed by Zhengzhou Gujia Technology Industry Co.

Table 6-2 List of dumping sites in Zhengzhou

Serial number	Name of storage site	Specific Location	Build time	Land area (mu)	Maximum consumption (million square meters)	Dissipated volume (million square meters)	Remaining storage capacity (million square meters)	Treatment Process
1	CK4 pit rehabilitation	West to Hou Zhang Line, East to Huang Longgang Village, South to Longxiang Road, North to Jinshui River Source	2021.3	35	30	0	30	Pit rehabilitation

Serial number	Name of storage site	Specific Location	Build time	Land area (mu)	Maximum consumption (million square meters)	Dissipated volume (million square meters)	Remaining storage capacity (million square meters)	Treatment Process
2	CK7 pit rehabilitation	North to Hongxing Road, east to one step two ditches, west to 012 country road. South to the north of Liyuan River	2021.1	25	44	7.835	36.165	Pit rehabilitation
3	CK8 pit rehabilitation	West to Hou Zhang Line, East to Huang Longgang Village, South to Longxiang Road, North to Jinshui River Source	2021.3	479	29	2.872	26.128	Pit rehabilitation
4	Zhang Dingbang abatement site	Ltd. in the north to the Yellow River Excursion Area in the south to Zhengzhou Yellow River Grand View Co.	2018.12	825	700	166.26	533.74	Deserted ditch restoration
5	Henan Zhongmin Environmental Protection Technology Co.	West 4th Ring Road West, Lianhuo Expressway North	2016.11	120	70 (annual disposal capacity)	120 (cumulative disposal volume)	-	Resourcefulness
6	Tangdong Disposal Site	West of Guangwu Town, the north is adjacent to Chengou Village Heyin Pomegranate Base, the	2019.2	484	700	169.27	530.73	Backfilling of barren ditches

Serial number	Name of storage site	Specific Location	Build time	Land area (mu)	Maximum consumption (million square meters)	Dissipated volume (million square meters)	Remaining storage capacity (million square meters)	Treatment Process
		west and the north Liugu Heyin Pomegranate Base						
7	Lantian Disposal Site	West of Cai Xinzhuang Bridge, West Zhongyuan Road, West of Cai Xinzhuang Village	2018.11	138	110	93	17	Backfilling of barren ditches
8	Golden Sunshine Disposal Site	Zhang Wangzhuang Village, West Longhai Road	2018.11	382	400	301	99	Backfilling of barren ditches
9	Zhonghui Disposal Site	South of Cai Xinzhuang Village, east of Cai Xinzhuang Bridge, West Zhongyuan Road	2019.2	120	200	133.58	66.42	Backfilling of barren ditches
10	Che Dagou Disposal Site	Outer ditch of Che Dagou Village, Guangwu Town, Xingyang City	2021.8	676	686	23.08	662.92	Backfilling of barren ditches
11	Magou Disposal Site	Ren Gou Group, Magou Village, Laiji Town, Xinmi City	2019.2	105	300	14.73	285.27	Backfilling of barren ditches
12	Henan Runzhi Bao Environmental Protection	Dashi Village, north of Yuanzhang Highway, Longhu Town,	2014.7	94	160 (annual disposal capacity)	300 (cumulative disposal	-	Resourcefulness

Serial number	Name of storage site	Specific Location	Build time	Land area (mu)	Maximum consumption (million square meters)	Dissipated volume (million square meters)	Remaining storage capacity (million square meters)	Treatment Process
	Engineering Co.	Xinzheng City				volume)		
13	Zhengzhou Huiming Environmental Recycling Co.	Henan Group, Nanwang Village, Jiayu Town, Xingyang City	2020.7	25	50 (annual disposal capacity)	6 (Cumulative disposal volume)	-	Resourcefulness
14	Henan Jiahe Xinbang Recycling Resources Co.	Xiaolihe Village, Mihe Town	2019.6	30	30 (annual disposal capacity)	30 (Cumulative disposal volume)	-	Resourcefulness

7 Public participation and information disclosure

7.1 Stakeholder Identification

Stakeholders are those individuals or groups that can influence the achievement of project objectives or be influenced or benefited by the achievement of project objectives. Stakeholders can be divided into primary and secondary stakeholders.

According to the nature of Zhengzhou Integrated Jinshui River Management Sub-project, the results of field survey and interviews with relevant institutions, the main stakeholders of this project are identified as the direct beneficiaries in the project impact area and the groups negatively affected by the project construction, including residents of the project area, disadvantaged groups, those affected by land acquisition and relocation, school teachers and students, doctors and patients in hospitals, etc. The secondary stakeholders include the project owner, the design unit, the construction unit, the supervision unit, etc., the government and its relevant functional departments.

7.1.1 Key Stakeholders

The main stakeholders of this project include the direct beneficiaries of the project and the groups negatively affected by the construction of the project.

(1) Beneficiaries of the project. The project will benefit the residents of 16 streets in 4 districts of Zhengzhou City and along the project area through the comprehensive improvement project along the Jinshui River (mainly including residents, women, elderly groups, poor groups, school teachers and students, hospital doctors and patients in the project area). At the same time, the project will contribute to the socio-economic development of the 16 street offices and townships in the project area, resulting in 752,770 people benefiting from the project, of whom 376,007 are women, accounting for approximately 49.95% of the female population. The beneficiary population of each project area is shown in Table 4-1 below.

(1) Residents in the project area: Residents in the project area are the most direct beneficiaries of the project, which will lead to approximately 752,770 residents in the four project areas to benefit from the project. The Zhengzhou 2021 7.20 flood disaster directly caused damage to the river and bridge functions along the Jinshui River, which indirectly brought loss of life and property and painful flood memories and negative psychological impacts to the residents along the Jinshui River. The impacts that the project construction will bring to the surrounding residents are mainly as follows.

Firstly, it can significantly improve the flood control and drainage capacity of the Jinshui River, reduce the frequency of water disasters in Zhengzhou and further reduce the residents along the Jinshui River from being affected by flooding. At the same time, the project will restore and reinforce the damaged bank slopes along the Jinshui River and improve the current soil erosion and water pollution situation.

Secondly, this project will improve the infrastructure conditions of the river and bridges along the Jinshui River, beautify the green landscape along the Jinshui River, improve the current traffic congestion along the river, facilitate the daily life of residents and reduce the incidence of traffic safety accidents.

Thirdly, with the promotion and implementation of this project, this project will enhance the land value on both sides of the Jinshui River, beautify the scenery along the Jinshui River, beautify the urban landscape and enrich the spiritual and cultural life of the residents in the project area.

At the same time, the construction and operation of the project will bring spiritual comfort to the residents of the project area, increase the income related to business and tourism along the Jinshui River, provide job opportunities for the residents along the Jinshui River and enhance the influence of Zhengzhou City.

(2) Vulnerable groups in the project area: the vulnerable groups in the project area are the low-income households, the five-guarantee households, the disabled, female-headed households and the poor groups in the project area, etc. These people are relatively vulnerable groups and their interests need to be paid attention to (but there is no relevant vulnerable population among the 48 households and 210 people affected by land acquisition and demolition in this project). The comprehensive improvement project of Jinshui River will undoubtedly bring more employment opportunities and convenient transportation environment to the local area. At that time, the disadvantaged groups in the project area will be given priority to obtain jobs along the Jinshui River, and will also be provided with relevant employment skills training. For example, the construction of infrastructure and landscaping along the Jinshui River will generate unskilled jobs such as security guards and cleaners, which will be given priority to local disadvantaged groups to achieve local employment, so that these disadvantaged groups can take care of their families and have a stable income. For women in the project area, the implementation of this project will further enhance women's voice and participation in the implementation, operation and management of the Jinshui River, effectively protecting women's rights and interests, and avoiding harmful behaviors such as gender violence, sexual abuse and

sexual harassment.

(2) Groups negatively affected by the project construction. Both include a category of groups whose normal production and life are negatively affected by project construction, land acquisition and demolition, mainly residents and enterprise stores affected by permanent land acquisition, temporary land occupation and demolition, which also include the disadvantaged groups in the project area, such as some low-income population and women.

According to the project migration impact identification survey statistics, it is found that the migration impact of this project is mainly caused by the land acquisition and house demolition involved in the project river training. The project land acquisition and demolition affects four districts in Zhengzhou, including Erqi District, Jinshui District, Zhongyuan District, and Zhengdong New District, affecting a total of 48 households and 210 people. Among them, 37 households and 145 people are affected by permanent land acquisition; 11 households and 65 people are affected by house demolition and relocation; the details can be found in the Resettlement Plan of this project.

7.1.2 Secondary Stakeholders

The secondary stakeholders of the project include: the project owner; the design unit, construction unit, supervision unit, etc.; the government and its relevant functional departments.

(1) Project Management Office. Since December 2021, Zhengzhou Municipal People's Government and Zhengzhou Urban and Rural Construction Bureau have successively established the Integrated Jinshui River Management Sub-project Department and other relevant institutions, and set up the Development of Integrated Jinshui River Management Sub-project, which is fully responsible for the organizational leadership, management implementation and supervision and guidance of this project, and is also responsible for liaising with the provincial and municipal AIIB Project Management Offices and AIIB. Zhengzhou Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District have all set up AIIB project coordination leading groups, which are responsible for the organization and coordination of AIIB projects. The project team members are drawn from the Zhengzhou Urban and Rural Construction Bureau, Zhengzhou Water Resources Bureau, Zhengzhou Ecological Environment Bureau, Zhengzhou Emergency Bureau, Natural Resources and Planning Bureau and other authorities to be responsible for the construction management of the local AIIB projects with a view to promoting the smooth implementation of the projects through overall coordination and inter-departmental cooperation within the jurisdiction under the unified coordination and guidance of the Zhengzhou Municipal People's Government.

(2) Project owner. Project owner as the project construction and operation and maintenance agencies, specifically responsible for and coordination of business relations between all parties and responsible for the construction of the project organization and management of the owner unit.

(3) The government and its related functional departments. The relevant government departments involved in this project mainly include the Urban and Rural Construction Bureau, Natural Resources and Planning Bureau, Housing Acquisition Affairs Center, Development and Reform Bureau, Transportation Bureau, Statistics Bureau, Human Resources and Social Welfare Bureau, Women's Federation, Civil Affairs Bureau, Rural Revitalization Bureau, Ecological and Environmental Bureau, and street offices; at the same time, the implementation of the project also involves the grassroots staff of specific community/village committees in the project implementation areas. The smooth

implementation of the project cannot be achieved without the coordination and cooperation of various government departments.

In addition, the secondary stakeholders of this project include the consultant who undertakes the design consulting work and the construction unit who undertakes the construction of the project.

7.2 Completed information disclosure and public participation

Since the preparation and operation of the AIIB project in 2021, the Zhengzhou Urban and Rural Construction Bureau, the Department of Integrated Jinshui River Management Sub-project and all relevant units have organized a series of information disclosure and social stability risk assessment work in collaboration with relevant functional departments at all levels. At the same time, during the pre-project preparation stage, the feasibility study preparation unit, social evaluation preparation unit and environmental assessment preparation unit have carried out project information disclosure and notification, as well as adequate informed consultation and public participation activities for the relevant information of the project.

7.2.1 Project-related information disclosure

(1) In November 2021, when the feasibility study preparation unit conducted the field survey, the Zhengzhou Urban and Rural Construction Bureau has started to communicate with the residents in the project area about the construction content of the Integrated Jinshui River Management Sub-project, the necessity of construction and social benefits, etc., to inform the people about the project and listen to their attitudes and opinions on the project construction.

(2) Since December 2021, under the guidance of consultants, relevant departments of Zhengzhou Municipal People's Government, Zhengzhou Urban and Rural Construction Bureau, Erqi District Government, Zhongyuan District Government, Jinshui District Government, Zhengdong New District Government, and project design units have conducted a series of socio-economic surveys and public opinion consultations (including the participation of about 30% of women), i.e., through project impact streets, communities, schools, hospitals, holding villagers/residents' representative meetings, party members' meetings, household heads' meetings, as well as community/village group project information public announcements, project notification letters, distribution of publicity brochures, hanging of publicity banners, outdoor wall slogans, WeChat public numbers, etc. Information disclosure and publicity on project construction content, site selection criteria and public transportation safety knowledge have been carried out, and a survey of residents' needs and wishes has been conducted.

(3) In February 2022, the social impact assessment survey team conducted field surveys in each of the four project areas, visited the streets and communities/villages involved in the project construction, conducted questionnaire surveys, symposiums, agency interviews, personal in-depth interviews, etc., to understand the production and living conditions, socio-economic status of the affected residents within the coverage of the project service area, the situation of the river and bridges along the Jinshui River, the project impact, and willingness to build were carefully understood, and a socio-economic sampling survey was conducted to understand the possible impact of each project on the affected people. The residents of the project area were informed of the content of the project construction, the social benefits of the comprehensive improvement project of the Jinshui River, etc.; the compensation policy and restoration measures for land acquisition and demolition, and the consultation results will be written into the resettlement plan prepared for planning; the people in the project area were consulted in detail about the

needs and wishes of the project, and their opinions and suggestions on the project implementation, and truthful records and feedback were made.

Since December 2021 to date, the Zhengzhou Municipal People's Government, the Zhengzhou Urban and Rural Construction Bureau and the four project areas have posted updates on their websites about the Project at different points, as shown in Figure 7-1 below.

Figure 7-1 Public release of project information

7.2.2 Institutional Interviews

Agencies and departments involved in the project area, such as the Integrated Jinshui River Management Sub-project Department of Zhengzhou City and Rural Construction Bureau of Henan Province (i.e., the project implementation and construction unit), Zhengzhou Housing Acquisition Service Center, Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological and Environmental Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Security Bureau (Labor Insurance Bureau), Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, and Transportation Administration Bureau Seventy-six agency interviews and interviews were conducted, and basic data and literature closely related to the project were collected. Details of the interviews are shown in Table 7-1 below.

