Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project Financed by Asian Infrastructure Investment Bank Loan

Environmental Impact Assessment Report

Project Implementation Unit：Wuli Industrial Zone (East City New District) Management Committee

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Prepared on: November 2023

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1. Executive Summary

1.1 Project introduction

The construction scope of Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project includes 2 towns: Zhangtan Town and Shiti Town, Hanbin District, Ankang City, Shaanxi Province; the construction content of the Project mainly includes five sections: (1) Low-impact and resilient road engineering; (2) Urban ecological restoration and green resilient infrastructure construction; (3) Ecological park and urban integrated waterlogging prevention and control system; (4) Green and low-carbon urban operation system; (5) Institutional capacity improvement and project management. Among them: (1) Low-impact and resilient road engineering includes the construction of 5 new roads (with a length range of 225~2,119m); reconstruction of Ankang Guanmiao - Huangyang River in the east section of the ring road (1,254m long) and resilience improvement of Shiti - Zhangtan first-class highway of national highway G211 (7,624m long), construction of public transport network, construction of slow traffic sidewalks, low-impact design of road LID, 4 green public parking lots as well as construction and installation of new energy street lamps, etc.; (2) Urban ecological restoration and green resilient infrastructure construction includes three projects: Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Environmental Improvement and Ecological Park Project, and Protection Zone 1 of Zhangtan Town Section Protection Engineering; (3) Ecological park and urban integrated waterlogging prevention and control system project includes 1 sports park, 2 community parks and 4 urban waterlogging prevention and control systems (mainly including adding rainwater pipes, pump stations, outlets, etc.); (4) Green and low-carbon urban operation system mainly includes the construction of a green and low-carbon urban operation management and data center, with a total floor area of 13,087.03m^2 and a total building area of about 49,950.00m^2; and the construction of a green and low-carbon digital platform and institutional capacity building in Chengdong New Area.

The Project takes the establishment of low-carbon means of transportation, the construction of open space systems such as community parks and slow traffic sidewalks, and the capacity expansion and improvement of urban public infrastructure as the implementation paths to carry out unified planning and adaptive construction for Chengdong New Area of Ankang City, so as to meet the basic needs of people's daily health preservation, give better play to ecosystem functions and eco-culture values, and finally achieve the goals of protecting the ecological environment, increasing carbon sinks and urban resilience.

This report is prepared in accordance with the *Environmental and Social Framework* issued by Asian Infrastructure Investment Bank (AIIB), *Environment Protection Law of the People's Republic of China*, *Environmental Impact Assessment Law of the People's Republic of China*

and the *Regulations on the Administration of Construction Project Environmental Protection* (Decree No. 253 of the State Council). By summarizing the research results, expert opinions and public opinions related to the Project, the positional relationship between the Project and the ecological conservation redline is analyzed to determine whether the Project is feasible and identify major environmental issues involved in the Project.

1.2 Implementation arrangement

Project Management Office (PMO) sits in Hanbin District Government，Project Implementation Unit (PIU) is the Wuli Industrial Zone Management Committee.PMO will be responsible to: (i) Lead the project preparation and implementation in all aspects; (ii) coordinate among all relevant government departments; (ii) lead the communication with the Bank; (iii) supervise the PIU in project preparation and implementation and provide governmental support; (iv) conduct Financial Management of the Project; (v) prepare and implement the Environmental and Social Management Plan (ESMP), Resettlement Action Plan (RAP), and Stakeholder Engagement Plan (SEP); and (vi) provide the Bank with progress reports, audit reports, financial reports, Environmental and Social (E&S) monitoring reports and other reports required on regular basis.The environmental monitoring report shall be submitted once a quarter in the first year of project implementation, and then once every six months thereafter.

1.3 Project type

The Project mainly involves road construction, ecological restoration, ecological parks and waterlogging prevention and control, etc. The impact of the Project on environment is mainly manifested in the construction period, which involves construction wastewater, solid waste, noise, dust and other impacts; in addition, during the construction period of road engineering and ecological restoration project along the river, a certain degree of water and soil loss may be caused under the action of rain wash in the concentrated rainfall season; the negative impacts during the project operation period mainly include road dust, automobile exhaust and traffic noise generated by the urban low-carbon and resilient transport facilities subproject, domestic sewage and domestic waste from staff of other subprojects and visitors, as well as equipment noise and noise of social activities. Such adverse impacts can be mitigated through good management schemes and effective measures.

The Project is classified as Type A project according to the requirements of Environmental and Social Policy (ESP) of Asian Infrastructure Investment Bank (hereinafter referred to as "AIIB"). This environmental impact assessment (EIA) report is prepared in accordance with the requirements of environmental and social policy, and environmental and social standard (ESS) of AIIB as well as the laws and regulations of China.

1.4 Main environmental impact and mitigation measures

The impact of the Project on environment is mainly during the construction period, and the area where the project is located has been seriously altered by human activities. Although the altered habitats are involved, these altered habitats have no important biodiversity value. During the construction of the Project, a large amount of earth excavation and soil borrowing and spoil are involved. According to the feasibility study report, no spoil site is set up for the Project outside the project area, and the excavated earth is temporarily piled up in the project area and reused in time; the required earthwork shall be backfilled with excavated soil first, and the insufficient portion shall be supplemented with purchased soil; at the present stage, the location of borrow site for the Project has not been determined, and the EIA puts forward the site selection requirements for the borrow site, which shall not be located in or near natural habitats, important habitats and altered habitats with important biodiversity value, and sand mining on river channel shall be avoided. The impacts during the construction period mainly include noise and dust pollution caused by earth excavation, site leveling, construction machinery and transportation in a short time, as well as the impact of wastewater and solid waste generated at the construction site. In addition, a certain degree of water and soil loss may be caused under the action of rain wash in the concentrated rainfall season, which may have a certain impact on surface water body and Shaanxi Hanjiang River Wetland. The environmental impacts during the construction period of the Project are temporary and will be addressed through the mitigation measures developed in the environmental management plan and the full implementation and management during the construction period.

The project operation period has a certain positive effect on ecological restoration and biodiversity protection; the negative impacts mainly include road noise, dust and automobile exhaust generated by the urban low-carbon and resilient transport facilities subproject, domestic sewage and domestic waste from staff of other subprojects and visitors, as well as equipment noise and noise of social activities. These environmental impacts are mild and will be addressed through mitigation measures and strengthened management. In addition, regarding Huangyang River Environmental Improvement Project in the urban ecological restoration and green resilient infrastructure construction sector, there are basic farmlands within the scope of project. According to the *Regulations on the Protection of Basic Farmland*: "No unit or individual may change or occupy after the basic farmland protection area has been demarcated according to law", the EIA proposes that the Project shall not occupy permanent basic farmland and shall not engage in any activities that damage basic farmland within the permanent basic farmland, and is allowed to engage in agricultural planting dominated by green agriculture to maintain its land nature unchanged; for the non-point source pollution of pesticides and fertilizers caused by pest control, the report puts forward the requirements for rational application of pesticides and fertilizers and other relevant pollution prevention and

control measures; Regarding Hanjiang River Rehabilitation and Riverside Green Corridor Project (Phase I) and Huangyang River Environmental Improvement and Ecological Park Project, there are some forest lands within the scope of project. According to the *Measures for Management of the Examination and Approval of Forest Lands Used by Construction Projects*, this assessment requires that forest lands should not be occupied or less occupied during project implementation. If forest lands must be used, they should conform to the forest land protection and utilization planning and make rational, economical and intensive use of forest lands;Regarding the greening and planting involved in the Project, the EIA report puts forward the suggestion of prohibiting the introduction of alien species and selecting local species. After consulting with experts from the local plant protection station, the EIA puts forward the protection requirements for transplanting wild soybean, a national second-class protected wild plant within the scope of project;In addition, regarding Hanjiang River Riverside Ecological Green Corridor Project and Huangyang River Environmental Improvement and Ecological Park Project, which cover a large area and are adjacent to Hanjiang wetland, the assessment proposes to strictly follow relevant requirements of the *Wetlands Conservation Law of the People's Republic of China* and the *Regulations on Wetlands Conservation in Shaanxi Province*, and incorporate the above relevant requirements and measures into the environmental management plan.

1.5 Information publicity and public consultation

According to the relevant policies and regulations on public participation in environmental impact in China and the requirements of AIIB's environmental and social framework, a questionnaire survey was conducted, and local residents, vulnerable groups and relevant units in the affected areas were interviewed in the early stage of the Project. After the follow-up report is revised and improved, it is planned to publicize relevant information of the Project through the network.

1.6 Environmental management plan

The Project has developed an environmental management plan (EMP) according to the requirements of AIIB's environmental and social framework.

EMP will be included in the construction bidding documents and managed by the project implementation agency - Wuli Industrial Zone (East City New District) Management Committee to ensure the smooth implementation of environmental impact mitigation measures and monitoring plans.

Through regular environmental management by Wuli Industrial Zone (East City New District) Management Committee (WIZMC), the implementation of the Project can be reviewed to meet the environmental laws in China and the policy requirements of AIIB's environmental

and social framework.

1.7 Other description

The basis of this environmental impact assessment is the *Feasibility Study Report of Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project* (edition in September 2023). According to the subsequent revision and change of the feasibility study report, the EIA report is planned to be revised and improved accordingly, especially the portion regarding Hanjiang River Riverside Ecological Green Corridor Project (Phase I) and Huangyang River Environmental Improvement Project will be refined, supplemented and improved.

2. Policy, Legal and Institutional Framework

2.1 Assessment basis

2.1.1 Environmental protection laws and regulations

(1) *Environment Protection Law of the People's Republic of China (Revision),* January 1, 2015;

(2) *Environmental Impact Assessment Law of the People's Republic of China* (Revision), December 29, 2018;

(3) *Law of the People's Republic of China on Prevention and Control of Water Pollution (Revision)*, January 1, 2018;

(4) *Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution (Revision)*, October 26, 2018;

(5) *Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise (Revision)*, June 5, 2022;

(6) *Law of the People's Republic of China on Soil Pollution Prevention and Control*, January 1, 2019;

(7) *Law of the People's Republic of China on Prevention and Control of Environmental Pollution by Solid Waste (Revision)*, September 1, 2020;

(8) *Law of the People's Republic of China on Water and Soil Conservation*, March 1, 2011;

(9) *Water Law of the People's Republic of China (Revision)*, July 2, 2016;

(10) *Law of the People's Republic of China on the Protection of Cultural Relics (Revision)*, November 4, 2017;

(11) *Highway Law of the People's Republic of China*, November 4, 2017;

(12) *Circular Economy Promotion Law of the People's Republic of China (Revision)*, October 26, 2018;

(13) *Law of the People's Republic of China on Conserving Energy (Revision)*, October 26, 2018;

(14) *Wild Animal Conservation Law of the People's Republic of China*, May 1, 2023;

(15) *Law of Land Administration of the People's Republic of China (Revision)*, January 1,

2020;

(16) *Yangtze River Protection Law of the People's Republic of China*, March 1, 2021;

(17) *Wetlands Conservation Law of the People's Republic of China*, June 1, 2022.