Table 7-1 List of interviews with institutions in each project area and county

Project Area	Institutional interviews (pcs)	Breakdown of interview departments
Erqi District	21	Zhengzhou City and Township Construction Bureau Integrated Jinshui River Management Sub-project Department (i.e. project implementation and construction unit), Zhengzhou City Housing Collection Service Center, Erqi District Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological and Environmental Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Security Bureau (Labor Insurance Bureau), Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, Transportation Administration, under the jurisdiction of Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street street offices
Zhongyuan District	18	Zhengzhou Urban and Rural Construction Bureau Integrated Jinshui River Management Sub-project Department (i.e., the project implementation and construction unit), Zhengzhou City Housing Acquisition Service Center, Zhongyuan District Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological and Environmental Bureau, Emergency Bureau, Bureau of Statistics, Human Resources and Social Security Bureau (Labor Insurance Bureau), Rural Revitalization Bureau, Civil Committee, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, Transportation Administration, under the jurisdiction of West Haining Road Street, Ruhe Road Street, and Linshanzhai Street Office
Jinshui District	20	Zhengzhou Urban and Rural Construction Bureau Integrated Jinshui River Management Sub-project Department (i.e., the project implementation and construction unit), Zhengzhou City Housing Acquisition Service Center, Jinshui District Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological Environment Bureau, Emergency Bureau, Bureau of Statistics, Human Resources and Social Security Bureau (Labor Insurance Bureau), Rural Revitalization Bureau, Civil Affairs Commission, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, Transportation Administration, under the jurisdiction of Dashiqiao Street, Duling Street, Jingjing Street Eight Road Street, People's Road Street, Future Road Street street offices
Zhengdong New District	17	Zhengzhou Urban and Rural Construction Bureau Integrated Jinshui River Management Sub-project Department (i.e., the project implementation and construction unit), Zhengzhou City Housing Acquisition Service Center, Zhengdong New District Housing and Urban Development Bureau, Natural Resources and Planning Bureau, Water Resources Bureau, Ecological Environment Bureau, Emergency Bureau, Bureau of Statistics, Human Resources and Social Security Bureau (Labor Insurance Bureau), Rural Revitalization Bureau, Civil Committee, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, Transportation Administration, under the jurisdiction of Ruyi Lake Street, Longhu Street Street Office
Total	**76**	**----------**

7.2.3 Field survey

The social assessment survey team conducted field visits to the townships, streets,

communities/village groups affected by the construction of the four projects and the river situation and infrastructure and traffic management along the Jinshui River, as well as the construction site of the project site. More practical and objective understanding of the impact of the comprehensive improvement project along the Jinshui River in each project area on the production and life of the surrounding residents, land acquisition and relocation; the socio-economic living conditions of urban and rural residents and affected people in the project beneficiary areas, as well as their suggestions, main concerns and demands for the improvement project and supporting facilities along the Jinshui River.

Figure 7-2 Field survey

7.2.4 Focus Group Discussions

In order to have a more comprehensive understanding of the needs and suggestions of the affected people in the project area (including urban and rural residents, women, low-income groups, and disadvantaged groups in the project area), the project beneficiaries' evaluation of the current status of the river along the Jinshui River near their living areas and their expectations of the prospect of the Integrated Jinshui River Management Sub-project, as well as the concerns and suggestions brought by the project implementation and construction. The social evaluation survey team took the form of focus group discussions in the field survey. The social evaluation team conducted 12 focus group discussions with a total of 435 participants in different streets and communities in the project counties. Among them, 141 were women, accounting for 32.4%; 80 were elderly, accounting for 18.4%; 27 were disadvantaged, accounting for 6.1%, and 248 were village committees and village representatives, accounting for 56.9%.

Figure 7-3 Focus group symposium

7.2.5 Key Informant Interviews

The social assessment survey team conducted interviews with key informants from county districts, township streets, villages/communities, and enterprises/institutions to more fully understand stakeholders' attitudes toward the project and to provide better suggestions for project design and project implementation. At the county and district levels, interviews were conducted with the heads of the four project district governments, the Urban and Rural Construction Bureau, the Natural Resources and Planning Bureau, the Water Resources Bureau, the Transportation Bureau, the Women's Federation, the Rural Revitalization Bureau, the Statistics Bureau, the Civil Affairs Bureau, and the street offices/township governments; at the community and village levels, interviews were conducted mainly with the community councils/village committees and resident representatives involved in the projects; at the enterprise and institution levels, interviews were conducted mainly with project impact At the enterprise and institution levels, interviews were conducted mainly with representatives of teachers and students in primary and secondary schools and colleges, as well as with medical and nursing staff and patient representatives in hospitals.

A total of 72 key informants were interviewed in this survey, including 19 in Erqi District; 20 in Zhongyuan District; 18 in Jinshui District; and 15 in Zhengdong New District.

Figure 7-4 Key Informant Interviews

7.2.6 Questionnaire

The social evaluation team conducted a social evaluation questionnaire survey by entering the townships, communities/village groups, etc. affected by the project construction after holding a unit seminar with relevant agencies in the project counties.

Figure 7-5 Questionnaire survey site

After nearly one month of efforts, the social impact assessment social evaluation survey team completed 520 copies of "Zhengzhou Integrated Jinshui River Management Sub-project Participatory Social Evaluation Questionnaire" in Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District of Zhengzhou City, of which 520 were valid questionnaires with 100% questionnaire efficiency.

Table 7-2 List of public participation in the project

Type of participation	Date	Location	Participation content	Participants
Project-related information to inform and publicize	November 2021	Related Affected Villages	Information Disclosure	Zhengzhou Urban and Rural Construction Bureau, Project management staff of each district, feasibility study preparation unit, relevant townships, communities/villages, villagers
	November 2021	Related Affected Villages	Make project information public during field surveys and listen to their willingness, attitude and opinions on project construction	Zhengzhou Urban and Rural Construction Bureau, Project management staff of each district, technical consultants, relevant county and district governments, village heads, villagers, and
	November 2021	Related Websites	The latest news of the project	Project management staff of each district, project area people
Field survey	February 9-18, 2022 March 8-15	Related Affected Villages	Conducting socio-economic sample surveys	Zhengzhou Urban and Rural Construction Bureau, Project management staff of each district, resettlement plan preparation unit, social impact assessment survey team

Type of participation	Date	Location	Participation content	Participants
	February 9-18, 2022 March 8-15	Related Affected Villages	Through field surveys, questionnaires, interviews and other means to understand the project area residents' opinions and suggestions on project implementation	Project impact village and street office, Zhengzhou Urban and Rural Construction Bureau, Project management staff of each district, social impact assessment investigation team
	February 9-18, 2022 March 8-15	Proposed project sites	Conducted a field survey of the proposed project site, visited and communicated with community residents, communicated and consulted on the pre-project preparation, and made suggestions for project optimization	Social Impact Assessment Survey Team
Questionnaire	February-March 2022	Relevant communities/villages and residents' homes in the project area	A total of 520 questionnaires were distributed and 520 valid questionnaires were recovered, with a valid recovery rate of 100%, of which 61.11% were males and 38.89% were females.	Villagers in the project area, social impact assessment survey team
Focus Group Symposium	February-March 2022	Project area related communities/villages	A total of 20 resident focus group discussions were conducted, with a total of 435 participants. Among them, 141 were women, accounting for 32.4%; 80 were elderly people, accounting for 18.4%; 27 were disadvantaged people, accounting for 6.1%, and 248 were representatives of village committees and villagers, accounting for 56.9%.	Affected residents in the project area, neighborhood/village committees and village representatives, social impact assessment survey team
Key Informant Interviews	February-March 2022	Related institutions, communities/villages	Seventy-two key informant interviews were conducted with the heads of relevant institutions in four project sites, including 19 in Erqi District; 20 in Zhongyuan District; 18 in Jinshui District; and 15 in Zhengdong New District.	Heads of relevant government departments, neighborhood/village committees and village representatives, employees of enterprises and institutions, social impact assessment survey team

7.3 Stakeholder Needs Analysis

7.3.1 Analysis of the project area stakeholders' needs for the project

Stakeholders in the project area are individuals or groups that can influence the achievement of the project objectives or be influenced or benefited by the achievement of the project objectives, including residents of the project area, teachers and students of kindergartens and elementary school along the project route, and medical patients of Zhengzhou People's Hospital.

(1) The project area residents suffer from the impact of daily life on the urgent needs of the project

The Jinshui River flows from southwest to northeast through Erqi District, Zhongyuan District, Jinshui District and Zhengdong New District, and is one of the main flooding and drainage channels in the central city, and the only urban river in Zhengzhou that connects the four major urban service centers and runs through the old and new urban areas. 18:00 on July 18, 2021 to 0:00 on July 21, the city of Zhengzhou received heavy rainfall. According to the post-disaster statistics, 28 bridges were damaged to varying degrees along the Jinshui River, with 3.25km of damaged banks and 8km of seriously silted river after the disaster, and the water quality was seriously affected. Residents in the project area are very supportive of the comprehensive improvement project of the Jinshui River and are eager to restore the function of the river as soon as possible to protect the daily life of residents.

The 7-20 rainstorm and flooding caused 28 bridges along the Jinshui River to be damaged to varying degrees, with 3,250m of damaged banks and 8,000m of seriously silted river, and water quality was seriously affected. Post-disaster reconstruction is urgently needed to restore the function of water conservancy infrastructure and enhance the flooding capacity of the river, so as to protect the lives and properties of Zhengzhou citizens. In addition, the landscape points on both sides of the Jinshui River are at the bottom of the terrain and too close to the river trough, and there is an undesirable risk of river water flooding the sidewalk and landscape at low places along the river. At the same time, some of the bridges along the Jinshui River there are some dangerous structures that need to be removed such as power distribution rooms, storage rooms, etc.

Interview Transcript 7-1 : Ms. Zhang, Jinshui District, Jingba Road Street (48 years old)

"When the 7-20 rainstorm, the sidewalks on both sides of the river near us were flooded can be serious, the landscape path is designed too low, but did not cause actual damage."

"The bridge cave is very narrow, the water flow is not smooth, the lake is full of water over the bridge embankment to overflow, so this water is certainly not good to drain out."

"The bridge is now individual low buildings, such as power distribution room ah, storage room ah, etc., the number is not much, but these if not dismantled, a flood affects the safety of life and property of the surrounding residents, is certain to be demolished. Otherwise, our surrounding residents do not agree."

② The dense population on both sides of the river and the damaged roads and bridges make it difficult to travel. With the economic development of Zhengzhou City and the improvement of the living standard of the residents, "river view houses" are highly sought

after and more and more people are living on both sides of the Jinshui River. However, some of the water bridges and underwater slow-moving systems on the Jinshui River are severely damaged, resulting in frequent congestion on the roads and bridges, which causes inconvenience to residents. At present, patients going to the hospital have to pass around the park road, and children visiting the elderly are also inconvenienced, which invariably reduces the opportunity and time to spend with the elderly and brings a lot of inconvenience to the residents along the river.

Interview Transcript 7-2 : Ms. Liu (35 years old) of Yangtze River Park (the name of a park next to Dihu) in Zhongyuan District

"All the basements were flooded, more than 1,000 residential households on this side, and a small 300 number of cars were submerged. Usually it rains some water, but not as bad as the 7-20 rainstorm, the whole area was a yellow sea of water."

"The water did not drain down for a few days, the kindergarten in front of a row of cars can not see the top, the lake next to this pavilion was also flooded, until the evening of July 21, the water receded some, July 22 began to dredge."

③ Dredging of river bottom and lake bottom is carried out to ensure the safety of river flooding. The current situation of Jinshui River, except for the local chokepoint, the rest of the river meets the 20-year flood control standard. As an artificial lake and landscape bridge built by the open business, Dihu does not have the ability of flood control and flood discharge, and cannot meet the flooding standard. In addition, the lake bottom siltation is serious, the bottom of the lake are silt, currently has bare bottom mud, limited capacity. When it comes to heavy rain and water protection function is not enough. Residents expect the Integrated Jinshui River Management Sub-project to improve the flooding and drainage capacity of rivers and lakes, improve the capacity of the city's emergency management system, and thus ensure the safety of flood control in the main city of Zhengzhou.

Interview transcript 7-3 : Mr. Fu, etc., of Dihu Garden Community, Zhongyuan District (42 years old)

"The emperor lake is open to build artificial lake, when the rain comes, like our emperor lake this side of the river water through the main city past, or will be some danger, this is the landscape bridge, the bridge does not have flood control function, only to connect the two sides of the residential, to facilitate the community pedestrian peer, simply does not have the ability to flood drainage, but also can not reach that standard, 7-20 heavy rainstorm, on the time stuck, the water does not flow out, the bridge was also washed out.

"The siltation at the bottom of the lake is too serious, it has to be more than a meter, the bottom of the lake are silt, the capacity of this whole lake he is small, once the heavy rain, big water will not work."

"The bottom of the lake siltation is very serious, I moved here for many years, no one has cleaned up the silt, 7-20 special rainstorm before the estimated 30 cm of silt, now have to have more than 1 meter, inside the silt, the whole lake water and yellow and smelly, a hot summer stinks, hurry up to clean up the siltation, siltation does not clean up this lake can not be good. "

④Improve the ecological environment quality of the river and create a happy river. The current ecological recharge water source of Jinshui River is mainly Zhengzhou eco-water system water transfer project, with a daily recharge flow of about 0.7m/s. Under the condition of stable recharge water, the water quality of Jinshui River is generally good in the dry season. Due to the current situation, the water quality of the river is poor after the rain and the lack of ecological water replenishment. The water quality is poor, the water body is yellow and smelly, eutrophication, a lot of green algae floating, and serious pollution. Meanwhile, it has been 23 years since the last treatment of the Jinshui River, and the current situation does not match the requirements of the new urban positioning, and the quality of the ecological green space on both sides of the river needs to be improved. At present, the overall Jinshui River facilities are relatively old, there are flood control is not up to standard, flood choke, unstable soil slope, barge aging problems, and the river still has sewage overflow, discharge mouth mixed phenomenon, residents expect to solve these problems through the comprehensive improvement of the Jinshui River, to create a happy river in the central city.

Interview Transcript 7-4 : Mr. Liu, Dihu Garden, Zhongyuan District (30 years old)

"Our emperor lake is very famous, four outside the week nothing to walk this side, hanging out, the summer time is very crowded, the original lake is not bad, now not, a lot of silt, the lake has also become yellow, but also stink, the weather is hot stinky, the top are also green algae, road rainwater sewage are also flowing directly into the lake, now this lake does not work, hurry to remedy remediation. "

"The main thing is to give the river silt to clean up well, so that the water clear a little, now this silt must be at least a meter deep. Summer time water does not circulate, the silt is not cleaned up, the water storage is also small, what is the use of landscape road again good, navigation road to the water below are smelly."

Interview Transcript 7-5 : Mr. Qi, Ruyi Lake Street, Zhengdong New District (43 years old)

"We think we should try to build a landscape river; the river should be as clear as possible. Now winter is better, once the summer, the river is often next to the swarms of small flying insects, stinky water, after all, is the city river, walking to the river smells bad."

(2) Residents along the line expect the pedestrian bridge to be repaired as soon as possible to facilitate access. 2021 7-20 mega-flood destroyed the urban pedestrian bridge. Most of the residents in the project area travel on foot and by bicycle on a daily basis. The damage to the bridge has caused inconvenience to the residents and requires them to take a detour for daily travel. At the same time, the river along the Jinshui River is a place for residents to relax and unwind, and the damage to the bridge has caused inconvenience to the residents' leisure.

Interview Transcript 7-6 : Ms. Wu (37 years old), West Nautical Road Street, Zhongyuan District

"The bridge above the Jinshui River is our original daily walk, there is a supermarket across the river, buy food what have to go through, now the bridge can not go, past the community opposite to a large circle around the road, the trouble is, hurry up to fix the bridge, the road will be very convenient."

(3) Teachers, students and parents of schools along the Jinshui River hope to carry out the restoration and upgrading of bridges along the river as soon as possible. 49 bridges along the river were hit by the 7-20-2020 flood disaster, which damaged the bridges in the short term, inconveniencing residents and exposing the safety hazards of some bridges. A large number of schools are located along the Jinshui River, and student groups, especially those facing further education, and their parents have spent a lot of time and energy on detours to and from school since the mega-flood. For example, the University of North Road Jinshui River Bridge because of the project needs, during construction must be closed in both directions of the University of North Road Jinshui River Bridge, vehicles must be through the peripheral roads and other long-distance detour, which not only increases the pressure on the passage of other sections of the peak period to and from school, and distract students and student parents, invariably increasing the burden of students and student parents.

Interview Transcript 7-7: Ms. Zhang (35 years old), Mingong Road Street, Erqi District

"Now the University of North Jinshui River Bridge are not given access, I still need to pick up the children home after work. Originally the time off work is late, the child will soon be elevated, time is very tight, and now every day the child has to wait for me to pick up at the school gatekeeper, the time is too rushed, the child is also very hard."

(4) The residents along the river expect to improve the public infrastructure along the Jinshui River and beautify the urban landscape. The Jinshui River is the only urban river in Zhengzhou that connects four major urban service centers and the old and new urban areas, and carries the ecological landscape function of the city. There are a large number of residential areas, commercial areas, elementary school and hospitals along the Jinshui River, and there is a large flow of people. The residents along the river expect to improve the public infrastructure along the Jinshui River, such as increasing the density of garbage can layout, adding some neat and clean public toilets to avoid casual drowning on both sides of the river, and increasing the green resting places and landscapes on both sides of the river, adding some sports and recreational facilities (such as outdoor fitness equipment, etc.).

Interview Transcript 7-8: Mr. Wu, Erqi District, University Road Street (50 years old)

"I think the river should increase some public toilets, garbage cans and other public facilities next to it, the public toilets around the river bank is still too little, usually walking along the river can be found on the road there are some open defecation phenomena, evening walk is also easy to step on a careless."

"We hope that the project can focus on the landscape and greenery next to the river, the people like to walk along the river after dinner, strolling, the two sides of the river is certainly designed for our usual recreation best."

(5) The residents along the river expect to improve and strengthen the river management along the Jinshui River. The Jinshui River has a large flow of people along the river, with a large number of residential areas and city parks. Residents along the river often engage in recreational activities near the Jinshui River. At present, part of the basin of the Jinshui River is developed by developers, and the lack of management in part of the basin has led to hidden dangers in river safety and river management in part of the basin. At the same time, the 7.20 floods in Zhengzhou brought serious loss of life and property to the residents along the Jinshui River.

Interview Transcript 7-9 : Mr. Zhang, Dihu Garden, Zhongyuan District (29 years old)

"The emperor lake under the connection of the Jinshui River channel, river management, the lake is currently not specifically responsible for the management, the emperor lake is initially built by the developer of artificial lake, the late operating costs are relatively large, right, now the developer is regardless, the government side feels that the developer made the lake should be managed by the developer, now in the state of the parties do not care, the lake connected to the river channel management maintenance, the lake is stuck In the middle no one is in charge."

"This side of the emperor's lake is said to be the landscape road, the south side of the lake next to the Yangtze River Park, but from the navigation road to the emperor's lake this section, it is not clear who is in charge of this lake specifically, only salvage garbage, not clean up the sludge, only do this surface work, 7-20 time washed down are sludge."

7.3.2 Low-income groups have higher motivation and willingness to participate in project construction

During the field interviews, it was found that low-income people in the project area generally expressed support for the project construction, and the support rate of this group for the project was as high as 98.9%. If there are long-term stable labor opportunities, they are willing to participate in the project when it is being implemented and operated, such as working as site workers during construction; when the project is in operation, they participate in jobs such as cleaners and river patrol management at the management station sites along the Jinshui River, in order to obtain local labor opportunities and increase their family's economic income, while still being able to take care of household chores.

Some low-income households and low-income families within the beneficiary area of the project area expressed their willingness to participate in the implementation of the project construction. For them, the comprehensive improvement project of Jinshui River is a good opportunity to achieve income increase and get rid of poverty. Because they can directly participate in the project construction by putting in work and labor, participate in the unskilled positions provided by the project construction, increase employment

opportunities and wage income, and finally achieve the purpose of having a stable source of income.

7.3.3 Women have a strong willingness to participate

The Jinshui River is an urban center river linking the four service centers of Zhengzhou city, and is also a major thoroughfare for residents' traffic and work, as well as one of the important places for their leisure and entertainment. A large number of residential areas, elementary school, stores, restaurants, entertainment venues and other facilities are located along the Jinshui River. For women, the project, when completed, will save them a lot of time spent on transportation to work, picking up and dropping off children at school and purchasing supplies. At the same time, there will be more options for after-dinner entertainment and leisure activities, such as square dancing, listening to opera, walking and other leisure activities, and the plaza and river along the Jinshui River will provide them with a better leisure and viewing experience.

When the women knew the construction content of the project, they all eagerly expressed their hope that the project would be stepped up and the infrastructure along the Jinshui River would be upgraded as soon as possible to bring them more convenient transportation in order to enhance their sense of well-being in life.

Through a survey of 202 women in the four project sites, statistical analysis revealed that 96.5% of the women were willing to participate in the project. Therefore, the willingness of women in the project area to participate in the implementation of the project construction is very high. For the willingness of women in the project area to participate in the project construction, see Table 7-3.

Table 7-3 Analysis of women's willingness to participate in the project after its completion

Indicators / Willingness		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Willingness	195	96.5	96.5	96.5
	Reluctance	7	3.5	3.5	100.0
	Total	202	100.0	100.0	

7.3.4 Residents in the project area have improved their knowledge of the project

After the Zhengzhou Urban and Rural Construction Bureau, the relevant units in the project area, feasibility study, social assessment, environmental assessment and other units of the preliminary participation and household survey publicity, the project area surveyed, "heard" of the project has reached 91.66%, which indicates that the project area residents have increased their knowledge of the project. In terms of the respondents who have heard of the project, the main way to hear about the project is to listen to others, accounting for 43.14%; followed by government publicity, accounting for 31.05%; and then the relevant announcement, accounting for 17.40%.

In the process of field survey interviews and talks, the social assessment survey team found that the staff of the project-related government departments or grass-roots government departments, the knowledge rate of the project construction content has improved to a certain extent, and most residents in the project area know the construction

content of the project through various channels. However, the primary way for the general residents in the project area to know about the project is to hear from others, and the awareness and participation rate of the grassroots people still need to be improved. It is necessary to further increase the project publicity and actively guide the public to participate in the project.

7.3.5 High level of project support from residents in the project area

In terms of the attitude of the residents in the project area toward the project, 87.8% of the respondents thought that the implementation of the project was important to their families, and 92.59% of the respondents supported the construction of the project.

Table 7-4 Analysis table of project support by residents in the project area

Statistical indicators / Options		Frequency	Percentage (%)	Effective percentage (%)	Cumulative percentage (%)
Effective	Very supportive	260	50.00	50.00	50.00
	Support	221	42.59	42.59	92.59
	Doesn't matter	39	7.41	7.41	100.0
	Total	520	100.0	100.0	

From the interviews and talks, it was found that the residents around the project site, after understanding the Integrated Jinshui River Management Sub-project, still generally support the construction of the project.

Interview transcript 7-10: Mr. Zhang (42 years old), Honeybee Zhang Street, Erqi District

"After the flood last year, we have long been looking forward to the river next to our home for remediation, this project can facilitate our daily traffic travel, governance of the river, to give us a pleasing entertainment and leisure environment, is a good livelihood project, we definitely support."

7.3.6 List of Stakeholder Needs Analysis

(1) The demand analysis of stakeholders of the Jinshui River Comprehensive Management Project is shown in Table 7-5.

Table 7-5 List of demand analysis of main stakeholders of Integrated Jinshui River Management Sub-project

Serial number	Main construction content of the project	Affected Streets	Key Stakeholders	Demand Analysis

1	River safety and security project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	**Residents of communities along the Jinshui River**	**Residents in the project area suffer from the impact on their daily lives and have an urgent need for river safety and security projects** a. Restoration of the river to protect the needs of residents for convenient daily travel and safety b. Dense population on both sides of the river, road and bridge damage resulting in travel inconvenience c. Dredging of the river bottom of the Jinshui River and the lake bottom along the river to ensure the safety of river flooding d. Improve the river management system of the Jinshui River basin and the communities along the river, and establish a complaint mechanism for residents to complain about the Jinshui River basin and the communities along the river
			Disadvantaged groups such as low-income people in the project area	**Disadvantaged groups such as low-income people in the project area expect to get employment opportunities and jobs** a. Rehabilitate the river to ensure the safety of the disabled, elderly, pregnant women and children for easy daily travel. b. During the construction of the project, transportation should be inconvenient and expect to receive transportation subsidy; after the completion of the

				project, provide corresponding vocational skills training and employment positions. c. If there are stable employment opportunities, low-income groups have higher motivation and willingness to participate in project construction
			Women in the project area	**Enhancing women's community participation and voice to protect women's rights and interests** a. Restoration of the river along the Jinshui River to ensure convenient daily travel and safety for women b.Promote the voice of community women in participatory management of the Golden Water River c. Female positions are provided during the construction and operation of the project.
2	Bridge restoration and upgrading project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao	**Students, parents of students and hospital patients along the Jinshui River**	**Residents along the route (especially students, parents of students, and patients) expect the pedestrian bridge to be repaired as soon as possible to facilitate access.** a. Hope to repair collapsed bridges and demolish dangerous and damaged banks along the Jinshui River as soon as possible to ensure convenient daily travel and safety for residents b. Residents along the line expect to repair the pedestrian bridge as soon as possible, to facilitate the daily

		Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street		travel of residents and patients along the line; to protect the safety of the Jinshui River Bridge, to facilitate students to go to school, residents to work, patients to see a doctor; to solve the problem of traffic congestion around the Jinshui River Bridge and reduce the occurrence of safety hazards c. Enhance the river safety and disaster emergency management capacity of the North University Road section of the Jinshui River Basin d. To ensure the safety of school students along the Jinshui River to school and after school passage e. Improve the traffic congestion along the Jinshui River and surrounding parks to reduce the occurrence of safety hazards.
			Disadvantaged groups such as low-income people in the project area	**Disadvantaged groups such as low-income people in the project area expect to get employment opportunities and jobs** a. Rehabilitation of road bridges and demolition of dangers along the Jinshui River to ensure the safety of the disabled, the elderly, pregnant women and children for convenient daily travel. b. During the construction of the project, transportation should be inconvenient and expect to receive transportation

				subsidy; after the completion of the project, provide corresponding vocational skills training and employment positions. c. If there are stable employment opportunities, low-income groups have higher motivation and willingness to participate in project construction
			Women in the project area	**Enhancing women's community participation and voice to protect women's rights and interests** a. Repair the road bridges along the Jinshui River and demolish dangers to ensure convenient daily travel and safety for women b.Promote the voice of community women in participatory management of the Golden Water River c. Female positions are provided during the construction and operation of the project.
3	Water quality assurance and ecological enhancement project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai	**Residents along the Jinshui River**	**Residents along the route expect to improve the public infrastructure along the Jinshui River and beautify the urban landscape** a. Dredging of river bottom and lake bottom to ensure the safety of river flooding b. Restoration of the river landscape along the Jinshui River and the road landscape on both sides c. Solve the problem of black odor in the Jinshui River and

		Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street		reduce the probability of water pollution in the Jinshui River d. Improve the natural and hydrological environment along the Jinshui River e. Enriching biodiversity along the Jinshui River
			Disadvantaged groups such as low-income people in the project area	**Disadvantaged groups such as low-income people in the project area expect to get employment opportunities and jobs** a.To ensure the safety of disabled, elderly, pregnant women and children for convenient daily travel. b. During the construction of the project, transportation should be inconvenient and expect to receive transportation subsidy; after the completion of the project, provide corresponding vocational skills training and employment positions. c. If there are stable employment opportunities, low-income groups have higher motivation and willingness to participate in project construction
			Women in the project area	**Enhancing women's community participation and voice to protect women's rights and interests** a. Repair the road bridges along the Jinshui River and demolish dangers to ensure convenient daily travel and safety for women

				b.Promote community women's voice in participatory management of the Jinshui River c. Provide female positions during project construction and operation
4	Greening improvement project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street **Jinshui District.** Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	**Residents along the Jinshui River**	**Beautify the landscape along the Jinshui River to provide a suitable living environment** a. Residents along the route expect to beautify the landscape along the Jinshui River and increase public green areas, squares and other leisure activity spaces. b. Improving the road landscape and river landscape along the Jinshui River, adding public toilets, etc. c. Residents along the route expect to use the smart park management system as soon as possible to more easily access the surrounding parks for recreational activities.
			Disadvantaged groups such as low-income people in the project area	**Disadvantaged groups such as low-income people in the project area expect to get employment opportunities and jobs** a.To ensure the safety of disabled, elderly, pregnant women and children for convenient daily travel. b. During the construction of the project, transportation should be inconvenient and expect to receive transportation subsidy; after the completion of the project, provide

				corresponding vocational skills training and employment positions. c. If there are stable employment opportunities, low-income groups have higher motivation and willingness to participate in project construction
			Women in the project area	**Enhancing women's community participation and voice to protect women's rights and interests** a. Beautify the landscape on both sides of the Jinshui River, increase greening facilities and create a beautiful living environment b.Promote the voice of community women in participatory management of the Golden Water River c. Provide female positions during project construction and operation
5	Intelligent Management Project	**Erqi District.** Houzhai Township, Wulibao Street, University Road Street, Minggong Road Street, Songshan Road Street, Honeybee Zhang Street **Zhongyuan District.** Haixi Road Street, Ruhe Road Street, Linshanzhai Street	**Residents along the Jinshui River**	Residents along the route expect to improve and strengthen river management along the Jinshui River, such as establishing a river manager system and strengthening community participatory management.
			Disadvantaged groups such as low-income people in the project area	If there are stable employment opportunities, low-income groups are more motivated and willing to participate in project construction

		Jinshui District. Dashiqiao Street, Duling Street, Jingba Road Street, Renmin Road Street, Future Road Street **Zhengdong New District.** Ruyi Lake Street, Long Lake Street	**Women in the project area**	Women have shown a strong willingness to participate

7.4 Information Disclosure and Public Participation Plan

Information disclosure and public participation will continue throughout the project cycle.

The Chinese and English versions of the "Environmental and Social Management Planning Framework for the AIIB Emergency Loan for the Post-Rainfall Flood Rehabilitation and Recovery Project in Henan Province" have been published on the website of the Henan Provincial Department of Finance (https://czt.henan.gov.cn/2021/11-05/2342160.html) and the AIIB website (China: Henan Flood Emergency Rehabilitation and Recovery Project - Projects - AIIB). The Chinese and English versions of the environmental and social framework, environmental and social impact assessment report and management plan of the project, including the grievance mechanism, will be made public on the website of Zhengzhou Municipal Bureau of Urban and Rural Construction and the website of AIIB before construction. Meanwhile, Zhengzhou Urban and Rural Construction Bureau will prepare paper copies of the environmental and social impact assessment report and management plan for public inspection.