2.1.2 Administrative regulations and policies of the State Council

(1) *Regulations on the Protection of Basic Farmland* (Revision) (Decree No. 588 of the State Council) issued by the State Council, January 8, 2011;

(2) *Action Plan for the Prevention and Control of Atmospheric Pollution* (GF [2013] No. 37) issued by the State Council, September 10, 2013;

(3) *Action Plan for the Prevention and Control of Water Pollution* (GF [2015] No. 17) issued by the State Council, April 2, 2015;

(4) *Action Plan for the Prevention and Control of Soil Contamination* (GF [2016] No. 31) issued by the State Council, May 28, 2016;

(5) *Regulations on the Administration of Construction Project Environmental Protection* (Decree No. 682 of the State Council) issued by the State Council, October 1, 2017;

(6) *Regulations on the Protection of Wild Plants of the People's Republic of China* issued by the State Council, October 7, 2017;

(7) *Guiding Opinions on Accelerating the Establishment and Improvement of a Green, Low Carbon and Circular Development Economic System* (GF [2021] No. 4) issued by the State Council, February 2, 2021;

(8) *Opinions on Deepening and Fighting the Battle Against Pollution Prevention and Control* issued by the State Council, November 2, 2021;

(9) *Regulations on Groundwater Management* (Decree No. 748) issued by the State Council, December 1, 2021;

(10) *Work Plan for Energy Conservation and Emission Reduction in the "14th Five-Year Plan" Period* (GF [2021] No. 33) issued by the State Council, December 28, 2021.

2.1.3 Regulations and normative documents of the ministries

(1) *Measures for Public Participation in Environmental Impact Assessment* (Decree No. 4) issued by the Ministry of Ecology and Environment, January 1, 2019;

(2) *Classified Administration Catalogue of Environmental Impact Assessments for Construction Projects (2021 Edition)* (Decree No. 16) issued by the Ministry of Ecology and Environment, November 30, 2020;

(3) *Guiding Opinions on Coordinating and Strengthening the Work Related to Addressing Climate Change and Protecting Ecological Environment* (HZH [2021] No. 4) issued by the Ministry of Ecology and Environment, January 9, 2021;

(4) *Technical Guide for Conservation and Restoration of Ecological Buffer Zones in Rivers and Lakes* issued by the Ministry of Ecology and Environment, December 4, 2021;

(5) *National Catalogue of Hazardous Wastes* (2021 Edition) issued by 5 ministries and commissions including the Ministry of Ecology and Environment and the National Development and Reform Commission, January 1, 2021;

(6) *Guiding Opinions on Strengthening the Management and Control of Ecological Redline of Resources and Environment* (FGHZ [2016] No. 1162) issued by 9 ministries and commissions including the National Development and Reform Commission, May 30, 2016;

(7) *Guidance Catalog for Industrial Structure Adjustment (2019 Edition)* (Decree No. 29) issued by the National Development and Reform Commission, January 1, 2020;

(8) *National Catalogue of Key Protected Wild Plants* issued by National Forestry and Grassland Administration and the Ministry of Agriculture and Rural Affairs (Announcement No. 15 of National Forestry and Grassland Administration and the Ministry of Agriculture and Rural Affairs in 2021), September 7, 2021;

(9) *Measures for Management of the Examination and Approval of Forest Lands Used by Construction Projects* (LZG [2021] No. 5) issued by National Forestry and Grassland Administration, September 13, 2021;

(10) *Catalogue of Terrestrial Wild Animals with Important Ecological, Scientific and Social Values* issued by National Forestry and Grassland Administration (Announcement No. 17 of National Forestry and Grassland Administration in 2023), June 26, 2023.

2.1.4 Local regulations and related documents

(1) *Regulations of Shaanxi Province on Water and Soil Conservation* issued by the Standing Committee of the People's Congress of Shaanxi Province, October 1, 2013;

(2) *Regulations of Shaanxi Province on Groundwater* issued by the Standing Committee of the People's Congress of Shaanxi Province, April 1, 2016;

(3) *Regulations of Shaanxi Province on Prevention and Control of Air Pollution (2019 Revision)* issued by the Standing Committee of the People's Congress of Shaanxi Province, July 31, 2019;

(4) *Regulations of Shaanxi Province on Prevention and Control of Water Pollution in Danjiang River Basin of Hanjiang River* (2020 Revision) issued by the Standing Committee of the People's Congress of Shaanxi Province, June 11, 2020;

(5) *Regulations of Shaanxi Province on Prevention and Control of Environmental Pollution by Solid Waste* (2021 Revision) issued by the Standing Committee of the People's Congress of Shaanxi Province, September 29, 2021;

(6) *Regulations of Shaanxi Province on Energy Conservation* issued by the Standing Committee of the People's Congress of Shaanxi Province,September 29, 2021;

(7) *Regulations on Wetlands Conservation in Shaanxi Province* issued by the Standing Committee of the People's Congress of Shaanxi Province, June 1, 2023;

(8) *Work Plan for Comprehensive Improvement of Urban Ambient Air Quality* (SZF [2012] No. 33) issued by the People's Government of Shaanxi Province, July 6, 2012;

(9) *Opinions on Implementing the Strictest Water Resource Management System* (SZF [2013] No. 23) issued by the People's Government of Shaanxi Province, May 19, 2013;

(10) *Work Plan for Prevention and Control of Water Pollution in Shaanxi Province* (SZF [2015] No. 30) issued by the People's Government of Shaanxi Province, December 30, 2015;

(11) *Work Plan for Prevention and Control of Soil Pollution in Shaanxi Province* (SZF [2016] No. 52) issued by the People's Government of Shaanxi Province, December 23, 2016;

(12) *Implementation Plan for Low-carbon Pilot Work in Shaanxi Province* (SZBF [2012] No. 48) issued by the General Office of the People's Government of Shaanxi Province, May 9, 2012;

(13) *Industrial Water Consumption Quota* (DB61/T943-2020) issued by Shaanxi Administration for Market Regulation, September 12, 2022;

(14) *Regulations of Ankang City on the Protection of Water Quality in Hanjiang River Basin* issued by the Standing Committee of the People's Congress of Ankang City, April 1, 2021;

(15) *Work Plan for Prevention and Control of Water Pollution in Ankang City* (AZF [2016] No. 7) issued by Ankang Municipal People's Government, March 24, 2016;

(16) *Work Plan for Prevention and Control of Soil Pollution in Ankang City* (AZF [2017] No. 12)

issued by Ankang Municipal People's Government, April 1, 2017;

(17) *"Three Lines and One Single" Ecological Environment Zoning Management and Control Scheme for Ankang City* (AZF [2021] No. 18) issued by Ankang Municipal People's Government, November 26, 2021;

(18) *Implementation Plan of Battles for the Defense of Blue Sky, Clear Water and Clean Land in 2022* (AZF [2022] No. 17) issued by the Office of Ankang Municipal People's Government, August 4, 2022.

2.1.5 Relevant planning

(1) *National Main Functional Area Planning* (GF [2010] No. 46) issued by the State Council, December 21, 2010;

(2) *Development Planning of Hanjiang Ecological Economic Belt* (GH [2018] No. 127) issued by the State Council, October 8, 2018;

(3) *Notice on the Issuance of the Soil, Groundwater and Rural Ecological Environment Protection Planning in the "14th Five-Year Plan" Period* (HTR [2021] No. 120) issued by 7 ministries and commissions including the Ministry of Ecology and Environment, December 29, 2021;

(4) *Water Function Zoning of Shaanxi Province* (SZBF [2004] No. 100) issued by the People's Government of Shaanxi Province, September 22, 2004;

(5) *Ecological Function Zoning of Shaanxi Province* (SZBF [2004] No. 115) issued by the People's Government of Shaanxi Province, November 17, 2004;

(6) S*haanxi Main Functional Area Planning* (SZF [2013] No. 15) issued by the People's Government of Shaanxi Province, March 13, 2013;

(7) *Outline of the 14th Five-Year Plan for National Economic and Social Development in Shaanxi Province and* the Long-term Goals in 2035 (SZF [2021] No. 3) issued by the People's Government of Shaanxi Province, February 10, 2021;

(8) *Ecological Environment Protection Planning of Shaanxi Province in the "14th Five-Year Plan" Period* (SZBF [2021] No. 25) issued by the General Office of the People's Government of Shaanxi Province, September 18, 2021;

(9) *Outline of Urban Master Planning of Ankang City (2017-2035)* issued by Ankang Municipal People's Government;

(10) *Outline of the 14th Five-Year Plan for National Economic and Social Development in Ankang City and the Long-term Goals in 2035* (AZF [2021] No. 4) issued by Ankang Municipal People's Government, April 15, 2021;

(11) *Low-carbon Development Planning (2018-2030) of Ankang City* (AZBF [2018] No. 62) issued by the Office of Ankang Municipal People's Government, July 30, 2018;

(12) *Division Scheme of Urban Acoustic Environment Function Areas in Ankang City* (AZBF [2020] No. 15) issued by the Office of Ankang Municipal People's Government, July 7, 2020;

(13) *Ecological Environment Protection Planning of Ankang City in the "14th Five-Year Plan" Period* (AZBF [2021] No. 33) issued by the Office of Ankang Municipal People's Government, December 31, 2021;

(14) *Comprehensive Transportation Development Planning of Ankang City in the "14th Five-Year Plan" Period* (AZBF [2022] No. 4) issued by the Office of Ankang Municipal People's Government, January 29, 2022;

(15) *Outline of the 14th Five-Year Plan for National Economic and Social Development in Hanbin District and the Long-term Goals in 2035* (HZF [2021] No. 2) issued by Hanbin District People's Government of Ankang City, May 10, 2021.

2.1.6 Assessment guidelines and technical specifications

(1) *Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment* (HJ 2.2-2018);

(2) *Technical Guidelines for Environmental Impact Assessment - Surface Water Environment* (HJ 2.3-2018);

(3) *Technical Guidelines for Environmental Impact Assessment - Groundwater Environment* (HJ 610-2016);

(4) *Technical Guidelines for Environmental Impact Assessment - Acoustic Environment* (HJ2.4-2021);

(5) *Technical Guidelines for Environmental Impact Assessment - Ecological Impact* (HJ19-2022);

(6) *Technical Guidelines for Environmental Impact Assessment - Soil Environment (Trial)* (HJ 964-2018);

(7) *Technical Guidelines for Environmental Risk Assessment of Construction Projects* (HJ

169-2018);

(8) *Technical Standard of Soil and Water Conservation for Production and Construction Projects* (GB50433-2018)

2.2 Relevant requirements of AIIB

1. Environmental and social policy (ESP). The objective of this overall policy is to promote the realization of these development results by integrating sound environmental and social management into the system of the Project. The overall policy includes Environmental and Social Policy (ESP), Environmental and Social Standard (ESS) and Environmental and Social Exclusion List. ESP stipulates mandatory requirements for the identification, assessment and management of environmental, social risks and impacts related to projects supported by the Bank and its clients and AIIB.

2. Environmental and social standard. *Environmental and Social Standard 1* aims to ensure the robustness and sustainability of the project in terms of environment and society, and supports the integration of environmental and social factors into the decision-making process and implementation of the project. ESS1 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 in direct proportion to the risks and impacts of the project. *Environmental and Social Standard 1* provides high-quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the implementation of the project. *Environmental and Social Standard 1* defines the detailed requirements for environmental and social assessment to be conducted for any project invested by AIIB.

3. The Project needs to meet not only local environmental laws and regulations, but also ESP and ESS of AIIB. The Project applies to *Environmental and Social Standard 1: Environmental and Social Assessment and Management*.

2.3 Environmental function zoning

The environmental function zoning of the Project is shown in Table 2.3-1.

Table 2.3-1 List of Environmental Function Zoning for the Project

Category	Location of the Project	Category of function area	Basis of division
Main function zoning	Hanbin District of Ankang City is a provincial-level key development zone, and its functional orientation is as follows: an important transportation hub connecting the northwest, southwest and central China, an important clean energy base in Shaanxi Province, a regional new material and green food processing base, a modern		*National Main Functional Area Planning* and *Shaanxi Main Functional Area Planning*

Category	Location of the Project	Category of function area	Basis of division
	service industry and logistics distribution center		
Environment Air	According to the *Ambient Air Quality Standard* (GB3095-2012), the ambient air function area is divided into two categories: Category I area includes natural reserve, scenic area and other areas requiring special protection; Category II area includes residential area, commercial traffic residential mixed area, cultural area, industrial area and rural area	The Project belongs to the commercial traffic residential mixed area, and the ambient air is classified as Category II area	Ambient Air Quality Standard (GB3095-2012)
Surface water	The Project is located in Hanjiang river system of the Yangtze river basin, adjacent to Hanjiang River in the north and Huangyang River in the west. The section from 500m upstream of the project site to Guanmiao is a Class III water function zone, and that from Guanmiao to 2km downstream of the project site is a Class II water function zone. However, the assessment has been conducted as per Class II water quality goal in recent years	Class II, Class III	*Water Function Zoning of Shaanxi Province*
Groundwater	Groundwater around the project is mainly suitable for centralized drinking water source and industrial and agricultural water	Class III	*Quality Standard for Ground Water* (GB/T14848-2017)
Noise environment	According to the *Environmental Quality Standard for Noise*, the Project is located in residential and commercial mixed area and belongs to Class 2 acoustic function area; according to the *Specification for Division of Acoustic Environment Function Areas* (GB/T15190-2014), the areas within 35m from both sides of first-class highway and secondary trunk road are Class 4a acoustic function areas	Class 2, Class 4a	*Environmental Quality Standard for Noise*, *Technical Specification for Division of Acoustic Environment Function Areas* (GB/T15190-2014)
Ecological Environment	From the perspective of Level I ecological zone, the project site is located in the deciduous broadleaf and evergreen broadleaf mixed forest ecoregion in the Qinba Mountainous region; from the perspective of Level II ecological zone, the project is located in the agro-ecological area in the hilly basin on both sides of the Hanjiang River; from the perspective of Level III ecological zone, the project is located in the towns and agricultural areas in Yuehe Basin. Ecosystem in the location of each subproject is dominated by agricultural and urban ecosystem, with no natural or important habitat distributed		*Ecological Function Zoning of Shaanxi Province*

2.4 Assessment standard

2.4.1 Environmental quality standards

(1) Ambient air: Ambient air quality shall be subject to the Level II standard given in the *Ambient Air Quality Standard* (GB 3095-2012), and the standard limits are shown in Table 2.4-1.

Table 2.4-1 Assessment Standard of Ambient Air Quality

S/N	Name of pollutants	Value time	Concentration limit	Unit	Source of standard
1	SO_2	Annual average	60	μg/m^3	*Ambient Air Quality Standard* (GB 3095-2012), Level II standard
		24-hour average	150		
		1h average	500		
2	NO_2	Annual average	40		
		24-hour average	80		
		1h average	200		
3	PM_{10}	Annual average	70		
		24-hour average	150		
4	$PM_{2.5}$	Annual average	35		
		24-hour average	75		
5	O_3	Daily maximum 8h average	160		
		1h average	200		
6	TSP	Annual average	200		
		24-hour average	300		
7	CO	24-hour average	4	mg/m^3	
		1h average	10		

(2) Surface water environment: Within the assessment scope, both Hanjiang River and Huangyang River shall be subject to the Class II standard given in the Environmental Quality Standard for Surface Water (GB3838-2002), and the standard limits are shown in Table 2.4-2.

Table 2.4-2 Environmental Quality Standard for Surface Water

S/N	Item	Class II standard limits (mg/L)	Source of standard
1	pH	6~9	Environmental Quality Standards for Surface Water (GB 3838-2002)
2	Chemical oxygen demand (COD)	15	
3	Five-day biochemical oxygen demand (BOD_5)	3	
4	Ammonia nitrogen (NH_3-N)	0.5	
5	Total phosphorus (P)	0.1	
6	Fluoride (F)	1.0	
7	Sulphide	0.1	
8	Cyanide	0.05	
9	Volatile penol	0.002	
10	Petroleum	0.05	

S/N	Item	Class II standard limits (mg/L)	Source of standard
11	Mercury	0.00005	
12	Arsenic	0.05	
13	Plumbum	0.01	
14	Cadmium	0.005	
15	Chromium (hexavalent)	0.05	
16	Fecal coliform (counts/L)	2000	

(3) The ground water shall be subject to the Class III standard given in the Quality Standard for Ground Water (GB/T14848-2017), and the standard limits are shown in Table 2.4-3.

Table 2.4-3 Quality Standard for Ground Water

S/N	Factor	Class III	Unit	Standard name and Category
1	pH	6.5-8.5	Dimensionless	*Quality Standard for Ground Water* (GB/T14848-2017), Class III
2	Na^+	200	mg/L	
3	Chlorides	250		
4	Sulphate	250		
5	Ammonia	0.5		
6	Nitrate (N)	20		
7	Nitrite nitrogen (N)	1.00		
8	Volatile phenolics (phenol)	0.002		
9	Cyanide	0.05		
10	Fluoride	1.0		
11	Arsenic	0.01		
12	Mercury	0.001		
13	Hexavalent chromium	0.05		
14	Plumbum	0.01		
15	Zinc	1.00		
16	Cadmium	0.005		
17	Iron	0.3		
18	Manganese	0.1		
19	Copper	1.0		
20	Total hardness ($CaCO_3$)	450		
21	Total soluble solids	1000		
22	Oxygen consumption	3.0		
23	Anionic surfactant	0.3		
24	Sulphide	0.02		
25	Total coliform group	3.0	CFU/100mL	
26	Total number of colonies	100	CFU/mL	

(4) Acoustic environmental quality

The comparison of noise level guideline values given in EHS Guidelines with China's *Environmental Quality Standard for Noise* is shown in Table 2.4-4.

In general, if China's standard is different from the performance level stipulated in EHS, the Bank requires to adopt the stricter standard. If lower requirement is adopted, sufficient and detailed rationality proof needs to be provided in the EIA process.

On the whole, the standards applicable to residence, office and education in China are equivalent to EHS general guidelines, while the environmental quality standard for noise applicable to industrial and commercial fields is more stringent than the standard of the World Bank. Compared to EHS of the World Bank, China's environmental quality standard for noise has five more specific classes, which are applicable to different acoustic function areas. These acoustic function areas are determined by the local government based on factors such as land utilization and actual background. Such zoning standard is applicable to the entire region, rather than an individual building. EHS General Guidelines of the World Bank Group only refer to the receptor, without considering the local background environment. If there are railways, highways or urban trunk roads in the local area, the EHS General Guidelines of the World Bank Group are not applicable, because it is unrealistic from a technical or economic point of view to keep the surroundings of railway quiet just like the railway does not exist, due to high traffic volume and noise.

China has a large population and all cities are densely populated. The land use planning is more mixed and complicated compared to many developed countries. Most of the land is mixed with residential and commercial or industrial area, or the residential area is adjacent to highway/railway. From a technical and economic point of view, it is not feasible to adopt a single standard of 55/45 dB as the environmental quality standard for noise for any residential receptor without regard to land use. It should be noted that China's standard takes into account the actual situation of urban land utilization and local roads and railways, and develops specific standards for different situations, but fails to emphasize the goal of protecting people's health.

Therefore, Class 2 and Class 4a standards given in China's *Environmental Quality Standard for Noise* (GB3096-2008) are adopted in this EIA process, and the recent increase in noise value of the receptor is required to be no more than 3dB, in order to protect people's health and meet the requirements of EHS General Guidelines of the World Bank Group.

Table 2.4-4 Comparison of Noise Guideline Values in EHS Guidelines with China's Environmental Quality Standard for Noise

<table>
<tr><th>China's Environmental Quality Standard for Noise (GB3096-2008)</th><th>Noise level guideline values given in EHS Guidelines</th></tr>
<tr><td>1. Classification of acoustic environment function areas
According to the functional characteristics and environmental quality requirements of the areas, the acoustic environment function areas are divided into the following five types:
Class 0 acoustic environment function area: refers to the rehabilitation and convalescence area and other areas that need to be quiet;
Class 1 acoustic environment function area: refers to the area where residential buildings, medical and</td><td>It is mentioned in EHS Guidelines that the noise impact shall not exceed the indexes listed in the following table, or shall not increase the background noise of the nearest receiving point outside the site to 3dB
<table><tr><th>Receptor</th><th>Daytime dB (A)/h</th><th>Night dB (A)/h</th></tr><tr><td>Residence, office, culture and</td><td>55</td><td>45</td></tr></table></td></tr>
</table>

health care, cultural education, scientific research and design, and administrative offices are the main functions, and where quietness is required;
Class 2 acoustic environment function area: refers to the area where commercial finance and market trade are the main functions, or where residential, commercial and industrial functions are mixed, and where residential quietness needs to be maintained;
Class 3 acoustic environment function area: refers to the area where industrial production, storage and logistics are the main functions and where industrial noise needs to be prevented from having serious impact on the surrounding environment;
Class 4 acoustic environment function area: refers to the area within a certain distance on both sides of the traffic trunk line where traffic noise needs to be prevented from having serious impact on the surrounding environment, including Class 4a and Class 4b. Class 4a refers to the areas on both sides of the expressway, first-class highway, second-class highway, urban expressway, urban trunk road, urban secondary trunk road, urban rail transit (aboveground section), and inland waterway; Class 4b refers to the areas on both sides of the trunk railway.

2) Environmental noise limits

Acoustic environment function area Category		Environmental noise limits/dB (A)	
		Daytime	Night
Class 0		50	40
Class 1		55	45
Class 2		60	50
Class 3		65	55
Class 4	4a	70	55
	4b	70	60

education		
Industrial and commercial facilities	70	70

(5) The soil environmental quality shall be subject to the soil contamination risk screening value of Class II land given in Soil Environmental Quality - Risk Control Standard for Soil Contamination of Development Land (Trial) (GB 36600-2018) and the soil contamination risk screening value of Table 1 given in Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial) (GB15618-2018). The standard limits are shown in Tables 2.4-5 and 2.4-6.