Notice boards are set up at the entrance of the construction site, stating the hot-line telephone numbers and names of contacts of the contractor, construction supervisory unit, duration of the project and local environmental, social and urban management authorities, etc., to seek understanding and sympathy from the affected people for the temporary disturbance caused by the project construction, and to facilitate the affected people to contact the relevant authorities when they find irregularities in the construction unit.

The contractor shall cooperate with the requirements of the Zhengzhou Urban and Rural Construction Bureau and participate in public participation meetings held by the owner in the affected communities, at which the construction unit sends someone to explain the construction activities, the environmental protection measures taken or to be taken, and to listen and respond to the environmental and social issues of public concern.

Based on questionnaires, symposiums, in-depth interviews and interviews with key informants, the following information disclosure and public participation plan was developed through participatory observation, as detailed in Table 7-6 below for a list of public participation plans.

Table 7-6 **List of public participation plans for each phase of the project**

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
Project Preparation Phase	**Project Basic Information Disclosure**	TV, radio, posting of bulletins, distribution of leaflets, villagers' meetings, village committees, internet	Zhengzhou Urban and Rural Construction Bureau, township, village committee	Residents (residents of the project area, especially those in the project implementation site), commune/township officials, Zhengzhou Urban and Rural Construction Bureau	Disclosure of basic project information. Collecting residents' opinions and suggestions. Answering residents' questions.	Project budget funds
	Site selection willingness survey	Residents' congress, questionnaire survey	Zhengzhou Urban and Rural Construction Bureau, Consulting Unit	Residents, Zhengzhou Urban and Rural Construction Bureau, consulting units	Conducting a site-willingness survey of the residents of the streets involved in the project. Questionnaire survey with actual households as the overall survey. More than 80% of the households in the village agreed to participate in the project in order to proceed with the project implementation.	Project budget funds
	Design solution participation and	Resident interviews, symposiums,	Zhengzhou Urban and Rural	Residents, Zhengzhou Urban and Rural	Developing a resident engagement program for communities along the river, including flood safety education and training, conducting flood warnings	Project budget

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
	consultation	public announcements	Construction Bureau, project design unit, consulting unit	Construction Bureau, project design unit, consulting unit, village council	and drills, and raising residents' awareness of flood prevention and safety. Encourage residents to provide their own comments and suggestions on relevant design elements during the program design process. After the preliminary design of the program is available, the Zhengzhou Urban and Rural Construction Bureau should publicize the program in the project village and collect residents' opinions and suggestions.	funds
	Land Acquisition	Street consultation with residents	Village Committee, Zhengzhou Urban and Rural Construction Bureau	Residents, village committees, Zhengzhou Urban and Rural Construction Bureau, land departments	Confirmation of land occupation. Consultation between the neighborhood committee and the residents to confirm the content and manner of compensation. The neighborhood committee signs relevant agreements with the residents and compensates them as required by the agreements.	Project budget funds
	Construction Information Disclosure	Residents' congresses, village council bulletin boards, posting notices, hanging slogans,	Zhengzhou Urban and Rural Construction Bureau, constructio	Villagers, Zhengzhou Urban and Rural Construction Bureau, construction unit,	Making public the construction work schedule and progress plan. Distribution of construction sites.	/

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
		broadcasting, etc.	n unit, village committee	village committee	Major construction impacts. Security issues for villagers to be aware of. Construction unit contact person and contact information, etc.	
Project implementation phase	**Reduced construction impact**	Improve the corresponding plans and effective mitigation measures	Zhengzhou Urban and Rural Construction Bureau Constructor Village Supervisory Committee	Zhengzhou Urban and Rural Construction Bureau, Construction Unit Traffic Bureau, Traffic Police, Environmental Protection Bureau Village Supervisory Committee Villagers' representatives	(a) Road excavation to allow easy access for residents in the project area. Adopting dust and noise reduction measures. Avoiding residential living areas as much as possible for pipe network laying. Try to identify the impacted households and the amount of impact involved in the temporary occupation.	Project budget funds
	Participation in project construction	Villagers' Assembly, Villagers' Representative	Zhengzhou Urban and Rural Constructi	Villagers, Zhengzhou Urban and Rural Construction	Identify the positions that can be provided by project construction. Determine the selection criteria for the personnel	Construction unit internal

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
		Assembly	on Bureau, construction unit, village committee	Bureau, construction unit, village committee	involved in the construction of the project, which needs to be offered to poor households and women as a priority. Determine the remuneration for participating in the construction of the project as well as the technical training and safety system training for the personnel involved in the construction.	budget
	Labor management	Expanding safety and health promotion and standardizing construction personnel education and management	Zhengzhou Urban and Rural Construction Bureau Constructor Health Bureau Village Supervisory Committee Project area	Zhengzhou Urban and Rural Construction Bureau, Construction Unit Department of Health, Township & Community Hospitals Village committee, village supervision committee Foreign workers, community residents	Conduct public health and AIDS and New Coronavirus prevention education campaigns and include them in the contracting documents. Conducting medical examinations for project construction workers. Strengthen the education of outsiders on the social culture and traditional customs of the project area's territory. To protect the physical and mental health of female workers at construction sites, construction units shall provide regular mental health counseling for female workers. The construction company should strengthen the supervision of the site (to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, and sexual harassment) and establish clear	Project Budget

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
			residents		channels for complaints and grievances. Sites should establish grievance panels that include at least two female members and ensure the safety of grievance panel members (to avoid bias and fear of retaliation against panel members).	
Project Operation Phase	**Flood safety education**	Knowledge Seminar	Zhengzhou Urban and Rural Construction Bureau, village committee	Villagers, Village Council	Increased passenger flow along the Jinshui River, which may pose a threat to the personal safety of the residents in the project area, and to raise the safety awareness of the residents through flood safety education and water safety education. Conducting special lectures on flood prevention and relief knowledge, including flood safety education and training, flood warning and drills to raise residents' awareness of flood prevention and safety, using the example of the exceptionally heavy rainfall in Zhengzhou. Diversified disaster training content (earthquake disaster protection, urban flood control, Yellow River flood control, etc.). When conducting education and training related to flood control and drainage, special attention is paid to the proportion of women, elderly and children attending lectures.	Special funds for administrative authorities, village collective finance

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
					Actively carry out training of natural disaster personnel and strengthen the team of disaster information personnel in Zhengzhou. Implement community participation in river and lake management, and create a good atmosphere and governance mechanism to protect the water environment along the Jinshui River and Dihu Lake in the residential areas along the river and lake. Strengthen the community's management of the watershed along the Jinshui River. a. Establish a river chief system and improve the relevant river management regulations. b. Establish a community "river protection team" and clarify the composition of the "river protection team", which is responsible for the rivers in the district according to the grid and the overall c. Regularly carry out river patrol of the Jinshui River. d. Create a good atmosphere for everyone in the community to participate in the river and promote the concept of river love and protection.	
	Publication of complaint and grievance channels	TV, radio, posting notices, issuing leaflets, villagers' meetings, village committees, internet	Zhengzhou Urban and Rural Construction Bureau, relevant government	Zhengzhou Urban and Rural Construction Bureau, relevant government management departments, streets/towns/towns	Publish the project implementation supervision telephone number in an appropriate location and open a complaint handling channel. In view of the problems reflected by the residents during the operation of the project, the complaints reflected through a variety of channels such as on-site complaints, letters and phone calls are	/

Stage	Participation content	Participation method	Implementation Unit	Participants	Topics to be addressed	Funding Sources
			management departments and village committees	hips, village committees	accepted and informed on site, and if they cannot be informed on site, a reply should be given within 15 days. Focus on listening to the views of women, low-income people and other vulnerable groups to ensure open, fair and transparent project implementation.	

8 Grievance mechanism

8.1 Complaint Complaint Procedure

In the course of project preparation, construction, and operation, project-level grievance and complaint channels will be established in order to understand and resolve the impacts and problems brought about by the project to stakeholders in a timely manner, to ensure residents' needs for information disclosure and the widest possible community participation, and to take into account the current situation of grievances and complaints by residents in the project area. All grievance records and the resulting resolutions will be kept and reported to AIIB through a semi-annual environmental and social monitoring mechanism.

The grievance mechanism for this project consists of two main types.

The first is a grievance mechanism for the project level, i.e., a channel of appeal to affected residents, social groups, subjects of business premises, etc., during the implementation and operation of the project.

The second is a grievance mechanism provided to project worker level, including direct and contract workers, employees responsible for projects, etc.

(1) Grievance mechanism for project impactors

The grievance mechanism addresses complaints mainly about disturbances caused by the project, such as dust caused by construction, construction noise, improper disposal of construction waste, safety measures to protect the public and construction workers, noise and waste generated by operations. Currently, Zhengzhou residents mainly reflect their problems through the Mayor's complaint hotline 0371-12345 and the environmental protection hotline 0371-12369. The improved complaint mechanism for this project is consistent with the regulatory standards of the People's Republic of China, which protects the rights of citizens from environmental and social impacts associated with construction. The State Council of the People's Republic of China issued the "Regulations on Letters and Visits No. 431" in 2005, which provides for complaint acceptance mechanisms at all levels of government and protects them from retaliation. Based on this regulation, the former Ministry of Environmental Protection issued an updated "Measures for Environmental Correspondence and Visits" (Decree No. 15) in December 2010.

The Zhengzhou Urban and Rural Construction Bureau established the Integrated Jinshui River Management Sub-project Department in December 2021, and four staff members from the Comprehensive Department under the Department are responsible for the operation of the grievance mechanism. If the Zhengzhou Urban and Rural Construction Bureau receives a complaint, the person in charge of the Integrated Jinshui River Management Sub-project Department shall first verify whether the content of the complaint is related to the project. If the content of the grievance is related to the project, the person in charge shall initiate coordination to resolve the grievance regardless of whether the grievance is related to the environment, society, etc. If the content of the grievance is not related to the project, the person in charge shall submit the grievance to the relevant authority on behalf of the complainant. All grievances shall be documented and the relevant personnel shall be notified of the full process of the grievance. The basic steps and time frame of the grievance mechanism are as follows.

- Phase I (5 days): If a problem arises during construction or operation, the affected

person may submit a written or verbal complaint to the Contractor. The Contractor will: (i) stop the relevant activities immediately after confirming the problem (e.g., noise impact of on-site construction on nearby residents); (ii) not resume the relevant activities until the complaint is resolved; (iii) immediately inform the Zhengzhou Urban and Rural Construction Bureau of the content of the complaint received and the proposed solution; (iv) provide a clear response to the affected person within two days; and (v) as far as possible, within five days of receiving the complaint resolve the problem.

- Phase 2 (5 days): If the contractor is unable to identify a solution implementation case, or if the affected person is not satisfied, the Zhengzhou Urban and Rural Construction Bureau will organize a meeting with the key stakeholders (including the contractor, affected person). A solution acceptable to all parties will be developed, including key steps to resolve the issue. The contractor shall immediately implement the resolution and resolve the issue within 15 days. All measures and results should be documented.

- Phase 3 (15 days): If the Zhengzhou Urban and Rural Construction Bureau is unable to determine a solution, or if the complainant is not satisfied with the proposed solution, the Zhengzhou Urban and Rural Construction Bureau will organize a stakeholder consultation meeting (including the complainant, the contractor, the local ecological and environmental bureau, the Human Resources and Social Security Bureau, the Urban Environmental Management Bureau, and other relevant regulatory authorities) within seven days. A solution acceptable to all should be determined at the meeting, including clear steps. The contractor will immediately implement the agreed solution and fully resolve the issue within 15 days. The actions and results of all phases will be documented. At the end of the third phase, the project implementation unit will inform AIIB of the results.

- In the fourth stage, if the complainant is still dissatisfied with the decision of Zhengzhou Urban and Rural Construction Bureau, he/she can appeal to the administrative organ with jurisdiction for arbitration at each level after receiving the decision in accordance with the Administrative Procedure Law of the People's Republic of China.

- In the fifth stage, if the complainant is still not satisfied with the arbitration decision, he/she may, after receiving the arbitration decision, sue in the civil court according to the civil procedure law.

(2) Grievance mechanism for workers

A separate complaint handling center will be set up by the project implementation unit to handle complaints filed with the contractor by workers working at the construction site. These complaints include wages, overtime pay, timely payment of wages, accommodation issues or facilities related to drinking water, sanitation and medical services.

At the same time, relying on the guidance and coordination of the Zhengzhou Urban and Rural Construction Bureau, district women's federations, township/street and village/community women's federations organizations in GBV management, project implementation agencies, project construction units (contractors), etc. in project implementation or operation, set up special commissioners responsible for the protection of women's rights and interests in protecting female workers from sexual harassment in the workplace, taking into account the work and production characteristics of their units and taking effective measures to prevent and stop Sexual harassment in the workplace. It also opens up a rapid response mechanism for female workers and women in the project area to complain and grieve or make suggestions regarding GBV. If there is sexual harassment of female workers in the workplace and other acts that endanger the personal safety of workers, the aggrieved person can immediately reflect or complain to the employer, who shall promptly deal with the matter and protect the personal privacy of

female workers in accordance with the law.

In addition, AIIB has established a Project Affected Person (PAP) Feedback Mechanism (PPM). The PPM provides an opportunity for independent and impartial review when project-affected persons believe that they have been or may be adversely affected by the failure of an AIIB project to implement its Environmental and Social Policy (ESP), and their concerns cannot be satisfactorily addressed through the Project Grievance Redress Mechanism (GRM) or AIIB's governance mechanisms. information on the PPM can be obtained by visiting the following link: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html.

8.2 Recording and follow-up feedback of complaints and grievances

During the implementation of the environmental social management plan, each entry point of the grievance mechanism shall do a good job of registering and managing the information of complaints and the information of treatment results, and report to the Integrated Jinshui River Management Sub-project Department of Zhengzhou City and Township Construction Bureau in the form of written materials once a month. The Integrated Jinshui River Management Sub-project Department of Zhengzhou Municipal Bureau of Urban and Rural Construction will conduct regular inspections of the complaint handling registration.

In order to completely record the complaints of the affected population and the handling of related issues, the Integrated Jinshui River Management Sub-project Department Department of Zhengzhou City and Township Construction Bureau and the project implementation agency have developed a registration form for the handling of complaints and grievances of the affected population. The form format is shown in Table 8-1.