Table 2.4-5 *Soil Environmental Quality - Risk Control Standard for Soil Contamination of Development Land (Trial)*
(GB36600-2018) (basic project) Unit: mg/kg

S/N	Pollutant item	CAS No.	Screening value
			Class II land
Heavy metal and inorganic substance			
1	Arsenic	7440-38-2	60
2	Cadmium	7440-43-9	65

S/N	Pollutant item	CAS No.	Screening value
			Class II land
3	Chromium (hexavalent)	18540-29-9	5.7
4	Copper	7440-50-8	18000
5	Plumbum	7439-92-1	800
6	Mercury	7439-97-6	38
7	Nickel	7440-02-0	900
Volatile Organic Compounds			
8	Carbon tetrachloride	56-23-5	2.8
9	Chloroform	67-66-3	0.9
10	Methyl chloride	74-87-3	37
11	1,1-dichloroethane	75-34-3	9
12	1,2-dichloroethane	107-06-2	5
13	1,1-dichloroethylene	75-35-4	66
14	Cis-1,2-dichloroethylene	156-59-2	596
15	Trans-1,2-dichloroethylene	156-60-5	54
16	Dichloromethane	75-09-2	616
17	1,2-dichloropropane	78-87-5	5
18	1,1,1,2-tetrachloroethane	630-20-6	10
19	1,1,2,2-tetrachloroethane	79-34-5	6.8
20	Tetrachloroethylene	127-18-4	53
21	1,1,1-trichloroethane	71-55-6	840
22	1,1,2-trichloroethane	79-00-5	2.8
23	Trichlorethylene	79-01-6	2.8
24	1,2,3-trichloropropane	96-18-4	0.5
25	Chloroethylene	75-01-4	0.43
26	Benzene	71-43-2	4
27	Chlorobenzene	108-90-7	270
28	1,2-dichlorobenzene	95-50-1	560
29	1,4-dichlorobenzene	106-46-7	20
30	Ethylbenzene	100-41-4	28
31	Styrene	100-42-5	1290
32	Toluene	108-88-3	1200
33	M-xylene + p-xylene	108-38-3 106-42-3	570
34	O-xylene	95-47-6	640
Semi-volatile organic compounds			
35	Nitrobenzene	98-95-3	76
36	Phenylamine	62-53-3	260
37	2-chlorophenol	95-57-8	2256
38	Benz[a]anthracene	56-55-3	15
39	Benzo[a]pyrene	50-32-8	1.5
40	Benzo[b]fluorathene	205-99-2	15
41	Benzo[k]fluoranthene	207-08-9	151
42	Chrysene	218-01-9	1293
43	Dibenz[a,h]anthracene	53-70-3	1.5
44	Indeno[1,2,3-cd]pyrene	193-39-5	15
45	Naphthalene	91-20-3	70

Table 2.4-6 *Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial)*
(GB15618-2018) Unit: mg/kg

S/N	Pollutant item	Risk screening value			
		pH≤5.5	5.5<pH≤6.5	6.5<pH≤7.5	pH>7.5
1	Cadmium	0.3	0.3	0.3	0.6
2	Mercury	1.3	1.8	2.4	3.4
3	Arsenic	40	40	30	25
4	Plumbum	70	90	120	170
5	Chromium	150	150	200	250
6	Copper	50	50	100	100
7	Nickel	60	70	100	190
8	Zinc	200	200	250	300
Note: ① Heavy metal and metalloid arsenic are calculated according to the total amount of elements. ② For paddy-upland rotation land, the stricter risk screening value is adopted.					

2.4.2 Discharge standard of pollutants

(1) Atmospheric pollutant

The dust during the construction period shall be subject to the *Limiting Value of Fugitive Dust Emissions from Construction Sites* (DB61/1078-2017), as detailed in Table 2.4-7.

Table 2.4-7 List of Atmospheric Pollutant Emission Standard Limits

S/N	Pollutant		Standard limit		Standard Name and Level
1	Construction dust (i.e. total suspended particulates TSP)	Demolition, earthwork and foundation treatment works	0.8 mg/m^3	Hourly average concentration limit at the highest concentration point outside the perimeter	*Limiting Value of Fugitive Dust Emissions from Construction Sites* (DB61/1078-2017)

(2) Water pollutant

Wastewater shall be discharged into the sewage treatment station and subject to the Level III standard given in the Integrated Wastewater Discharge Standard (GB8978-1996), and the specific standard limits are shown in Table 2.4-8.

Table 2.4-8 List of Water Pollutant Discharge Standard Limits

S/N	Sources of pollution	Pollutant	Standard limit	Unit	Standard name and level (class)
1	Wastewater	pH	6~9	Dimensionless	*Integrated Wastewater Discharge Standard* (GB8978-1996), Level III
2		SS	≤400	mg/L	
3		BOD_5	≤300		
4		COD	≤500		
5		Petroleum	≤30		
6		Ammonia	/		

(3) Noise

During the construction period, the noise shall be subject to the Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011). During the operation period, the noise shall comply with relevant requirements of the Emission Standard for Community Noise (GB22337-2008) because there are commercial water theme parks in community parks. The specific standard limits are shown in Table 2.4-9.

Table 2.4-9 List of Noise Pollution Emission Standard Limits

S/N	Period	Noise at boundary of plant (site)	Standard limit	Unit	Standard name and level (class)
1	Construction period	Daytime	70	dB(A)	*Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011)
2		Night	55		
3	Operation period	Daytime	55	dB(A)	*Emission Standard for Community Noise* (GB22337-2008)
4		Night	45		

(4) Solid waste

The general solid waste shall be subject to the Standard for Pollution Control on the Non-hazardous Industrial Solid Waste Storage and Landfill (GB18599-2020); the hazardous waste shall be subject to the Control Standards of Hazardous Waste Storage Pollution (GB18597-2023).

3. Project description

3.1 Project composition and distribution

The Project is located in Chengdong New Area of Ankang City, extending from the south bank of the Hanjiang River in the north to the east bank of the Huangyang River in the west, with the southern boundary being the Ankang-Pingli Highway (Provincial Highway 308). It includes areas such as Shiti Town to the east and is connected to the southwest by the southern bridgehead of the Huangyang River Bridge, including Zhangtan Town and Shiti Town in Hanbin District of Ankang City.

The project mainly includes five sections: the urban low-carbon and resilient transport facilities, the urban ecological restoration and green resilient infrastructure construction, the ecological park and urban integrated waterlogging prevention and control system, the green and low-carbon urban operation system, and the institutional capacity improvement and project management system. It includes a total of 19 sub-projects, as shown in Figure 3.1-1. See table 3.1-1 for specific details of the project. The rest are projects related to the operation system and capacity improvement system construction project.

Table 3.1-1 Project Composition

Project section	S/N	Project name	Note
Urban Low-carbon and Resilient Transport Facilities	1	Low-impact and Resilient Road Engineering	
	①	Ankang Chengdong City-Industry Integration Demonstration Area — Zhenxing Road	Total length: 2080.03m
	②	Ankang Chengdong City-Industry Integration Demonstration Area — Huanta Road	Total length: 1890.00m
	③	Ankang Chengdong City-Industry Integration Demonstration Area —Lvyuan Road	Total length: 225.00m
	④	Ankang Chengdong City-Industry Integration Demonstration Area —Chunlin Road	Total length: 227.91m
	⑤	Ankang Chengdong City-Industry Integration Demonstration Area —Yongan Road North Section	Total length: 1148.077m
	⑥	The Second Bidding Section of the Reconstruction Project of National Highway G211	Total length: 1254.00m

Project section	S/N	Project name	Note
		Ankang Guanmiao-Huangyang River (East Section of the Ring Road)	
	⑦	Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	Total length: 7624.00m
	2	Public transport network construction project	Roads of the project are 100% covered by buses, involving a total of 58 bus stations. 20 new energy buses are purchased to fill the public transport gap after the completion of public transport system in the core area of Chengdong New Area and achieve the green and low-carbon public transport mode
	3	Slow traffic system construction	The project involves slow traffic guidance signs that fully cover the slow traffic system, and involves supporting shared bicycle parking lots, connection points, etc.
	4	Low impact design of road LID	The design of sponge facilities includes measures such as permeable pavement, sunken green space, bioretention grass ditch, ecological tree pool, overflow gutter inlet, and environment friendly gutter inlet
	5	Green public parking lot project in the core area of Chengdong New Area in Ankang	4 parking lots with a total area of 25,550m^2 and 679 parking spaces, including 663 car parking spaces and 16 barrier-free parking spaces
	6	New energy street lamp construction project	The project covers 5.4km^2 of the core area of Chengdong New Area, and will install a total of 3,471 new energy street lamps on existing and planned roads (17 roads)
Urban ecological restoration and green resilient infrastructure construction	7	Hanjiang River Riverside Ecological Green Corridor Project (Phase I)	The project starts from Jianghan Bridge in the south, ends at Shiti Bridge in the north, and extends from Shizhang Avenue to the red line 10m away from the river bank, with a length of 7.6km and a total area of 93.5ha. It intends to carry out ecological restoration and design ecological footpath and landscape layout.
	8	Huangyang River Water Environment Improvement and Ecological Restoration Project	The project is located in the flood land on east side of Huangyang River between Ankang Old Town and Chengdong New Area, with a total area of 144.7ha. It is distributed along the riverbank, with a total length of 3.7km.

Project section	S/N	Project name	Note
	9	Protection zone 1 project of Zhangtan Town section protection engineering	The project includes construction of embankment and ancillary works, with an embankment line length of 2,490m, of which 500m has been built for Zhangtan Bridge section. The designed length of embankment line is 1,990m and the protection area is 760 *mu*
Ecological park and urban integrated waterlogging prevention and control system	10	Chengdong Sports Park in Ankang (one)	The planned land area for the project is 174,747.62m^2, approximately 262.12 *mu*, which includes: the main entrance plaza of 9,635.96m^2, park roads of 19,674m^2, outdoor sports facilities of 3,082m^2, outdoor plazas and children's activity areas of 8,431.56m^2, 200 parking spaces, a green area of 139,867.06m^2, with a green coverage rate of 80.04%; supporting infrastructure such as water supply and drainage pipelines will also be constructed.
	11	Community ecological park project (two)	Community parks are positioned as the water theme park and the health care theme park, which are located on the southwest side of Boxue Road and Chongshan Road and on the southwest side of Biyun Road and Yong'an Road respectively, covering an area of 1.19ha and 1.20ha, totaling 2.39ha
	12	Urban integrated waterlogging prevention and control system	In order to enhance the waterlogging prevention and control system in the four susceptible areas of the waterlogging in Chengdong New Area, new drainage pipelines, rainwater outlets, rainwater lift pumping stations, and anti-backflow facilities will be constructed to address urban waterlogging issues.
Green and Low-Carbon Urban Operation System	13	Green and low-carbon urban operation management and data center	The project is located in the northern part of the Chengdong New Area of Ankang City, with a planned building area of approximately 49,950.00m^2.

The institutional capacity improvement and project management system construction project msponge cityainly includes the construction of a green and low-carbon digital platform and institutional capacity building in Chengdong New Area. Among them, the construction of a green and low-carbon digital platform in Chengdong New Area mainly serves the functions of urban waterlogging, flood monitoring and command system, sponge city water cycle

monitoring center, carbon emission monitoring center, smart city management center, traffic control and route guidance integrated traffic flow management system (traffic signal optimization, intelligent reversible lane control to improve the smart city transportation efficiency), urban low-carbon transportation system (environmentally friendly electronic signs, vehicle perception base stations, environmental monitoring base stations, and regulatory control platforms), online dust monitoring system, and other urban operation management platform constructions. The core components include urban waterlogging, flood monitoring and command system, sponge city water cycle monitoring center, carbon emission monitoring center, smart city management center, traffic control and route guidance integrated traffic flow management system. The main content of institutional capacity building is to: a) improve the execution capability, the management and technical level of of project management institutions on the green and low-carbon ecological education, knowledge dissemination, and community participation, through management and technical training, consulting, investigation and exchange, and monitoring related to the construction (including but not limited to low-carbon society, low-carbon economy, low-carbon resources, and low-carbon management) of green and low-carbon cities; b) enhance the practical level of all parties involved in the project to achieve institutional capacity of green and low-carbon city construction and management as well as substantial breakthroughs in multi-party participation; c) form a scientific model that can be popularized and demonstrated to promote the sustainable development of the regional low-carbon city construction economy.

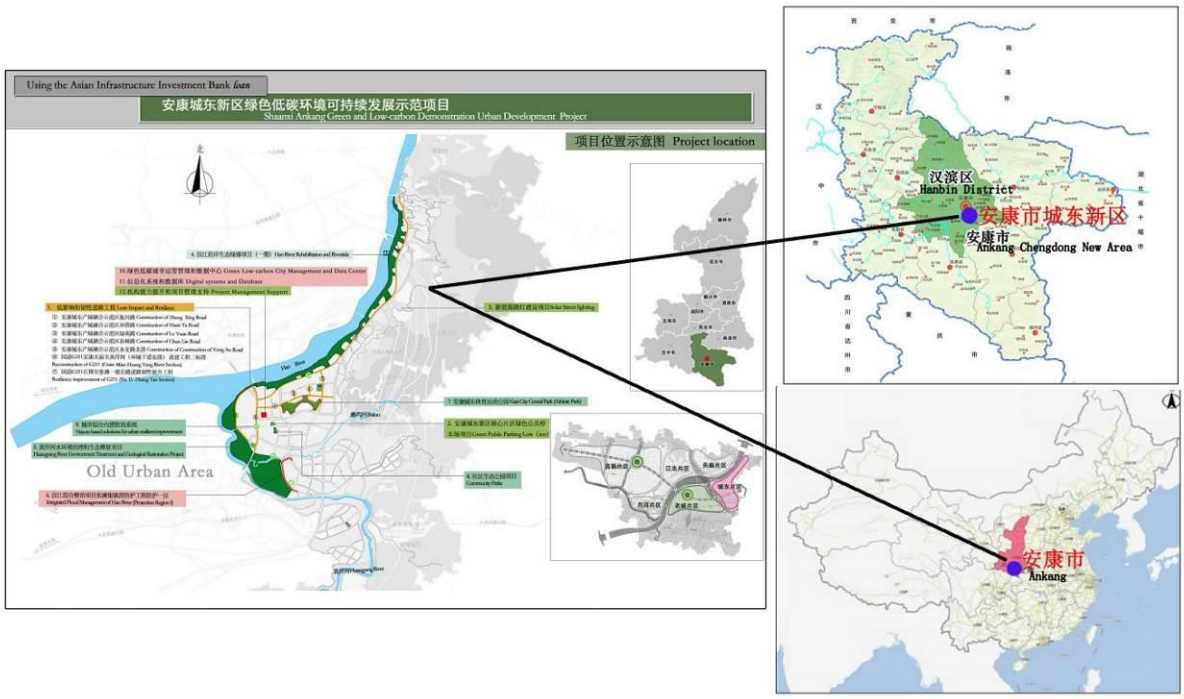


Figure 3.1-1 Project Distribution Map

3.2 Description of each subproject

3.2.1 Urban Low-carbon and Resilient Transport Facilities

3.2.1.1 Low-impact and Resilient Road Engineering

The low-impact and resilient road engineering mainly includes the construction and reconstruction projects of 7 roads. According to the *Feasibility Study Report of Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project* (edition in October 2023), the design of the roads, roadbeds, pavements, transportation, electricity, communication, water supply and drainage, and rainwater engineering of the project has been carried out based on urban planning, construction conditions, design conditions, and design specifications. The sponge design has been taken into consideration for the design of pavements of each road, and all of them are designed with rainwater side ditch and chutes. Specific construction plans have been provided. The following is a detailed discussion on water supply and drainage, rainwater engineering, and other aspects related to ecological environment protection and governance. The specific construction content is as follows:

1. Ankang Chengdong City-Industry Integration Demonstration Area - Zhenxing Road

(1) Road engineering

According to the *Controlled Detailed Planning of the Chengdong Area of Ankang City Central Cities*, Zhenxing Road belongs to the east-west urban secondary trunk road of the transportation system in Chengdong New Area. The project starts from Dongcheng Avenue (planned road, currently National Highway 211) in the west and extends to the East Ring Avenue, with a total length of 2080.03m. The boundary line width is 26m, and the width of the canal section is 32m. The total area of land for Zhenxing Road in this project is 54,080.70m^2.

The terrain of the site is relatively undulating, and the longitudinal section design takes into account the railway and highway, while also considering the intersection road elevation connection according to the surface drainage needs.

The width of the boundary lines for Zhenxing Road in this project is 26m. The layout of the road cross section is as follows:

Sidewalk (3m) + Non-motorized vehicle lane (3m) + Side strip (3m) + Motor vehicle lane (8m) + Side strip (3m) + Non-motorized vehicle lane (3m) + Sidewalk (3m) = 26m

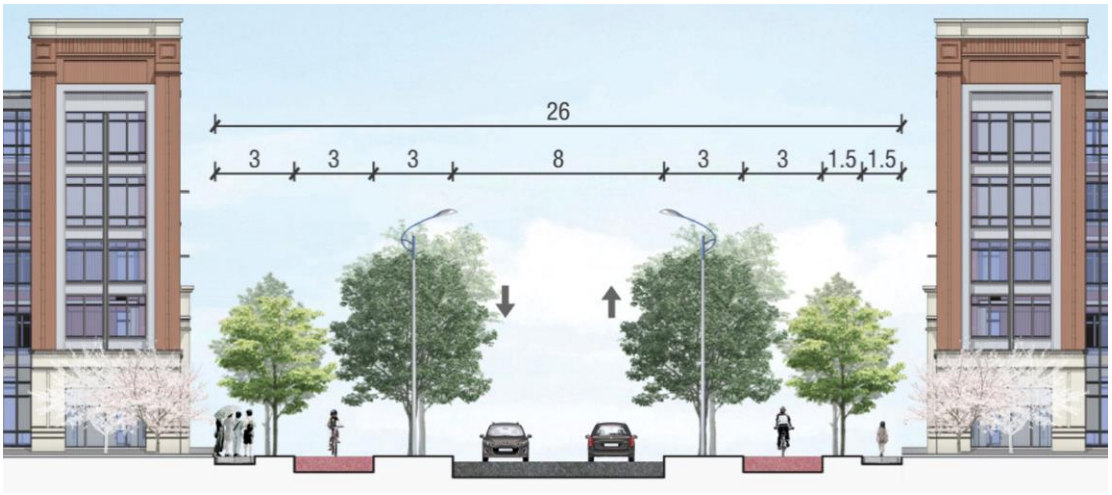


Figure 3.2-1 Standard Cross Section

(2) Water supply engineering

The main pipe diameter of water supply pipeline for Zhenxing Road ranges from dn200 to dn300mm, and the pipe length is 2080m. The diameter of the pre-buried pipeline in the land parcel is dn160mm, and the pipe length is 388m. The water supply pipe is made of polyethylene PE (100), and the pipe fittings adopt polyethylene PE (100) fittings. The nominal pressure of the pipeline is 1.0Mpa. The working pressure of the pipeline is 0.6MPa. Auxiliary structures such as gate valve wells and exhaust valve wells, and supporting projects such as pre-buried branch pipes are designed for construction.

(3) Rainwater engineering

The rainwater pipeline for Zhenxing Road adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline ranges from D800mm to D1000mm, and the pipe length is 1972m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 368m. Auxiliary structures such as rainwater inspection wells, gutter inlets, rainwater connecting pipes, and supporting projects such as pre-buried branch pipes are designed for construction.

(4) Sewage engineering

The sewage pipeline for Zhenxing Road adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 1920m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 358m. Auxiliary structures such as sewage inspection wells and reserved branch pipes for sewage, and supporting projects are designed for construction.

The main construction contents of water supply engineering, rainwater engineering, and sewage engineering for Zhenxing Road are shown in Table 3.2-1.

Table 3.2-1 Overview of the Main Construction Contents of Water Supply Engineering, Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
Zhenxing Road	Main pipe of water supply pipeline	dn200~300	2080	Polyethylene PE (100) pipes and fittings
	Pre-buried pipeline for water supply pipeline	dn160	388	
	Exhaust valve well	Φ1200	2	
	Sludge valve well	Φ1200	2	
	Valve chamber	Φ800	2	
	Main pipe of rainwater pipeline	D800~D1000	1972	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	368	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 99, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 31.68m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	1920	Class II reinforced concrete pipe
	Pre-buried branch pipe for sewage pipeline	D400	358	
	Sewage inspection well	1100×1100	74	Rectangular reinforced concrete sewage inspection well

2. Ankang Chengdong City-Industry Integration Demonstration Area - Huanta Road

(1) Road engineering

This project is a planned urban branch road and the road alignment is determined based on the red line map for road planning. The road starts from Wangwan Road in the south and extends to Dongcheng Avenue in the north. It serves as an important channel for the main north-south traffic flow in the land parcel. The total length of the road is approximately 1890.00m, and the road alignment is straight. The total area of land for Huanta Road in this project is 22,680m^2.

Huanta Road starts and ends at Wangwan Road and Dongcheng Avenue respectively, with the terrain along the route being higher in the north and lower in the south. Due to the undeveloped land on both sides of the road, the longitudinal section design aims to lower the elevation as much as possible to match the elevation of the land parcels, so as to facilitate the connection between the road and the land parcels, reduce the development cost of the land parcels, and also minimize the earthwork volume for the road. In this design, the starting point of the road is connected to Wangwan Road with a longitudinal slope of 0.30%, and the terminal point is connected to Dongcheng Avenue with a longitudinal slope of 3.04%. The minimum longitudinal slope in the longitudinal section design is 0.30%, and the maximum longitudinal slope is 3.04%, in order to facilitate road drainage.

The width of the boundary lines for Huanta Road in this project is 12m. The layout of the road cross section is as follows:

3m (sidewalk) + 3m (motor vehicle and non-motor vehicle mixed traffic lane) + 6m (motor vehicle lane) = 12m

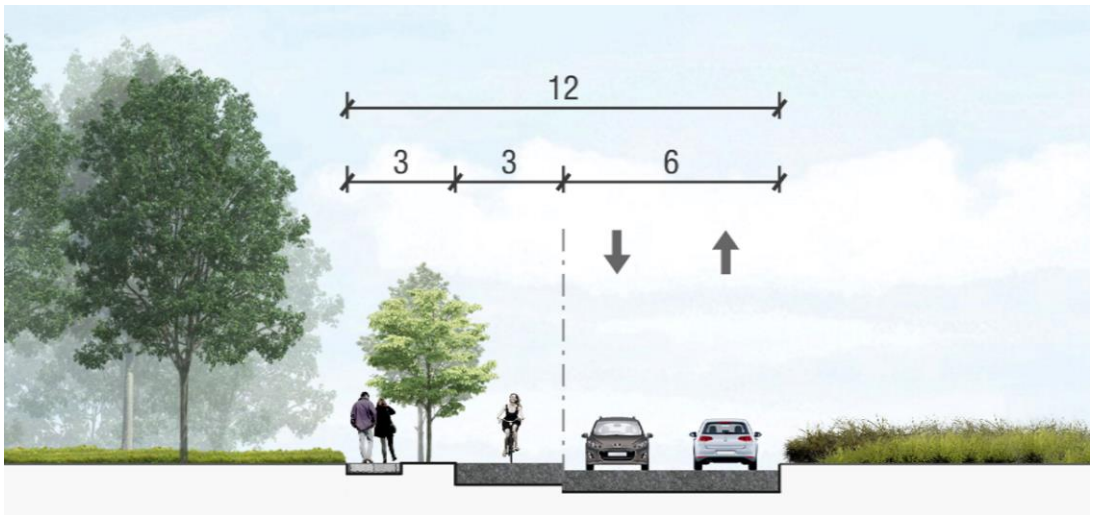


Figure 3.2-2 Standard Cross Section

(2) Water supply engineering

The main pipe diameter of water supply pipeline for Huanta Road is dn160mm, and the pipe length is 1890m. The diameter of the pre-buried pipeline in the land parcel is dn160mm, and the pipe length is 151m. The water supply pipe is made of polyethylene PE (100), and the pipe fittings adopt polyethylene PE (100) fittings. The nominal pressure of the pipeline is 1.0Mpa. The quality and specifications of the pipes should comply with the Polyethylene Pipes for Water Supply (GB/T 13663-2000), and *Polyethylene (PE) Piping System for Water Supply Part 2: Fittings* (GB/T13663.2-2005). The working pressure of the pipeline is 0.6MPa. Auxiliary structures such as gate valve wells and exhaust valve wells, and supporting projects such as pre-buried branch pipes are designed for construction.