Table 8-1 Complaint and grievance registration form

Name of complainant	**Time**	**Location**	**Receive feedback from the appeals unit**	**Zhengzhou Urban and Rural Construction Bureau**	**External monitoring unit recommendations**	**Progress in the resolution of the complaint**	**AIIB Opinion**
Subject matter of the complaint							
Ways to request a solution							
Proposed Solution							
Actual processing							
Responsible person (signature)							
Note: 1) The recorder shall truthfully record the content and requirements of the complainant's complaint. 2) The complaint process shall not be subject to any interference or obstruction. (3) The proposed solution should respond to the complainant within a specified period of time.							

8.3 Contact information for expressing complaints and grievances

The implementing agency will arrange for a key responsible person to be dedicated to receiving and handling grievances and complaints from the affected population. The names, office addresses and contact numbers of the principals currently identified are shown in Table 8-2. Upon completion of the tender, the construction and supervision units will need to identify the environmental social leader as their contact person for the grievance mechanism.

Table 8-2 Information on the institutions and personnel that receive complaints and grievances from the affected population

Institution/Unit	**Contact person**	**Address**	**Phone**
Integrated Jinshui River Management Sub-project Department	Zhang Yan	No.25 Huaihe West Road, Zhongyuan District, Zhengzhou	0371-67881617
Integrated Jinshui River Management Sub-project Department	Jiang Hongtao	No.25 Huaihe West Road, Zhongyuan District, Zhengzhou	0371-67186345
Integrated Jinshui River Management Sub-project Department	Wang Guanfei	No.25 Huaihe West Road, Zhongyuan District, Zhengzhou	0371-67188908
Integrated Jinshui River Management Sub-project Department	Song Ting	No.25 Huaihe West Road, Zhongyuan District, Zhengzhou	0371-67886000
Zhengzhou Housing Acquisition Service Center	Wang Jun	No.25 Huaihe West Road, Zhongyuan District, Zhengzhou	0371-67186345
Jinshui District Jingba Road Street Office	Wang Yan	No.20-1, Jingba Road, Jinshui District, Zhengzhou	15937106060
West Coastal Road Street Office	Director Li	No.212, Fuyu Road, West Huangyu Road, Zhongyuan District, Zhengzhou	0371-68558600
Dihu Community Council	Wu Dongjuan	Zhong Yuan District Tongbai Road Dihu Community Committee	1350356502
East China Academy	Li fogu	No.25 Huaihe West Road, Zhongyuan District, Zhengzhou	15515995328
Zhongyuan District	Staff on duty	Zhengzhou Zhongyuan District Collection Center	67639363
Jinshui District	Staff on duty	Zhengzhou Jinshui District Levy Office	86011951
Erqi District	Staff on duty	Zhengzhou Erqi District Collection Center	68713266
Zhengzhou East New District	Staff on duty	Zhengzhou Zhengdong New District Levy Office	67179520
Erqi District resettlement area	Director Hu	Spring River Home, Jingguang South Road, Erqi District, Zhengzhou	13623857818

9 Environmental and Social Management Plan

9.1 Institutional responsibilities

The Zhengzhou Municipal Government set up a task force to apply for AIIB loan projects, led by the Deputy Mayor of the government as well as the Deputy Secretary General, with members including the Municipal Finance Bureau, Municipal Development and Reform Commission, Municipal Transportation Bureau, Municipal Urban and Rural Construction Bureau, Municipal Water Resources Bureau, Municipal Natural Resources and Planning Bureau, and Municipal Ecological Environment Bureau.

Zhengzhou City set up a project management office (Zhengzhou Project Management Office) under the AIIB loan project task force. The Project Management Office is located in Zhengzhou Finance Bureau, and the personnel of the Project Management Office mainly come from Zhengzhou Finance Bureau, Zhengzhou Transportation Bureau, Zhengzhou Urban and Rural Construction Bureau, Dengfeng Water Resources Bureau, etc. The Project Management Officehas set up five groups: Comprehensive Coordination Group, Bidding and Procurement Group, Financial Audit Group, Environment and Social Safeguards Group, and Project Implementation Supervision Group, each of which is equipped with full-time personnel responsible for the daily work of the group.

The Project Management Office, under the guidance of the task force is mainly responsible for the comprehensive coordination of loan projects, bidding and procurement guidance, financial statistics, project implementation supervision and other day-to-day work to ensure the smooth implementation of loan projects. The main responsibilities of the Project Management Office are: responsible for the day-to-day management of the project, the organization to guide the project implementation unit to carry out the project pre-preparation, mid-term implementation and post-assessment work; specific implementation of the project plan, funding, finance, procurement, training, monitoring, supervision and management of archives.

Zhengzhou Urban and Rural Construction Bureau is the implementation agency of the Integrated Jinshui River Management Sub-project, and the Zhengzhou Integrated Jinshui River Management Sub-project Department was established in December 2021 to coordinate and promote the construction of the Jinshui River Improvement Project in Zhengzhou. This department is composed of four departments: Comprehensive Department, Engineering Department, Technical Measurement Department, and Relocation Department. Under the guidance of the Zhengzhou AIIB Loan Project Task Force and the Project Office, the Integrated Jinshui River Management Sub-project Department is responsible for (1) designating an environmental and social coordinator for each tender section to coordinate the implementation of the environmental and social management plan; (2) ensuring that the environmental and social management plan, monitoring program and mitigation measures are included in the tender documents and construction contract; (3) operating the grievance mechanism; and (4) dealing with unforeseen adverse impacts that arise and report them to AIIB in a timely manner.

Contractor: 1) Ensure adequate funding and manpower to implement the mitigation measures and monitoring program in the Environmental and Social Management Plan throughout the construction phase; 2) Responsible for the operation of the grievance mechanism during the construction phase.

Construction supervision companies: 1) Ensure that sufficient financial and human

resources are available to supervise and direct the Contractor and require the Contractor to implement mitigation measures and monitoring in a timely manner as required in the Environmental and Social Management Plan; 2) Monitor construction progress and quality; 3) Appoint qualified staff responsible for occupational health and safety to provide regular on-site supervision of the Contractor; and 4) Monitor the Contractor's Environmental and Social Management Plan implementation performance.

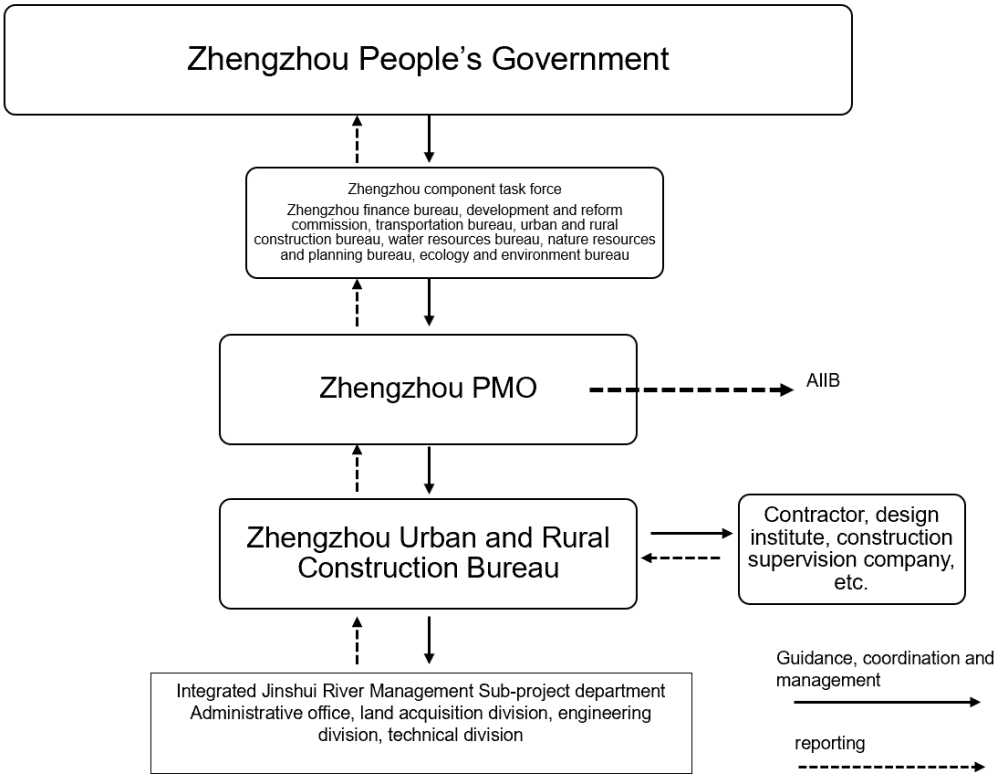


Figure 9-1 Organization chart

9.2 Anticipated environmental and social impacts and mitigation measures

Based on the identified environmental and social impacts, appropriate mitigation measures have been developed (Table 9-1 and Table 9-2). Mitigation measures will be incorporated into the design, bidding documents, construction contract, and operations management by the design and contractor under the supervision of the project implementation unit and the construction supervision companies. The effectiveness of these measures will be evaluated based on the results of monitoring by the construction supervision companies and external monitoring units to determine if adjustments and improvements to these measures are needed.

9.2.1 Reduce the risk of land acquisition and resettlement

a. Develop a detailed migration action plan; b. In the migration action plan, special attention needs to be paid to how vulnerable groups (if any) such as female heads of households, low-income and five-poor households can use the resettlement compensation for income restoration. b, the associated project Guojiazui Reservoir is under intense

construction, and the implementation unit (Erqi District Agricultural and Rural Working Committee), project management agency (Water Resources Bureau), and project funding source (Domestic financial allocation funds), etc. are not associated with the Integrated Jinshui River Management Sub-project, related land acquisition compensation and other immigration implementation information is temporarily difficult to collect complete; therefore, the due diligence of immigration resettlement for Guojiazui Reservoir restoration and construction reinforcement project, so the due diligence of immigration resettlement for Guojiazui Reservoir restoration and construction reinforcement project will be organized by the Zhengzhou Urban and Rural Construction Bureau during the monitoring period of the project implementation (before the end of December 2022). This action is included in Chapter 6, 6.3 Implementation Plan and Table 6-3 in this report and ESMP 9.2.1 and Table 9-2 Social Management Plan Action 1.

9.2.2 Regular education and training related to flood control

In order to further prevent the negative impact of the disaster, the Zhengzhou Urban and Rural Construction Bureau, Emergency Management Bureau, Municipal Flood Control and Drought Relief Command, township offices, urban communities and street offices should regularly carry out flood control and drainage related training throughout the implementation and operation of the project. education and training. For the development of disaster training, it should a. Carry out the number of thematic flood control and drainage related education and training, the number of participants, and the proportion of female participation. b. Diversify the content of disaster training (earthquake disaster protection, urban flood control, Yellow River flood control, etc.). c. Regularly check the learning effect of trained personnel and conduct index assessment. d. Develop and clarify the management process for the use of disaster relief materials reserves and disaster relief funds.

9.2.3 Participatory river management along the Jinshui River

The survey found that there are a large number of residential communities along the Jinshui River, and some sections of the Jinshui River pass through residential communities. a. Improve the river manager system and strengthen the management and governance of the river. b. Form a community "river protection team" and clarify the composition of the "river protection team" to c. Carry out regular river patrol of the Jinshui River. d. Create a good atmosphere for everyone in the community to participate in the river and promote the concept of river love and protection.

9.2.4 Supporting public health and service facilities along the Jinshui River to meet the needs of residents

In response to the lack of public health and service facilities along the Jinshui River, a. design comfortable and clean public restrooms that meet the needs of the residents along the densely populated sections of the Jinshui River, set up signs indicating toilets and arrange relevant cleaning managers to manage them, and beautify the landscape along the Jinshui River; b. suggest the establishment of special access for the disabled and the elderly along the Jinshui River; c. each river section along the Jinshui River needs to Identify the river management unit and river management personnel, formulate relevant policies and regulations, promptly solve the problem of river blockage, and prohibit residents from occupying the river to engage in personal activities; d. Set up small parking lots along the river with high pedestrian flow to facilitate the parking of electric vehicles for residents who drive electric vehicles along the Jinshui River for leisure and relaxation.

9.2.5 Protecting women's labor rights and interests, giving priority to providing jobs for women laborers in the project area

a. We can pay more attention to the problem of idle women labor during the construction of the project, especially the employment of surplus labor of women over 50 years old.

b. Project units can negotiate with recruiting enterprises to give priority to some women in recruiting, provide them with employment positions, and allow more women to participate in the project, without discriminating against women laborers and ensuring equal pay for equal work.

c. Need to strengthen the protection of female labor rights and interests and be alert to gender violence. During the implementation and operation of this project, the physical and mental health of female laborers at the construction site needs to be safeguarded, and the construction unit should provide regular mental health counseling and training on female labor rights protection for female laborers.

d. The construction company should strengthen the supervision of the site (to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, and sexual harassment) and establish clear channels for complaints and grievances.

e. Establish a site grievance team, including at least two female members, and ensure the safety of grievance team members (to avoid bias and fear of retaliation against team members).

9.2.6 Strengthen the management of foreign labor importation and prevent social risks such as AIDS and new coronavirus

During the construction of the project, a certain amount of labor will need to be imported from outside the country (provinces, cities and counties). A large number of foreign construction workers are stationed in the project area, and the intensity of communication and interaction with local residents increases, which will trigger certain social and health risks. This requires expanding safety and health promotion, standardizing construction personnel education and management, and preventing social risks.

- Conducting educational campaigns on public health and AIDS prevention, including epidemic and infectious diseases (including AIDS, New Coronavirus, influenza, etc.) in the project area, incorporating them into the contract documents for the works and their effective implementation.
- Educate and promote AIDS and other infectious diseases, basic knowledge and skills of social communication of personnel, etc. to construction site employment and locally recruited workers in the project area.
- Conduct medical check-ups for foreign construction workers on the project and establish a mechanism for medical check-ups for foreign construction workers on the project (e.g., setting up temporary medical offices, making full use of local medical resources, etc.) to ensure that only those who meet the medical health standards can participate in the project.
- Diversified awareness campaigns on AIDS prevention, such as brochures, posters, photo books, etc.
- To strengthen the education of outsiders on the local social culture and traditional customs in the project area, we invite respected elders or knowledgeable community cadres in the project area to carry out publicity activities on local social and cultural customs to enhance their understanding of and respect for local

social and cultural customs.

At the same time, in order to promote the project beneficiaries to widely participate in the construction of the project, to participate and supervise the project construction, and to establish a positive communication and interaction between the residents of the project site and the project builder and project owner, the project construction period also requires the employment of local laborers (including women). The details are as follows.

- The proportion of local labor among the project construction personnel is not less than 25%, and needs to include certain women and poor groups.
- Ensure that unskilled employment opportunities are prioritized for vulnerable groups, including women.
- Provide labor remuneration not lower than the local minimum wage according to the actual situation of the work, and a certain subsidy for environmental supervision work.
- Provide job training opportunities for recruited and hired local workers.