(3) Rainwater engineering

The rainwater pipeline for Huanta Road adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline is D800mm, and the pipe length is 1871m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 151m. Auxiliary structures such as rainwater inspection wells, gutter inlets, rainwater connecting pipes, and supporting projects such as pre-buried branch pipes are designed for construction.

(4) Sewage engineering

The sewage pipeline for Huanta Road adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 450m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 36m. Auxiliary structures such as sewage inspection wells and reserved branch pipes for sewage, and supporting projects are designed for construction.

The main construction contents of water supply engineering, rainwater engineering, and sewage engineering for Huanta Road are shown in Table 3.2-2.

Table 3.2-2 Overview of the Main Construction Contents of Water Supply Engineering, Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
Huanta Road	Main pipe of water supply pipeline	dn160	1890	Polyethylene PE (100) pipes and fittings
	Pre-buried pipeline for water supply pipeline	dn160	151	
	Exhaust valve well	Φ1200	2	

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
	Sludge valve well	Φ1200	2	
	Valve chamber	Φ800	2	
	Main pipe of rainwater pipeline	D800	1871	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	151	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 95, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 30.4m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	450	Class II reinforced concrete pipe
	Pre-buried branch pipe for sewage pipeline	D400	36	
	Sewage inspection well	1100×1100	17	Rectangular reinforced concrete sewage inspection well

3. Ankang Chengdong City-Industry Integration Demonstration Area - Lvyuan Road

(1) Road engineering

This project is a planned urban branch road and the road alignment is determined based on the red line map for road planning. The road starts from Zhenxing Road in the south and extends to Biyun Road in the north. It serves as an important channel for the main north-south traffic flow in the land parcel. The total length of the road is approximately 225.00m, and the road alignment is straight. The total area of land for Lvyuan Road in this project is 4050m^2.

Lvyuan Road starts and ends at Biyun Road and Zhenxing Road, respectively, with the terrain along the route being higher in the north and lower in the south. Due to the undeveloped land on both sides of the road, the longitudinal section design aims to lower the elevation as soon as possible to match the elevation of the land parcels, so as to facilitate the connection between the road and the land parcels, reduce the development cost of the land parcels, and also minimize the earthwork volume for the road. In this design, the starting point of the road is connected to Zhenxing Road with a longitudinal slope of 5.83%, and the terminal point is connected to Biyun Avenue with a longitudinal slope of 5.83%. The minimum longitudinal slope in the longitudinal section design is 5.83%, and the maximum longitudinal slope is 5.83%.

The width of the boundary lines for Lvyuan Road in this project is 18m. The layout of the road cross section is as follows:

3.0 (sidewalk) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 3.0 (sidewalk) = 18.0m

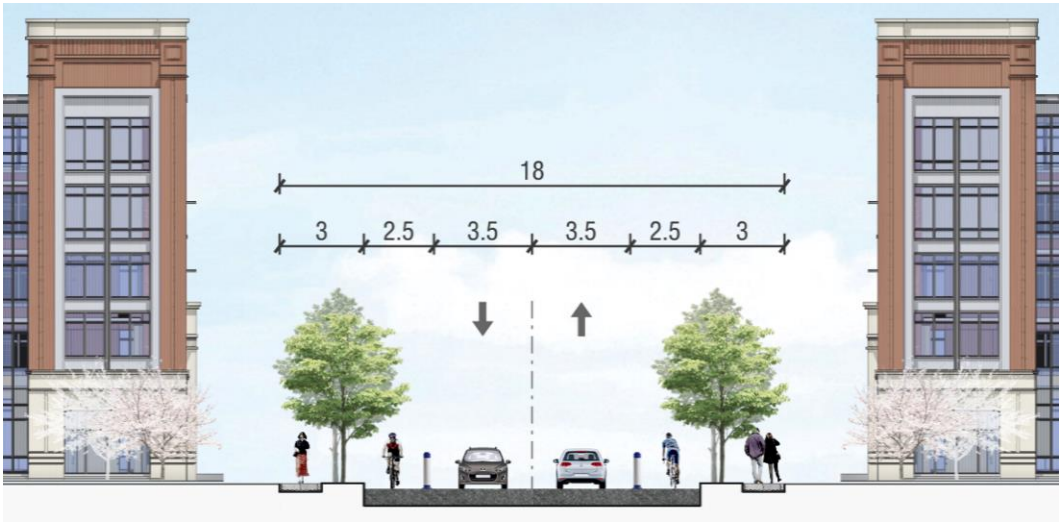


Figure 3.2-3 Standard Cross Section

(2) Water supply engineering

This road does not involve any water supply engineering.

(3) Rainwater engineering

The rainwater pipeline for Lvyuan Road adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline is D600mm, and the pipe length is 225m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 27m.

Auxiliary structures such as rainwater inspection wells, gutter inlets, rainwater connecting pipes, and supporting projects such as pre-buried branch pipes are designed for construction.

(4) Sewage engineering

The sewage pipeline for Lvyuan Road adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 225m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 27m. Auxiliary structures such as sewage inspection wells and reserved branch pipes for sewage, and supporting projects are designed for construction.

The main construction contents of rainwater engineering and sewage engineering for Lvyuan Road are shown in Table 3.2-3.

Table 3.2-3 Overview of the Main Construction Contents of Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
Lvyuan Road	Main pipe of rainwater pipeline	D600	225	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	27	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 11, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 2.95m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	225	Class II reinforced concrete pipe
	Pre-buried branch pipe for sewage pipeline	D400	27	

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
	Sewage inspection well	1100×1100	9	Rectangular reinforced concrete sewage inspection well

4. Ankang Chengdong City-Industry Integration Demonstration Area - Chunlin Road

(1) Road engineering

This project is a planned urban branch road and the road alignment is determined based on the red line map for road planning. The road starts from Zhenxing Road in the south and extends to Biyun Road in the north. It serves as an important channel for the main north-south traffic flow in the land parcel. The total length of the road is approximately 227.91m, and the road alignment is straight. The total area of land for Chunlin Road in this project is 4102.38m^2.

Chunlin Road starts and ends at Biyun Road and Zhenxing Road, respectively, with the terrain along the route being higher in the north and lower in the south. Due to the undeveloped land on both sides of the road, the longitudinal section design aims to lower the elevation as soon as possible to match the elevation of the land parcels, so as to facilitate the connection between the road and the land parcels, reduce the development cost of the land parcels, and also minimize the earthwork volume for the road. In this design, the starting point of the road is connected to Zhenxing Road with a longitudinal slope of 3.62%, and the terminal point is connected to Biyun Avenue with a longitudinal slope of 3.62%. The minimum longitudinal slope in the longitudinal section design is 3.62%, and the maximum longitudinal slope is 3.62%.

The width of the boundary lines for the Chunlin Road in this project is 18m, which is consistent with the width of Lvyuan Road and the layout of the road cross section is also consistent.

(2) Water supply engineering

This road does not involve any water supply engineering.

(3) Rainwater engineering

The rainwater pipeline for Chunlin Road adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline is D600mm, and the pipe length is 228m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 27m.

Auxiliary structures such as rainwater inspection wells, gutter inlets, rainwater connecting pipes, and supporting projects such as pre-buried branch pipes are designed for construction.

(4) Sewage engineering

The sewage pipeline for Chunlin Road adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 228m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 27m. Auxiliary structures such as sewage inspection wells and reserved branch pipes for sewage, and supporting projects are designed for construction.

The main construction contents of rainwater engineering and sewage engineering for Chunlin Road are shown in Table 3.2-4.

Table 3.2-4 Overview of the Main Construction Contents of Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/mm	Length/m	
Chunlin Road	Main pipe of rainwater pipeline	D600	228	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	27	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 11, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 3.63m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	228	Class II reinforced concrete pipe
	Pre-buried branch pipe for sewage pipeline	D400	27	

Construction site	Construction content			Pipes and fittings
	Project type	Specification/mm	Length/m	
	Sewage inspection well	1100×1100	9	Rectangular reinforced concrete sewage inspection well

5. Ankang Chengdong City-Industry Integration Demonstration Area - North Section of Yong'an Road

(1) Road engineering

According to the *Controlled Detailed Planning of the Chengdong Area of Ankang City Central Cities*, the North Section of Yong'an Road belongs to the north-south urban secondary trunk road of the transportation system in the Chengdong New Area. The project starts from Taiba Road in the south and extends to Shizhang Avenue in the north, with a total length of 1,148.077m and the road width of 26m, 31m, and 34.5m. The width of the boundary lines of roads 26m, while the width of the boundary lines of canal section is 33m. The outer green belt on the east side of the road is 1.5m wide and 5m wide. The total area of land for North Section of Yong'an Road in this project is 45923.08m^2.

The terrain of the site is relatively undulating, and the longitudinal section design takes into account the railway and highway, while also considering the intersection road elevation connection according to the surface drainage needs.

The width of the boundary lines for North Section of Yong'an Road in this project is 26m, which is consistent with the width of Zhenxing Road and the layout of the road cross section is also consistent.

(2) Tunnel engineering

This road design includes tunnel engineering, with a total of one short tunnel measuring 380m. The entrance and exit of the tunnel are both located on a straight line, with the entrance milepost number set at K1+460 and the exit milepost number set at K1+840. The longitudinal slope of the tunnel section is -0.777%. The tunnel is classified as an urban secondary trunk road, with the vehicle load rating of City-A and the design speed of 40km/h. The tunnel structure has a net width of 12.8m X 2 (continuous arch) and a net height of 5.2m. Taking into account the terrain, geological features, structural fractures, and some geotechnical properties, the tunnel axis is divided into Va-grade surrounding rock. The tunnel road surface has a cross slope of ±2%. The design service life of the structure is 10 years.

The cut-off diversion ditch is set above the tunnel portal to divert surface water into the roadside ditch or natural valley outside the tunnel portal, thus forming a complete external drainage system for the tunnel.

The open-cut tunnel section adopts the clay waterproof layer as the first waterproof measure to prevent surface water leakage; the outer layer of the open-cut tunnel lining is covered with geotechnical cloth and waterproof panels as the second waterproof measure. For the concealed tunnel, geotechnical cloth and waterproof panels are laid between the initial support and the secondary lining; the waterproof panels are laid from the tunnel vault to the drainage pipe at the lower part of the side wall. The settlement joints and deformation joints of the secondary lining are sealed with buried rubber waterstops, and the construction joints are sealed with water-swelling waterstops

In the initial stage of support, drainage pipes are set at specified intervals according to the groundwater volume to divert the collected water into the longitudinal drainage pipes located outside the footings of the lining walls. Along the tunnel's length, the central drainage pipe is installed beneath the center of the roadway. The water from the longitudinal drainage pipes is directed into the central drainage pipe through lateral connections, and then discharged outside the tunnel through the central drainage ditches. The longitudinal drainage pipe, central drainage ditches, and side ditches on both sides of the road are equipped with inspection wells and sedimentation tanks at appropriate intervals to facilitate maintenance and the use of high-pressure water for flushing and dredging.

The tunnel is designed with environmental protection considerations in mind, trying to avoid the creation of new mountain diseases caused by man-made factors, and to minimize adverse impacts on the buildings, residential life, production and ecological environment in the vicinity of the project. For this reason, the following aspects have been primarily considered in the environmental design:

1) The tunnel design follows the principle of "early entry and late exit" (appropriate lengthening of tunnel portals and tunnels), reducing the need for deep excavation and preserving the natural slopes and vegetation.

2) The excavated tunnel debris should be vertically distributed as far as possible for roadbed filling. According to the actual situation of each construction site, the excavated soil should be piled up in a centralized manner. When discarding the soil, vegetation should be protected. When piling up the soil, a suitable site should be selected, and protective measures such as retaining walls should be taken at the foot of the slope to prevent the soil from being washed away during flood periods, causing artificial debris flows. If conditions permit, a layer of topsoil can be used to cover the discarded soil, or it can be used for the reclamation or afforestation.

3) During the construction period, sewage should be discharged centrally and treated through sedimentation and filtration. The excavation of the side and heading slope at the tunnel portal should primarily be done through smooth blasting, and large guns are strictly prohibited. For sections with poor stability of the slope at the tunnel portal, permanent protection (slope protection) works should be carried out. Clean up, green and restore the construction site to the farmland after completion to protect the natural environment.

(3) Water supply engineering

The main pipe diameter of water supply pipeline for North Section of Yong'an Road is dn150mm, and the pipe length is 1890m. The diameter of the pre-buried pipeline in the land parcel is dn150mm, and the pipe length is 151m. The water supply pipe adopts ductile iron pipe Class K9, and the pipe fittings adopt ductile iron pipe fittings. The nominal pressure of the pipeline is 1.0Mpa. The quality and specifications of the pipes should comply with the *Ductile Iron Pipes, Fittings and Accessories for Water or Gas Applications* (GB/TI3295-2013). The working pressure of the pipeline is 0.45MPa. Auxiliary structures such as gate valve wells and exhaust valve wells, and supporting projects such as pre-buried branch pipes are designed for construction.

(4) Rainwater engineering

The rainwater pipeline for North Section of Yong'an Road adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline is D800mm, and the pipe length is 1871m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 151m. Auxiliary structures such as rainwater inspection wells, gutter inlets, rainwater connecting pipes, and supporting projects such as pre-buried branch pipes are designed for construction.

(5) Sewage engineering

The sewage pipeline for North Section of Yong'an Road adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 450m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 36m. Auxiliary structures such as sewage inspection wells and reserved branch pipes for sewage, and supporting projects are designed for construction.

The main construction contents of water supply engineering, rainwater engineering, and sewage engineering for North Section of Yong'an Road are shown in Table 3.2-5.

Table 3.2-5 Overview of the Main Construction Contents of Water Supply Engineering, Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
North section of Yong'an Road	Main pipe of water supply pipeline	Dn150	1890	Ductile iron pipe Class K9
	Pre-buried pipeline for water supply pipeline	dn150	151	
	Exhaust valve well	Φ1200	2	
	Sludge valve well	Φ1200	2	
	Valve chamber	Φ800	2	
	Main pipe of rainwater pipeline	D1800	1871	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	151	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 34, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 10.88m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	450	Class II reinforced concrete pipe
	Pre-buried branch pipe for sewage pipeline	D400	36	
	Sewage inspection well	1100×1100		Rectangular reinforced concrete sewage inspection well

6. The Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)

(1) Road engineering

This project aims to widen and renovate the existing National Highway 211 (widening to 40m on the existing 12m wide road). The starting point of the main line is at milepost number K1+576, and the ending point is at milepost number K2+830, with a total length of 1254m. The total area of land for roads in this project is 32,604m^2.

The longitudinal section design of the road follows the current road conditions, with the cross-slope of the carriageway facing outward and the cross-slope of the sidewalk facing inward without change.

The width of the boundary lines for the roads in the second bidding section of the reconstruction project in this project is 40m. The layout of the road cross section is as follows:

Sidewalk (6m) + Non-motorized vehicle lane (4m) + Side strip (3m) + Motor vehicle lane (14m) + Side strip (3m) + Non-motorized vehicle lane (4m) + Sidewalk (6m) = 40m

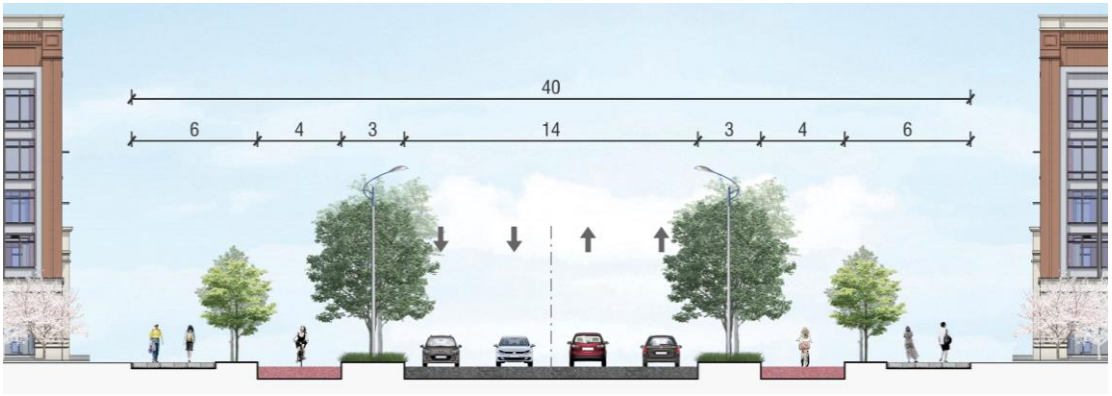


Figure 3.2-4 Standard Cross Section

(2) Water supply engineering

The Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) relies on the water supply engineering of existing road.

(3) Rainwater engineering

The current situation of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road), and the Shiti-Zhangtan First-Class Highway is that there are only rectangular concrete gutters on both sides of the road, so it is necessary to design and construct rainwater pipes.

The rainwater pipeline for the Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)

adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline ranges from D600mm to D1200mm, and the pipe length is 1227m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 344m.

(4) Sewage engineering

The sewage pipeline for the Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 1254m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 351m. Auxiliary structures such as sewage inspection wells and reserved branch pipes for sewage, and supporting projects are designed for construction.

The main construction contents of rainwater engineering and sewage engineering for the Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) are shown in Table 3.2-6.

Table 3.2-6 Overview of the Main Construction Contents of Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
The Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)	Main pipe of rainwater pipeline	D600~1200	1227	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	344	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 62, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 19.84m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	1254	Class II reinforced concrete pipe

Construction site	Construction content			Pipes and fittings
	Project type	Specification/ mm	Length/m	
	Pre-buried branch pipe for sewage pipeline	D400	351	
	Sewage inspection well	1100×1100	48	Rectangular reinforced concrete sewage inspection well

7. Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211

This project aims to enhance the resilience of existing roads, while effectively balancing and coordinating the multiple functions of the roads based on ensuring the traffic function. The main construction content includes rainwater, sewage, electricity, communication, and other ancillary works.

(1) Rainwater engineering

The rainwater pipeline for the Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211 adopts Class II reinforced concrete pipes. The main pipe diameter of the rainwater pipeline ranges from D500mm to D1500mm, and the pipe length is 6514m; the diameter of the pre-buried branch pipe in the land parcel is D500mm, and the pipe length is 442m.

Rainwater inspection wells are made of rectangular reinforced concrete with dimensions of 2200×1100, 1700×1100, 1400×1100, and 1100×1000, depending on the diameter of the rainwater pipeline.

The pipeline foundation and interfaces, gutter inlet, gutter inlet connecting pipes, and reserved branch pipes are all consistent with the design of those for Zhenxing Road.

(2) Sewage engineering

The sewage pipeline for the Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211 adopts Class II reinforced concrete pipes. The main pipe diameter of the sewage pipeline is D400mm, and the pipe length is 3347m; the diameter of the pre-buried branch pipe in the land parcel is D400mm, and the pipe length is 223m.

The pipeline foundation and interfaces, inspection wells, and reserved branch pipes are all consistent with the design of those for Zhenxing Road.

The construction contents of rainwater engineering and sewage engineering are shown in Table 3.2-7.

Table 3.2-7 Overview of the Main Construction Contents of Rainwater Engineering and Sewage Engineering

Construction site	Construction content			Pipes and fittings
	Project type	Specification/mm	Length/m	
Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	Main pipe of rainwater pipeline	D500~1500	6514	Class II reinforced concrete pipe
	Pre-buried branch pipe in the land parcel	D500	442	
	Gutter inlet	It adopts the double-grate gutter inlet with a depth of 1.0m. The inner and outer walls of the gutter inlet are coated with the 20mm thick 1:2 cement mortar mixed with 5% waterproofing agent. The drain grate is made of ductile iron. The total number of gutter inlet is 62, with the single water storage capacity of 0.32m^3 and the total water storage capacity of 19.84m^3.		
	Gully connecting pipe	D300		Class II reinforced concrete pipe
	Reserved branch pipe for rainwater pipeline	D500		
	Main pipe of sewage pipeline	D400	3347	Class II reinforced concrete pipe
	Pre-buried branch pipe for sewage pipeline	D400	223	
	Sewage inspection well	1100×1100	106	Rectangular reinforced concrete sewage inspection well

8. Public transport network construction

Due to the influence of the road cross section, the dedicated bus lane has been set up on the outermost motor vehicle lane of the North Section of Yong'an Road in this design, while buses and private cars share the same lane on other roads. In this design, every road is equipped with public buses in order to provide convenient transportation for residents. With a public transportation network system that covers 100% of the area and well-developed supporting facilities, residents are encouraged to choose the public transportation system for their daily commute. In this design, the total length of the bus routes is 14,449m, and the coverage rate of the bus lanes reaches 100%, which means that every road needs to be equipped with a bus lane to establish the framework of the bus system's road network.

In this design, bus stops will be set up at an interval of 500m, and there are a total of 58 bus stops in this design. In order to maintain the traffic capacity and service level of the motor vehicle lane (or motor vehicle and non-motor vehicle mixed traffic lane), and to minimize the impact on traffic flow when buses stop, it is common to widen the road or compress the sidewalk to create a bay-style bus stop.

The purchase of 20 new energy buses is included in the Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project.

9. Slow traffic system construction

In this road design, there are four types of boundary lines of roads, namely 12m, 18m, 26m, and 40m. In cross section design, the safe and comprehensive slow traffic system is established by appropriately widening the non-motorized vehicle lanes and sidewalks. The specific form of the cross section is as follows:

(1) 3m (sidewalk) + 3m (non-motorized vehicle lane) + 6m (motor vehicle lane) = 12m

(2) 3.0 (sidewalk) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 3.0 (sidewalk) = 18.0m

(3) Sidewalk (3m) + Non-motorized vehicle lane (3m) + Side strip (3m) + Motor vehicle lane (8m) + Side strip (3m) + Non-motorized vehicle lane (3m) + Sidewalk (3m) = 26m

(4) Sidewalk (6m) + Non-motorized vehicle lane (4m) + Side strip (3m) + Motor vehicle lane (14m) + Side strip (3m) + Non-motorized vehicle lane (4m) + Sidewalk (6m) = 40m

In this design, the total area of the non-motorized vehicle lane is 80,603m^2, accounting for 22.29% of the total area. The total area of the sidewalk is 83,321m^2, accounting for 23.04% of the total area.

In this design, the length of the accessible tactile paving is 26,450m, with a coverage rate of 100% for accessible facilities. There are 124 wheelchair accessible ramps, 62 sets of pedestrian crossing facilities, and 252 curb stones. A total of 4500m of road guardrails for isolating the motor vehicle lane and non-motorized vehicle lanes are installed to establish the slow traffic system by using full coverage of slow traffic guidance signs.

In the road design of the Chengdong New Area, a total of 67 shared bicycle parking lots are set up, with a density of 430m/place. 21 shared bicycle connection points are designed. In this design, 5 slow traffic connection points are designed for the Chengdong Sports Park in Ankang, 2 for each community ecological park, 2 for each public parking lot, 4 for the Hanjiang River riverside ecological green corridor, and 2 for the Huangyang River environmental remediation and ecological park.