9.2.7 Adopt appropriate construction methods to avoid the lives of residents in the project area from being affected by the project construction

a. Do a good job of safety during construction, arrange the construction time and site reasonably, and at the same time make a scientific construction plan to carry out encircling operations to prevent personal safety to the surrounding residents; b. Do a good job of river excavation and investigation in the pre-construction period to prevent there are electric wires, water pipes and gas pipes under the construction site; c. The project unit should do a good job of propaganda before the construction starts, and adopt segmented construction and other methods to minimize the impact on the business activities of the enterprise stores on both sides of the road; d. Take measures to reduce noise pollution, control the construction site and traffic road noise, in addition to the construction time of high-noise equipment as far as possible arranged in the daytime, avoiding night construction. In addition, the construction time of high-noise equipment should be arranged in daytime as much as possible, avoiding night construction. Low-noise equipment should be used in the selection of equipment as much as possible to reduce the noise impact on the surrounding villagers and construction personnel; e. Watering the approach road and construction road regularly to prevent dust pollution; f. Setting up no-noise signs in the population gathering areas where vehicles pass through, construction vehicles should enter and leave the site at low speed and no-noise, and planning the transportation routes of sludge reasonably. h. Avoid night operation. Avoid night operation as far as possible. h. Regularly educate and train construction personnel to prevent loud and crowded activities during lunch break and at night. i. Post construction information on the outer wall of construction fence and near sensitive points, including project name, construction duration, construction content and other information, and reserve the name and contact information of the person in charge of the site, and arrange a person in charge of handling residents' complaints and reactions. j. COVID -19 During the period, construction personnel and construction sites should take strict epidemic prevention and control measures, strictly control the movement of people at construction sites, and regularly conduct medical checkups and health hazard inspections to minimize the impact of construction on community health and safety.

9.2.8 Improve the labor force protection system and working conditions to safeguard the legitimate rights and interests of labor

It is recommended that the construction unit meet the following five requirements.

(1) Based on the principle of equal opportunity and fair treatment, the employment of project staff shall not discriminate against specific groups such as women, people with disabilities, migrant workers, and youth of legal working age.

(2) Provide appropriate protection and assistance measures to care for specific groups of workers, such as women, people with disabilities, migrant workers, and youth of legal working age.

(3) The right of workers to form and join workers' organizations of their choice and the guarantee of non-interference in their collective bargaining, in compliance with national law.

(4) To prevent the occurrence of sexual harassment, the contractor will set up sufficient separate facilities for men and women in the temporary toilets at the site according to the number of female staff; formulate rules and regulations related to the prevention of sexual harassment and assign special personnel to be responsible for them, and clearly inform all personnel of the relevant requirements; and include the prevention of sexual harassment in the contractor's daily management training.

(5) Establish and clarify the grievance mechanism for handling labor complaints and complaints, clarify the labor protection supervision mechanism, and protect personal privacy in accordance with the law when handling sexual harassment complaints. The labor grievance mechanism is consistent with the grievance mechanism of this project, see the grievance mechanism in this report8.

Based on full consultation and discussion with the Zhengzhou Urban and Rural Construction Bureau, as well as relevant agencies and residents in the project area, a practical social management plan has been developed to address the impact of the project on society, women and possible risks, as detailed in Table 9-2 below.

Table 9-1 Environmental mitigation measures

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	**Main pollutants**					
Exhaust	Dust	• The construction site is set up with a fence of not less than 2m in height to ensure that the entire construction area is fully isolated from the outside world, with no gap between the fences, with a spill-proof seat at the bottom and a pressure top at the top. • Construction site entrances and exits set up automatic vehicle washing devices, vehicle washing is appropriate to use recycled water, set up sedimentation ponds, sedimentation ponds to do impermeable treatment, washing wastewater after treatment of all reuse; washing devices should be set up from the date of construction, and retained until the completion of the project, the damaged equipment should be timely maintenance to ensure normal use. • Earth and rock works are operated by wet method along the excavation and transfer. • Construction site should be masonry garbage pile pool, construction waste, household garbage concentrated, sorted piles, daily production and daily cleaning; sludge removal and formal company signed a contract for cleaning, transport vehicles for transport approval and two-way registration card, to ensure that "three not out of the field"; the site exit two measurements of each 100 meters of the road to implement "Three packages" (package clean, package order, package beautification), dedicated	Comprehensive Emission Standards for Air Pollutants GB16297-1996 Table 2	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	2650

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		to flush cleaning, to ensure that the dust does not go out of the hospital, vehicles without mud. Construction site is prohibited on-site mixing concrete, mortar; sand, stone, earth and other bulk materials should be stacked centrally and covered; field loading and unloading, moving materials should be covered, closed or sprinkled with water, not overhead throwing, scattering. • When windy weather above level 4 or the government issues an air quality warning, it is strictly forbidden to carry out earth excavation, backfilling and other construction that may generate dust, while covering the net for dust control. • Construction site should be kept clean and tidy environmental health and set up a person responsible for the installation and use of sprinklers to ensure full coverage of the exposed ground spraying set the appropriate number of full-time cleaning staff, responsible for the environmental health of the site and the site fence outside the perimeter of 10 meters. • Install remote monitoring cameras, construction site information public signs (LED), vehicle access and flushing monitoring equipment, ready-mixed mortar tank storage monitoring equipment, etc. in accordance with the standard of smart sites, and access the data to the corresponding industry competent department platform, and finally aggregated to Zhengzhou City dust pollution prevention and control management information				

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		platform. Arrange dedicated personnel to manage and maintain the monitoring equipment to ensure normal operation of the monitoring. • Construction units to organize construction, supervision and other units, the development of a sound dust control program. Construction units in accordance with relevant regulations and contractual agreements, specifically responsible for the prevention and control of construction dust. Supervisory units should be the construction site dust pollution prevention into the project supervision planning, the preparation of the corresponding supervision rules, including the content of the regular supervision meetings. • ⑨ Four or more windy weather or the municipal government issued an air quality warning, the construction of earth excavation, backfill and other construction that may generate dust is strictly prohibited, while covering the net dust.				
	Stench	• Removal of sludge is not in the field temporary each other or disposal, timely transported by closed tanker to the disposal site. • The residential area near the dredging site should be built with a fence with a height of 2.5~3m to avoid the direct diffusion of odor to the residents.				
	Mechanical Exhaust	• Selection of construction machinery and transport vehicles with environmental requirements. • Regular maintenance of construction machinery and transport vehicles.				

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		• Shut down construction machinery after construction has stopped to reduce emissions during non-working periods; • Reasonable scheduling of vehicles entering and leaving the site to avoid blockage and reduce exhaust emissions when cars are idling.				
Wastewater		• There is one set of construction wastewater collection and treatment facilities in each construction production area, and the treatment facilities are composed of one sedimentation tank and one wastewater collection tank. The sedimentation pond is designed based on one day's production, and the effective capacity is proposed to be 3.8m3 ; the scale of wastewater collection pond is designed based on 5 days' sewage production, and the effective capacity is proposed to be 19m3 . The wastewater collection pond and sedimentation pond should be lined with impermeable lining. The construction production wastewater is treated by the sedimentation tank and then used for dust reduction and vehicle washing in the construction production and living area, without external discharge.	No external discharge	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	38
		• Domestic wastewater is discharged through the municipal pipe network	Comprehensive Wastewater Discharge Standards (GB8978-1996) tertiary standards and wastewater	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
			treatment plant receiving water standards			
Noise		• Installing temporary sound barriers in key project areas to mitigate the impact on sensitive points. • Reasonable arrangement of construction time and site, the development of scientific construction plan, should avoid as far as possible a large number of high-noise equipment used at the same time. Night construction is prohibited. Try to use low-noise equipment in the selection of equipment. • ③ Reduce man-made noise and operate machinery and equipment in accordance with regulations. • ④ Regular maintenance of the machine should be carried out during construction to ensure stable and efficient operation of the equipment. • ⑤ Construction vehicles should enter and leave the site with low speed and no horn. The transportation route should be reasonably planned, avoiding environmentally sensitive points as far as possible, and transport vehicles should not sound their horns at sensitive points and should travel slowly at a uniform speed. • ⑥ Regularly educate and train construction personnel to prevent loud and congregate activities during lunch break and at night. • ⑦ Post construction information outside the	Environmental Noise Emission Standards for Construction Site Boundaries (GB12523-2011)	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	224

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		construction enclosure and near sensitive points, including the project name, construction duration, construction content and other information, and reserve the name and contact information of the person in charge of the site, and arrange a person responsible for handling residents' complaints and reactions. Major processes must be constructed at night, should apply to the urban and rural construction administrative departments for night construction permits, and 3 days in advance outside the construction fence and residents near the construction content, construction hours, site person in charge and contact information, etc., to obtain the understanding of the surrounding residents. If the surrounding units and individuals caused losses, and the affected units and individuals to negotiate compensation.				
Construction Solid Waste		• Construction waste and sludge: transported to Zhengzhou Yijia Technology Industry Co. • ② Construction personnel's domestic waste in the construction camp set up garbage cans, centralized collection and handed over to the sanitation department for unified treatment, so as to avoid littering, into the river and construction sites. • ③Recovered waste rubber dams and waste sewage pipes are sold out to scrap collection stations.	General Industrial Solid Waste Storage and Landfill Pollution Control Standards (GB18599-2020)	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	478
Traffic Management		• Safety isolation: closed management of construction area. Separate construction and	Reasonably set up traffic	Contractors	Construction supervision	300

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		access road with color steel plate isolation wall to avoid mutual interference of construction and access. • Traffic guidance: By setting up road signs at intersections, lane changes, overhead passages, temporary occupation in front of the road, etc., to inform vehicles of the road conditions, lanes, speed limits, warnings and other information required to enter the construction site and guide vehicles to pass safely. • Construction road traffic signs set: during construction at both ends of the construction site, the right side of the motorway vehicle direction of travel set the front construction slow safety (reflective paint) signs and warning signs, etc. • Traffic control: In the main traffic intersections into the construction area, special places of operation, the contractor should send additional personnel to direct and guide traffic. Temporary need for enclosure parts, should be set up mobile tool type enclosure and safety warning signs, and take isolation measures at the project danger.	guidance and warning signs; no traffic travel-related complaints.		companies, Zhengzhou Urban and Rural Construction Bureau	
Construction camp management		• The construction site should provide the necessary living facilities for construction personnel, including offices, dormitories, canteens, toilets, showers, etc. • Emergency evacuation and escape signs and emergency lighting should be installed at the passages and staircases of living and office areas and should comply with the provisions of the	Construction Site Environment and Health Standards for Construction Projects (JGJ146-2013)	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	140

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		Technical Specification for Fire Safety at Construction Sites (GB50720-2011) and fire safety signs (GB13495-92). • Set up closed garbage containers in offices and living areas. Classified storage and timely removal of domestic garbage to reduce the breeding of mosquitoes and insects. • The construction site is equipped with commonly used drugs and first aid equipment such as bandages and tourniquets. • Dormitory to ensure the necessary living space, indoor net height shall not be less than 2.5 meters, the width of the channel shall not be less than 0.9 meters, to facilitate the normal activities of personnel and evacuation in the event of an emergency, the accommodation per capita area shall not be less than 2.5 square meters • Installation of heat protection facilities such as air conditioners or electric fans in construction site dormitories. • Canteen facilities grease traps, which are cleaned regularly. • Domestic sewage is connected to the municipal sewage network in the vicinity. • Construction site dormitory and office area set flush or mobile toilets, toilet ground hardening, doors and windows complete and well ventilated. Toilets set up a person responsible for regular cleaning and disinfection.			Bureau	

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
Ecological Protection		• Set a strict scope of construction activities, construction vehicles should drive according to the planned construction roads to avoid crushing the vegetation around the construction area; regulate the behavior of construction personnel, limit and minimize the scope of construction operations, strictly prohibit the arbitrary cutting and destruction of vegetation outside the construction area, and strictly control other activities outside the construction operation area. • Take erosion control measures in accordance with the requirements of the soil and water conservation program.	Timely restoration of vegetation in areas affected by construction	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	45
Heritage Conservation		• shall not exceed the construction operation zone designed for the project, shall not encroach on the currently built Lucun River site, and shall avoid extending construction activities into the protected area of the Lucun River site. • The use of large machinery for excavation is strictly prohibited, and the excavation should be carried out manually with the construction of small machinery. • During the concrete construction, large concrete trucks, material trucks and pump trucks are strictly prohibited from entering the protection area of the Lucun River site. • The construction site is carefully guarded by a special person, who is strictly forbidden to enter the construction site, and regularly clean up the scattered materials on the construction road and	/	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau	/

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		sprinkle water to suppress dust. • Pipeline laying and weir new construction involves excavation. The construction unit shall assign a person responsible for communication and docking with the Zhengzhou Cultural Relics Bureau. Construction area construction process, once the discovery of cultural relics, should immediately stop construction and notify the relevant cultural relics departments to deal with, to obtain construction permission from the cultural relics department before resuming construction. • In the control zone for greening construction, engineering arrangements for protection, perimeter greening and water storage height, river bank construction and other engineering content should seek the consent of the heritage conservation department, shall not plant root depth of more than 0.2m greenery.				
South-North Water Diversion Trunk Canal Water Source Protection Zone		• Construction is prohibited in the primary protection zone, and large construction machinery shall not be used for construction in the secondary protection zone to avoid causing vibration to the structure and foundation of the trunk canal and affecting its structural safety. • During the earthwork should be taken to cover, sprinkling and other measures to suppress dust generation. • (a) The discarded debris from bridge demolition shall not be deposited within the protected area. • Strengthening the maintenance and servicing	/	Contractors	Construction supervision companies, Zhengzhou Urban and Rural Construction Bureau Bureau	/

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		of equipment and not washing construction machinery within the protected area. • When the bridge is reconstructed, the mud and wastewater generated by the construction is introduced into the protected area by closed tanker trucks for treatment, and no temporary facilities for wastewater treatment such as mud ponds and sedimentation tanks shall be set up in the protected area. • During the construction of the top of the inverted siphon, deep excavation and arrangement of large machinery are strictly prohibited, and environmental protection materials should be used for bank slope protection and greenery placement to avoid secondary pollution of the South-North Water Transfer Trunk Canal. • The trail setting in the protection area should be a single-side trail, while garbage cans should be set on the bank slope and regular cleaning should be arranged during the operation period to avoid domestic garbage from entering the South-North Water Diversion Trunk Canal under unfavorable meteorological conditions. • Arrangement of greening in the river channel to try to avoid the use of seasonal broad-leaved forest trees, to prevent the autumn and winter season withered leaves into the South-North water transfer canal; greening planting should use organic fertilizer or slow-release fertilizer, the application of highly toxic pesticides is strictly prohibited.				

Environmental Elements		Content of measures	Performance Standards	Implementation	Supervision	Environmental Investment (10,000 yuan)
Category	Main pollutants					
		• The construction right-of-way set up to minimize the width of the temporary road, in and out of the protected area vehicles should be selected from small transport vehicles, safety manned at the construction fence to avoid extraneous personnel to enter the South-North Water Diversion Trunk Canal Protection Zone. • The construction unit should obtain the consent of the South-North Water Diversion Management Department before construction, and develop emergency plans for environmental incidents to protect the water quality safety and engineering safety of the South-North Water Diversion Central Artery Project. At the same time the construction unit shall strengthen the environmental education and training of construction personnel, shall not conduct fishing, swimming in the river and other prohibited acts within the protected area, shall not move, cover, alter or damage the markers, shall not encroach on or damage the water transmission channels (pipelines, river channels), embankments, berms, etc. • The entrance and exit of the construction site and vehicle washing facilities of the water source protection zone are set outside the water source protection zone.				
Solid waste during operation		The floating materials salvaged from the river are transported to the garbage transfer station by the sanitation department together with the landscape area and the domestic garbage generated in the	/	Zhengzhou Urban and Rural Construction Bureau	/	/

Environmental Elements		**Content of measures**	**Performance Standards**	**Implementation**	**Supervision**	**Environmental Investment** (10,000 yuan)
Category	**Main pollutants**					
		park.				
Noise during operation		Posting no horn signage, hanging speed limit signs, etc.		Zhengzhou Urban and Rural Construction Bureau	/	/
Total						3875

Table 9-2 Social Management Plan

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
1 Risks arising from migration and land acquisition and relocation	a. Develop a detailed migration action plan. b. In the Migration Action Plan, special attention needs to be paid to how vulnerable groups such as female heads of households, low-income and five-income households use resettlement compensation for income recovery. c. Housing renovation transition period to provide residents with temporary housing, related fee waivers and leaseback possibilities. d. The associated project Guojiazui Reservoir resettlement due diligence will be organized by the Zhengzhou Urban and Rural Construction Bureau during the monitoring period of the project implementation (before the end of December 2022).	Zhengzhou Urban and Rural Construction Bureau, project owner, resettlement plan preparation unit, external monitoring unit	Preparation phase, construction period	Project Funding	a. Migrant resettlement plan. b. Due diligence report on migrant resettlement in Guojiazui Reservoir, an associated project.
2 education and training related to flood control and drainage	a. Carry out lectures on flood prevention and disaster relief knowledge, including flood safety education and training, flood warning and drills to raise residents' awareness of flood prevention and safety, using the example of the	Zhengzhou Urban and Rural Construction Bureau, Emergency Management Bureau, Flood and	Preparation phase, construction period, operatio	Project budget, government finance	a. The number of education and training related to thematic flood control and drainage, the number of participants, and the proportion of female participation.

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	exceptionally heavy rainfall in Zhengzhou City b. Diversified disaster training content (earthquake disaster protection, urban flood control, Yellow River flood control, etc.) c. When carrying out education and training related to flood prevention and drainage, special attention is paid to the proportion of women, the elderly and children attending lectures d. Actively carry out training for natural disaster personnel and strengthen the team of disaster information personnel in Zhengzhou	Drought Control Command, township offices, urban communities and street offices	n period		b. Diversified disaster training content (earthquake disaster protection, urban flood control, Yellow River flood control, etc.) c. Regularly check the learning effect of the trained personnel and conduct index assessment d. Develop and clarify the use of disaster relief supplies reserves and disaster relief funds management process
3 Participatory river management along the Jinshui River	Implement community participatory river and lake governance, and create a good atmosphere and governance mechanism for protecting the water environment along the Jinshui River and Dihu in residential areas along the rivers and lakes; strengthen community residents' management of some of the watersheds along the Jinshui River through the city. a. Improve the river manager system and strengthen related river management and governance. b. Form a community "river protection team" for	Zhengzhou Urban and Rural Construction Bureau, River Chief Office, Emergency Management Bureau, Human Resources Bureau, township/street, community/village	Operatio n period	Project budgets, governme nt departmen t financial budgets	a Strengthen the management and governance of rivers and lakes along the Jinshui River, and use the established information dissemination platform to release management messages b. The number of communities "river protection teams" established for the Jinshui River and their clear composition. c. The number and frequency of

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	the Jinshui River, clarify the composition of the "river protection team", and take responsibility for the river in the district by grid, and act as a whole. c. Conduct regular river patrols on the Jinshui River. d. Create a good atmosphere for everyone in the community to participate in the river and promote the concept of love and protection of the river	committee			annual community river protection team participation in the Golden Water River river patrol d. Willingness and satisfaction of residents along the Jinshui River to participate in river management
4. Provide employment opportunities for vulnerable groups such as women and poor groups	a. Prioritize the recruitment of a certain number of female members in the recruitment of Zhengzhou Urban and Rural Construction Bureau staff at all levels to facilitate the work related to women. b. After the completion of this project, the management station along the Jinshui River, employing a certain number of female staff, such as security inspectors, cleaners, security guards, etc. c. Provide training opportunities for recruiting and hiring women. d. Ensure that unskilled employment	Zhengzhou Urban and Rural Construction Bureau, Contractor, Labor Bureau, Community/Housing Committee, Project Area Women	During project construction	Contractor's budget	a. The proportion of women and poor groups in unskilled employment positions during the construction of the project. b. The number of women and poor groups employed in the public service jobs provided during the project's operation. c. The location, content, and frequency of training for female workers or employees.

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	opportunities are given priority to vulnerable groups, including women, during project construction, with full respect for their wishes. e. Provide labor compensation not lower than the local minimum wage according to the actual situation of the work, equal pay for the same work, and certain subsidies for environmental supervision work.				
5. Promote women's participation in all phases of the project and prevent sexual harassment	a. Ensure that no less than 50% of women participate in the public participation activities during the pre-project preparation phase. b. The payment of compensation for land acquisition and demolition will be given to the household after both spouses in the family being acquired and demolished have signed, ensuring women's right to know and share. c. During the operation and maintenance phase of the project, ensure that at least one female member is required at all levels of the project organization and implementation structure. d. Conducting project information campaigns at a time, place and in a form that takes full account of the needs of women and the	Design unit, Zhengzhou Urban and Rural Construction Bureau, civil affairs, women's federation, transportation bureau, project street/township, community/village committee, women and poor groups in the project area	During construction; during operation	Project budget, government finance	a. The number of symposiums on public participation held in the pre-project phase, the number of women participating, the minutes of the meetings. b. The signature of the female member of the family when signing the procedures for receiving compensation for land acquisition. c. Female members and their numbers in the project organization and implementation bodies at all levels during the operation and maintenance phase. d. Conduct project information dissemination, training at a time, place

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	characteristics of their labor activities, during their free time. e. Take into account the literacy level and cognitive ability of women, etc., and conduct publicity in a way that is easily acceptable to women.				and in a manner acceptable to women. e. Number of women participating in skills training.
6. Gender violence management	a. Strengthen the protection of female labor rights and interests and be vigilant against gender violence. b. The construction unit shall provide regular mental health counseling and training on female labor rights protection for female laborers. c. Relying on the guidance and coordination of the Zhengzhou Urban and Rural Construction Bureau, municipal women's federations, township and village/community women's federations organizations, project implementation agencies, project construction units (contractors), etc. in the implementation or operation of the project, set up commissioners specializing in the protection of women's rights and interests, and take effective measures to prevent and stop sexual	Design unit, construction unit, owner unit, Zhengzhou Urban and Rural Construction Bureau, URA, civil affairs, women's federation, transportation bureau, project street/township, community/village committee, women and poor groups in the project area	During construction; during operation	Project budget, government finance	a. Gender ratio of laborers in construction units. b. The number of times female mental health counseling and labor rights training was provided. c. Project implementation agencies, project construction units (contractors), etc., setting up special commissioners responsible for the protection of women's rights and interests, and specific measures taken to prevent and stop sexual harassment of female workers in the workplace. d. Supervisory measures to prevent sexual harassment in the construction unit, the establishment and staffing of

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	harassment of women workers in the workplace, taking into account the work and production characteristics of their units. d. The construction company shall strengthen the supervision of the site (to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, sexual harassment, etc.), establish clear channels for complaints, set up a site complaints team, including at least two female members, and guarantee the safety of the members of the complaints team (to avoid prejudice and fear of retaliation against the team members)				the grievance and complaint group, and the smoothness of the grievance and complaint mechanism.
7. Measures to reduce potential social crisis	a. Strengthen education and awareness of health and HIV and NICU prevention, including prevention of HIV, NICU and other infectious diseases, to be included in the contracting documents. b. Public health and AIDS and New Coronavirus prevention education to be included in the works contract, as well as the education and promotion of those employed in the industrial park, etc. to be effectively	Contractors, Health Bureau, project owners, enterprises, Women's Federation, relevant townships, village groups	Project construction and operation period	Project construction contract funding, Health Department budget	a. The terms of the construction contract and its implementation. b. Number of public safety and AIDS, and new coronavirus prevention training courses and participants. c. Number of health posts. d. The number of publicities on AIDS and new coronavirus prevention and control during the construction phase

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	implemented. c. Medical checkups for project construction workers (e.g., setting up temporary medical offices, making full use of local medical resources, etc.). d. Diversified awareness-raising activities on AIDS and NCCV prevention, such as brochures, posters, photo books, etc. e. Invite respected elders or knowledgeable community leaders in the project area to conduct awareness-raising activities on local social and cultural practices, such as brochures, posters, photo books, etc; f. Recommend signing labor agreements for temporary workers to protect the labor rights and economic benefits of temporary workers				of the project, including the number of brochures, posters and photo books, etc. e. Information and education on local social and cultural customs and other knowledge during the construction phase of the project, including the number of brochures, posters and photo books, etc.
8 Risks during project construction	a. Safety work should be done during construction, reasonable arrangement of construction time and site, as well as the development of a scientific construction plan to surround the operation to prevent personal safety to the surrounding residents. b. Do a good job of river excavation and	Zhengzhou Urban and Rural Construction Bureau, Construction Unit	Preparation phase; during construction	Project Environmental Management Plan Costs	a. Slow down when transport vehicles pass by or through residential areas, and set up roadside warning signs. b. The daily flow of visitors to the site during construction.

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	investigation in the pre-construction period to prevent the presence of electric wires, water pipes and gas pipes under the ground at the construction site. c. The project unit should do a good job of publicity before the start of construction and adopt segmented construction and other methods to minimize the impact on the business activities of the stores on both sides of the road. d. Take measures to reduce noise pollution, control construction site and traffic road noise, in addition, the construction time of high-noise equipment as far as possible arranged in the daytime, avoid night construction. Equipment selection to try to use low-noise equipment to reduce the impact of noise on the surrounding villagers and construction personnel. e. Regular watering of approach roads and construction roads to prevent dust pollution. f. Set up no-noise signage for the population gathering areas through which vehicles pass, and construction vehicles should enter and leave the site at low speed and no-noise.				c. The number of complaints about environmental pollution (including dust and noise) during construction and the status of their resolution. d. The integration of construction safety management into the management of construction contracts; measures to promote and educate construction personnel on safety awareness. e. The number of notices and warning signs installed during construction and the number of damaged public facilities repaired in a timely manner.

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	Reasonable planning of transportation routes. g. Avoid socially sensitive points as far as possible, transport vehicles should not sound their horns at sensitive points, should keep a uniform speed and avoid night operations as far as possible. h. Regularly educate and train construction personnel to prevent loud and congregate activities during lunch breaks and at night. i. Posting construction information on the outer wall of the construction fence and near sensitive points, including information on the project name, construction duration, construction content, etc., and reserving the name and contact information of the person in charge of the site, and arranging for a person to be responsible for handling complaints and reactions from residents. j.During COVID-19, construction personnel and construction sites should take strict epidemic prevention and control measures, strictly control the movement of personnel at construction sites, and regularly conduct medical examinations and health hazard checks to minimize the impact of construction				

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	on community health and safety.				
9 Improve the labor force protection system and working conditions to protect the legitimate rights and interests of labor	a. Specify that the employment process adheres to the principles of equal opportunity and fair treatment in hiring project staff and, in addition, does not discriminate against personal characteristics unrelated to inherent job requirements. b.Provide appropriate protection and assistance measures for specific groups of workers, such as women, persons with disabilities, migrant workers, and children of legal working age, to address project staff deficiencies. c. Comply with the provisions of national law to assist workers in forming workers' organizations, and workers have the right to form and join workers' organizations of their choice and to guarantee that their collective bargaining is not interfered with. d. Establish and clarify the mechanism for handling labor complaints and complaints, clarify the mechanism for monitoring labor protection, and protect personal privacy in accordance with the law when handling sexual	Zhengzhou Urban and Rural Construction Bureau, Construction Unit	Preparation phase; during construction	Project Environmental Management Plan Costs	a. The percentage of the population of special groups, such as women and people with disabilities, among the workers employed. b. Protection measures and provisions for women, persons with disabilities, and child labor. c. The number of training and educational activities on workers' organizations. d. Frequency of workers' bargaining through unions. e. The establishment and smooth operation of the complaint mechanism, preventive measures to deal with sexual harassment, the number and proportion of female workers in the construction stage, feedback and suggestions.

Project Risks	Specific measures or actions	Actors	Action Time	Funding Sources	Monitoring Indicators
	harassment complaints.				

9.3 Institutional strengthening and capacity building

Zhengzhou Urban and Rural Construction Bureau has no previous experience with AIIB projects, and there are no domestic environmental impact assessment requirements for this type of project, so the implementation of this Environmental and Social Management Plan is a new task for the project implementation unit. During the implementation of this project, the Zhengzhou Project Management Office will organize experts to provide initial training on the implementation of the Environmental and Social Management PIan for the environmental and social commissioners, construction units, and supervision units of the project implementation agency. The training will cover the AIIB's Environmental and Social Policy, good management practices during construction, monitoring and reporting, and complaint mechanisms.

9.4 Monitoring and reporting

9.4.1 Environmental Monitoring

The environmental impact of this project is mainly concentrated in the construction period, in order to understand the impact of construction activities on the water quality of the Jinshui River and the atmospheric environment on both sides of the river, the surface water environment of the Jinshui River and the sound environment, the Zhengzhou Project Management Office shall commission a unit qualified in environmental monitoring. Monitoring program is as follows.

(1) Water environment monitoring

1）Surface water monitoring

Monitoring points: 50m below the dam of Guojiazui reservoir at the upstream of Jinshui River and one monitoring point at the downstream of Jinshui River into Dongfeng Canal.

Monitoring items: water temperature, pH, dissolved oxygen, permanganate index, COD, BOD_5 , NH_3 -N, TP, TN, copper, zinc, fluoride, selenium, arsenic, mercury, cadmium, chromium, lead, cyanide, volatile phenols, petroleum, anionic surfactants, sulfide, fecal coliform, sulfate, chloride, nitrate, iron, manganese and other 29 items.

Monitoring frequency: 1 period every quarter during the construction period and 1 period during the operation period, each period is monitored continuously for 3 days.

Monitoring methods: According to the methods specified in the "Environmental Quality Standards for Surface Water" (GB3838-2002) and "Technical Specification for Surface Water and Wastewater Monitoring" (HJ/T 91-2002).

2）Wastewater monitoring

Monitoring point placement: the end of the pit wastewater treatment facility.

Monitoring items: pH, SS, wastewater flow.

Monitoring frequency: one period of monitoring during the peak of the construction period, each period of continuous monitoring for 3 days.

Monitoring methods: According to the methods specified in the "Environmental Quality Standards for Surface Water" (GB3838-2002) and "Technical Specification for Surface Water and Wastewater Monitoring" (HJ/T 91-2002).

(2) Ambient air monitoring

Monitoring point placement: select representative residential points downwind from the project and set up one monitoring point each.

Monitoring items: TSP, PM_{10} , SO_2 , NO_2 , odor concentration.

Monitoring frequency: 1 period per quarter during the peak construction period, with 7 days of continuous monitoring per period.

Monitoring methods and sampling frequency: According to the requirements and provisions of the Ambient Air Quality Standards (GB3095-2012) and the Ambient Air Quality Monitoring Specifications (Trial).

(3) Acoustic environment monitoring

The arrangement of measurement points: choose a representative residential site near the project and set up one monitoring point around the construction site boundary.

Monitoring items: day and night equivalent sound levels.

Monitoring frequency: 1 period per quarter during the construction period, 3 days per period, once during the day and once during the night.

Monitoring methods; according to the methods specified in the "Sound Environmental Quality Standards" (GB3096-2008).

(4) Substrate monitoring

Monitoring point placement: within the dredged river channel.

Monitoring items: water content, substrate particle size and gradation, density, sediment capacity, pH, characteristic pollutants, etc.

Monitoring frequency: 1 time each during the construction period and operation period.

9.4.2 Dam Safety

The environmental expert of the consulting services package during the implementation period is responsible for collecting and collating the construction quality and environmental management of the associated facility Guojiazui Reservoir Reinforcement Project during the construction period and the results of the dam safety appraisal during the operation period with the support of Zhengzhou Urban and Rural Construction Bureau, and reporting to AIIB in the environmental monitoring report.

9.4.3 Social Monitoring

Social monitoring and evaluation is an important part of ensuring that the Project is

implemented in accordance with the objectives of the Project's social management plan, that the Project's information disclosure and public participation, as well as the social management action plans proposed in the design of the social impact assessment report, such as the resettlement plan for migrants, participatory river management, improvement of labor force working conditions, and avoidance of gender violence, can be paid attention to and implemented, and that the proposed Project is an important error correction mechanism and participation The proposed project is also an important corrective and participatory mechanism. To this end, the proposed project has established monitoring and evaluation mechanisms, including internal monitoring and external monitoring and evaluation.

Internal monitoring is carried out by the Zhengzhou AIIB Project Management Officeand the Integrated Jinshui River Management Sub-project Department to monitor and evaluate the implementation progress of the proposed project, the implementation of the social management action plan, the progress of the information disclosure and public participation plan, the use of project funds, and the implementation of rules and regulations.

The external independent monitoring and evaluation will be conducted by an independent monitoring unit accredited by AIIB and with 10 years or more experience in monitoring and evaluation of social and migration in ADB, WB, AIIB and other international financial organizations' loan projects, which will be engaged by the Project Management Office to carry out external monitoring of the implementation of the Social Management Action Plan. The independent monitoring and evaluation unit will conduct regular follow-up monitoring and evaluation of the implementation activities of the social management action plan, and provide advice and submit monitoring and evaluation reports to AIIB.

9.4.4 Reporting

The Zhengzhou Project Management Office is required to report regularly on the implementation of the Environmental and Social Management Planning Framework for the subprojects under its jurisdiction, i.e., quarterly in the first year of project implementation and semi-annually thereafter as a stand-alone document and as part of the project implementation report. Based on the results of AIIB's assessment of the implementation of environmental and social-related measures, the frequency of environmental and social monitoring reports is semi-annually.

9.5 Cost estimates

Environmental and social mitigation measures implementation and management costs of 40.15 million yuan, including: 1) measures during the construction phase, including baffles, water sprinkling, construction material cover, drainage ditches, sound barriers, traffic signage, etc., totaling 38.75 million yuan, borne by the contractor (as part of the construction contract); 2) environmental and social monitoring costs of 1.8 million yuan; 3) capacity building and training costs of 100,000 yuan. The operation phase is the cost of daily maintenance of the facilities, which is borne by the Zhengzhou Urban and Rural Construction Bureau. 3) 500,000 RMB for training sessions to recruit women, low-income workers, etc., public participation in the organization and implementation and representation of complaints, etc.

Annex 1: Spoils, sediment and construction waste disposal agreement

消纳处置协议

公司名称：郑州航港科技实业有限公司（下文简称甲方）

法定代表人或法定授权代理人：

公司名称：郑州市金水河综合整治工程指挥部（下文简称乙方）

法定代表人或法定授权代理人：刘锐

本协议依照《中华人民共和国合同法》相关规定为明确双方在施工过程中的权利、义务和责任，经双方协商，就建筑垃圾消纳的有关事宜达成协议如下：

一、工程概况：

工地名称：郑州市金水河综合整治工程土方清运

消纳场名称：车大沟消纳场

工地位置：郑州市金水河沿线

工　期：

清运路线：金水路、未来路、中州大道、龙四环、大河路、荥广路、S312

二、甲方责任义务：

1、保证消纳场各类报案齐全，人员、管理、工艺、安全、设备及配套设施到位，保证运输车辆进场后安全有序倾倒弃土。

2、配合乙方办理工地排放证、车辆进行证等相关手续，并按车次收取弃土消纳服务费。

3、保证场区道路平整，保持场地整洁卫生，无黄土裸露；场地无扬尘、出入口硬化，对出场车辆进行冲洗，保证无污水外流。

4、对进入场地车辆检查手续是否齐全，密闭及车身冲洗是否到位；确保弃土无余物，不准柴油车及手续不全的车辆进入消纳场作业。

三、乙方责任义务：

1、向甲方提供该项目运输车辆的牌照号明细进行备案，备案车辆须持有郑州市

本协议有效期自_____年__月___日至_____年____月___日。

七、违约责任：

本协议签署生效后，合同各方应本着诚信、合法、合理、谨慎、维护合作的原则与本协议约定的各项义务，任何一方违反本协议约定的任何责任、义务、保证及承诺，视视为违约，守约方有权终止协议，并要求违约方赔偿因其违约行为给守约方造成的一切损失。

八、其他：

1、甲乙双方自觉履行相关义务，如发生争议，本着协商友好解决，协商不成，双方都可请政府有关部门进行劳动仲裁，或向合同签订地人民法院提起诉讼。

2、甲乙双方确认以本协议约定的联系地址为双方之间书面文件往来及涉及仲裁、诉讼时仲裁机构、法院送达相关材料的送达地址，相关材料送达至上述地址即视为送达。因联系方式和联系信息错误而无法直接送达的自交邮后第7日视为送达。一方变更地址或联系电话的，应以书面形式通知对方。

3、本协议在履行过程中，未尽事宜另行签订补充协议，对本协议条款的任何变更均以书面形式作出，且须经各方签署确认方有效。

4、本协议一式肆份，每份具有相同法律效力，甲方执叁份，乙

甲方：	乙方：
法人或法定授权代理人：	法人或法定授权代理人：
联系地址：郑州市金水区经一路与大河路交叉口东北角宏远汽车产业园	联系地址：中原区须河西路39号
联系电话：18637811333	联系电话：19337101108
年 月 日	年 月 日

Annex 2: List of seminars for residents in the project area

Date of survey	Surveyed units	Survey time	Survey Locations	Survey method and content
Feb. 9	Erqi District	10:30 a.m.	University Road Street	1) Women's Symposium: 6 people, 2 young (under 30), 2 middle-aged (30-55) and 2 old (55+). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
		15:00 PM	Honeybee Chang Street	
Feb. 10	Erqi District	10:30 a.m.	Wulibao Street	1) Women's Symposium: 6 people, 2 young (under 30), 2 middle-aged (30-55) and 2 old (55+). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
		15:00 PM	Songshan Road Street	
Feb. 11	Erqi District	9:30 a.m.	Houzhai Township	1） Residents' Symposium: 20 people, 10 men and 10 women. 2） Senior Citizen Symposium: 2 people (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
Feb. 12	Zhongyuan District	9:30 a.m.	Imperial Lake Garden	1) Residents' forum: 20 people, 10 men and 10 women. (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
Feb. 13	Zhongyuan District	9:30 a.m.	Emile Kindergarten at Dihu	1) Women's Symposium: 6 people, 2 young people (under 30 years old), 2 middle-aged (30-55 years old) and 2 old people (55 years old and above). 2) Senior citizen symposium: 2 people (1 male, 1 female) (3) Symposium on vulnerable groups: 6 people (2 poor households, 2 disabled people, 2 low-income households)
Feb. 14	Jinshui District	9:30 a.m.	Waterfront Restaurant	1) Residents' forum: 20 people, 10 men and 10 women. (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)

Feb. 15	Jinshui District	9:30 a.m.	Jingba Road Street	1) Women's Symposium: 6 people, 2 young (under 30), 2 middle-aged (30-55) and 2 old (55+). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
Feb. 16	Jinshui District	9.30am	Dashiqiao Street	1) Women's Symposium: 6 people, 2 young (under 30), 2 middle-aged (30-55) and 2 old (55+). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
Feb. 17	Jinshui District	14:30 PM	Renmin Road Street	1) Women's Symposium: 6 people, 2 young (under 30), 2 middle-aged (30-55) and 2 old (55+). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
Feb. 18	Zhengdong New District	9:30 a.m.	Ruyi Lake Street	1) Women's Symposium: 6 people, 2 young people (under 30 years old), 2 middle-aged (30-55 years old) and 2 old people (55 years old and above). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)
		14:30 PM	Longhu Street	1) Women's Symposium: 6 people, 2 young (under 30), 2 middle-aged (30-55) and 2 old (55+). (2) Seminar for the elderly: 2 persons (1 male, 1 female) (3) Symposium for disadvantaged groups: 6 people (2 poor households, 2 people with disabilities, 2 people from low-income households)

Annex 3: List of interviewees

Sections covered	Specific details of the people involved in the interview Records
5	Interview Records 5-1: Mr. Zhang, Wulibao Street, Erqi District (35 years old)
	Interview Records 5-2: Mr. Liu (54 years old), Dashiqiao Street, Jinshui District
	Interview Records 5-3: Mr. Li (65 years old), Jinshui District, Jingba Road Street
	Interview Records 5-4: Mr. Zhang, Dihu Garden, Zhongyuan District (51 years old)
	Interview Records 5-5: Mr. Zhang, Dihu Garden, Zhongyuan District (51 years old)
	Interview Records 5-6: Ms. Kong (55 years old), Longhu Street, Zhengdong New District
	Interview Records 5-7: Dihu Garden Ms. Hu (33 years old)
	Interview Records 5-8: Mr. Wang (63 years old), Songshan Road Street, Erqi District
	Interview Records 5-9: Ms. Zhang (39 years old), Renmin Road Street, Jinshui District, Zhengzhou City
	Interview Records 5-10: Ms. Li (40 years old), Jinshui District, Zhengzhou City, Jingba Road Street
	Interview Records 5-11: Ms. Liu, Houzhai Township, Erqi District, Zhengzhou City (35 years old)
	Interview Records 5-12: Ms. Liu (48 years old), Haixi Road, Zhongyuan District, Zhengzhou City
7	Interview Records 7-1 : Ms. Zhang, Jinshui District, Jingba Road Street (48 years old)
	Interview Records 7-2: Ms. Liu (35 years old) of Yangtze River Park (the name of a park next to Dihu Lake) in Zhongyuan District
	Interview Records 7-3: Mr. Fu, etc., Dihu Garden, Zhongyuan District (42 years old)
	Interview Records 7-4: Mr. Liu (30 years old), Dihu Garden, Zhongyuan District
	Interview Records 7-5: Mr. Qi (43 years old), Ruyi Lake Street, Zhengdong New District
	Interview Records 7-6: Ms. Wu (37 years old), West Nautical Road Street, Zhongyuan District
	Interview Records 7-7: Ms. Zhang, Mingong Road Street, Erqi District (35 years old)
	Interview Records 7-8: Mr. Wu (50 years old), University Road Street, Erqi District
	Interview Records 7-9: Mr. Zhang (29 years old), Dihu Garden, Zhongyuan District
	Interview Records 7-10: Mr. Zhang (42 years old), Honeybee Zhang Street, Erqi District

Annex 4: Interview Records

Time	**February 2022**
Location	Dihu Garden Community in Zhongyuan District
Organizers	Zhengzhou Dihu Garden Community Committee
Participants	Wang Gong of the Zhengzhou Urban and Rural Construction Bureau, Zhang Director of the neighborhood committee, Hohai University
Participating Topics	Jinshui River Comprehensive Improvement Project Community Panel Discussion
Main content and results	1. Dihu Garden Community is located in Zhengzhou City, Zhongyuan District, Nautical West Road Street, part of the Jinshui River through the Dihu Garden Community. At the same time, there is an Emile kindergarten in the Dihu Garden community. The Dihu Garden community is based on Dihu Lake, and usually has a large flow of people. 2. Residents said that the July 20, 2021 flood caused serious property damage to them. The infrastructure of the river in the project area is not perfect, and many watersheds are occupied by private individuals and developers, resulting in an unattended state in some of the watersheds of the Jinshui River. At the same time, because of the lack of water flow in the basin of the Jinshui River on weekdays, flooding rarely occurs, resulting in inadequate flood control facilities and related supporting facilities along the Jinshui River and lack of flood control material reserves (sandbags, lifeboats, lifeboats, etc.). 3. The residents of the Integrated Jinshui River Management Sub-project are well aware of the project, while the residents are very supportive of the start of the Integrated Jinshui River Management Sub-project. Residents think that the comprehensive improvement project of Jinshui River should start construction as soon as possible. The residents along the river said that the comprehensive improvement project of the Jinshui River can bring them comfortable living experience, convenient transportation environment and beautiful scenery on both sides of the Jinshui River. 4. Residents also expressed their needs: 1) Urgent demand for river safety and security projects, "I hope the river on both sides of the Jinshui River can be restored as soon as possible, we often go to both sides of the Jinshui River for walking activities, and now the roads and bridges on both sides of the Jinshui River are damaged, and we have trouble getting around." (2) Residents hope to improve the river management system of the Jinshui River basin and the communities along the river, "Our Dihu area was originally managed by the real estate developer, but actually no one comes to manage it at all. Many foreign residents come to our side of the Imperial Lake to fish, and there are often vehicles parked indiscriminately and more garbage than usual, causing a lot of trouble for our community residents to live and travel." 3) Women in the community expressed their hope that the project would bring them work opportunities, "I heard that this project started construction years ago, and I am still unemployed at home with my children, I hope this project will bring some work opportunities for us housewives. We are willing to take part in the daily management of the river along the Jinshui River, such as the work in cleaning, we

	are willing to do it."