10. Low impact design of road LID

Low-impact development technologies can generally be divided into several categories based on their main functions, including infiltration, storage, regulation, transportation, and pollution interception and purification. By combining various technologies, it is possible to achieve goals such as total runoff control, peak runoff control, runoff pollution control, and rainwater resource utilization.

(1) The width of the boundary lines for Zhenxing Road in this design is 26m. The layout of the road cross section is as follows:

Sidewalk (3m) + Non-motorized vehicle lane (3m) + Side strip (3m) + Motor vehicle lane (8m) + Side strip (3m) + Non-motorized vehicle lane (3m) + Sidewalk (3m) = 26m

(2) The width of the boundary lines for Huanta Road in this project is 12m. The layout of the road cross section is as follows:

3m (sidewalk) + 3m (non-motorized vehicle lane) + 6m (motor vehicle lane) = 12m

(3) The width of the boundary lines for Lvyuan Road in this project is 18m. The layout of the road cross section is as follows:

3.0 (sidewalk) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 3.0 (sidewalk) = 18.0m

(4) The width of the boundary lines for Chunlin Road in this project is 18m. The layout of the road cross section is as follows:

3.0 (sidewalk) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 3.0 (sidewalk) = 18.0m

(5) The width of the boundary lines for North Section of Yong'an Road in this project is 26m. The layout of the road cross section is as follows:

Sidewalk (3m) + Non-motorized vehicle lane (3m) + Side strip (3m) + Motor vehicle lane (8m) + Side strip (3m) + Non-motorized vehicle lane (3m) + Sidewalk (3m) = 26m

(6) The width of the boundary lines for roads in the National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) in this project is 40m. The layout of the road cross section is as follows:

Sidewalk (6m) + Non-motorized vehicle lane (4m) + Side strip (3m) + Motor vehicle lane (14m) + Side strip (3m) + Non-motorized vehicle lane (4m) + Sidewalk (6m) = 40m

Combined with this design for road cross section, the design of sponge facilities in this project includes measures such as permeable pavement, sunken green space, bioretention grass ditch, ecological tree pool, overflow gutter inlet, and environment friendly gutter inlet.

① Permeable pavement

This design incorporates permeable pavement on the sidewalk to effectively alleviate the current urban problems of waterlogging and rainwater runoff pollution, allowing rainwater on the sidewalk to infiltrate through the permeable pavement and replenish groundwater.

② Sunken green space

Concave green spaces are provided on both sides of the side strip of the road to store and purify rainwater in this section. In the initial period, rainwater is utilized in an integrated manner to achieve the goal of first storing, infiltrating and then discharging. Initially, the rainwater first flows into the side strip, and then infiltrates to serve as a supply source for the green belt. After the soil in the side strip becomes saturated, the rainwater overflows into the gutter inlet and finally discharges into the rainwater pipes.

③ Biological retention ditch

The ecological retention ditch in this design is divided into three parts from top to bottom: the water storage layer, the planting soil layer, and the gravel layer.

A. Water storage layer

The elevation of the water storage layer is lower than the elevation of the road surface on both sides of the side strip, and the depth of the water storage layer is 0.30 m. It is used for storing and transferring rainwater during rainfall.

B. Planting soil layer

The planting soil is sandy soil (mixed with 20% fine sand), and the thickness of the planting soil layer is 1.50 m. Sandy soil has good permeability and filterability.

C. Gravel layer

The gravel layer is divided into two layers from top to bottom, the upper gravel layer with a thickness of 10cm and a gravel size of 5-15mm; the lower gravel layer with a thickness of 23cm, and a gravel size of 30-50mm.

A DN150 flexible permeable pipe is installed in the lower gravel layer, and the permeable pipe is on the same slope as the side strip. Both ends of the permeable pipe are connected to the gutter inlet. When encountering trees or existing structures, flexible permeable pipes can be appropriately bent and connected to the nearest overflow gutter inlet.

④ Ecological Tree Pond

An ecological tree pond, as a small-scale biological retention facility, is generally composed of the planting soil layer, the sand filtering layer, the drainage system, and shrub trees. The water outlet generally adopts the form of a side grate, which collects surface runoff and then discharges into municipal pipelines after soil infiltration. It is a new type of road ecological gutter inlet. The road tree ponds in this design are all ecological tree ponds that can collect and preliminarily filter rainfall runoff.

⑤ Overflow gutter inlet

The roads with side strips and green belts for this design (Zhenxing Road, North Section of Yong'an Road, National Highway 211 Guanmiao-Huangyang River (East Section of Ring Road), National Highway 211 Shiti-Zhangtan First-class highway) are designed with overflow gutter inlets. The overflow gutter inlets are arranged in the concave green belt, at the center of the side strip. The top surface of the gutter inlet grate is 0.25m higher than the surrounding green belt, and a retaining weir is set at the downstream of the overflow gutter inlets. The overflow gutter inlet adopts the Chinese national standard brick flat grate type single grate (concrete well ring), with the method referring to the Chinese national standard 06MS201-8. The position of the gutter inlets can be adjusted on site according to the low point. The drain grate used is a specially made finished cast iron overflow drain grate.

A 0.20 m wide pebble strip should be scattered around the overflow gutter inlet to settle impurities and buffer runoff. The pebbles are 3-5 cm in particle size, and are laid on a 1:1 slope from the bottom of the grass ditch to the top of the overflow gutter inlet (well).

⑥ Environmentally friendly gutter inlet

The gutter inlets for roads without side strips or green belts (Huanta Road, Chunlin Road, Lvyuan Road) are designed with environmentally friendly single grate gutter inlets, with a starting depth of 1m for the rainwater connecting pipe and drain grate. The inner and outer walls of the gutter inlet are both plastered with 20mm thick 1:2 cement mortar and 5% waterproof agent, and the drain grate is made of ductile iron.

The gutter inlet connecting pipe adopts reinforced concrete Grade II pipe, with a diameter of D300 mm and a slope of 1% towards the rainwater inspection well. The foundation of the gutter inlet connecting pipe uses a 120° concrete foundation, and is connected through a socket type rubber ring joint.

The sidewalks in this design are all paved with fully permeable bricks, and the motor and non-motor vehicle lanes are made of permeable asphalt concrete material, which can achieve a semi-permeable effect. Due to the design of permeable materials, rainwater can seep in-situ through the pavement structure, thereby eliminating or reducing surface runoff, restoring rainwater to supplement groundwater, and cutting runoff pollution load.

3.2.1.2 Green Public Parking Lot Project in the Core Area of East New Area in Ankang

I. Project Overview

The total area of the Project is about 25,550 m^2 (approximately 38.3 mu), and new parking lots are planned in the four areas of the urban area. As planned, a total of 679 parking spaces will be built, including 663 car parking spaces and 16 accessible parking spaces. The designed charging pile configuration ratio is 50%, and it is expected to add 349 new charging parking spaces. PV canopies are installed above the parking spaces, which will be used for daily use and electric vehicle charging, while the remaining electricity will be connected to the grid. The charging and energy storage smart car sheds are a flexible and interconnected AC and DC hybrid microgrid system that integrates various functions such as electric vehicle charging and discharging, smart energy storage, and distributed PV power generation. The charging and energy storage smart car sheds can enable orderly charging and discharging of electric vehicles, and achieve new energy consumption, peak load shifting and valley load filling, seamless grid connection and off-grid switching, and uninterrupted power supply for important loads. At the same time, it can provide stable DC system and reliable power supply.

It also integrates PV storage and charging functions, and the total installed capacity of the PV canopy is about 2.5MWp.

The main content of the parking lot project includes traffic sign engineering, parking space and marking engineering, safety facilities, roadbed and pavement engineering, monitoring system, green construction, emergency shelter facility, and sponge facility construction, all of which are designed and constructed according to relevant design specifications and standards.

The specific engineering details of each parking lot are shown in Table 3.2-8:

Table 3.2-8 Parking Lot Bill of Quantities

S/N	Description	Unit	Bill of Quantities for Parking Lot 1		Bill of Quantities for Parking Lot 2		Bill of Quantities for Parking Lot 3		Bill of Quantities for Parking Lot 4	
			Quantity	Remarks	Quantity	Remarks	Quantity	Remarks	Quantity	Remarks
1	Area of construction land	m^2	9200		4400		7300		4600	
2	Greening area	m^2	1619		1276		1533		1012	
3	Greening rate	%	18		29		21		22	
4	Number of parking spaces for small motor vehicles	Vehicle Nr.	253		106		198		122	
Where	Parking space for normal cars	Vehicle Nr.	247	5.5*2.5m	104	5.5*2.5m	192	5.5*2.5m	120	5.5*2.5m
	Accessible parking space	Vehicle Nr.	6	3.7*6.0m	2	3.7*6.0m	6	3.7*6.0m	2	3.7*6.0m
	Charging parking space	Vehicle Nr.	127	50%	53	50%	99	50%	61	50%
5	PV canopy	m^2	3529.45		1474.4		2773.2		1694.4	
6	Installed capacity of PV canopies	Wp	705890		294880		554640		338880	
7	Road	m^2	4056		1648		2991		1899	
8	Water supply pipeline	m	1106		449		816		518	
9	Rainwater pipeline	m	1032		419		761		483	

2. Public auxiliary engineering of the Project

The public auxiliary engineering of the Project mainly includes water supply and drainage engineering, solid waste collection engineering, and PV energy storage and charging system.

(1) Water supply and drainage works

The water supply and drainage works of the Project includes the water supply for the parking lot toll booth, the drainage and fire protection systems for buildings and parking lots, the rainwater collection and storage system, and the sewage treatment system.

The Project uses the municipal pipe network as the water supply source, and is connected to the municipal water supply pipe network from the nearby municipal roads. The water usage for the Project mainly includes two parts, namely, domestic water for office staff and vehicle attendants, and domestic water for mobile personnel. Among them, the quota for office staff and vehicle attendants is 64.

The wastewater of the Project mainly consists of domestic wastewater discharged from various buildings in the parking lot. The drainage system of the Project adopts a separate sewer system, with sewage and wastewater separated inside the building and rainwater and sewage separated outside the buildings. After the sewage and wastewater treatment meets the standards, it is discharged into the municipal pipe network.

The rainwater in the Project area is collected by the road and parking lot gutter inlets and enters the rainwater tank for reuse. The treated reclaimed water can also be used for flushing, car washing, or sprinkling. The excess part is discharged into the current and planned sewage treatment plant in the Chengdong New Area and can be discharged after meeting the standards.

(2) PV energy storage and charging system

An integrated solar energy storage and charging power station will be built with limited land resources, featuring PV canopies for the parking lot. Multiple PV components are combined and connected to the PV DC combiner box, which is connected to the power grid and off-grid PV power generation system through PV inverters. The off-grid PV power generation system effectively solve the problems of power generation, discharge, power supply of solar PV components, and energy conversion during the transmission of power. This ensures the reliability, efficiency, and safety of the entire system's power generation, and enables the stable operation of the power station's power generation units.

The energy storage system has a battery compartment and an equipment compartment. The battery system consists of battery modules and battery clusters with a single battery cell as

the smallest unit, and the battery capacity is configured according to the actual needs on site; the equipment compartment is provided with energy storage converters (PCS), AC distribution cabinets, DC distribution cabinets, fire protection systems, EMS & dynamic environment monitoring cabinets, etc.

The retired batteries of electric vehicles are used to construct an energy storage battery system. When the PV canopies are generating electricity during the daytime, the system supplies power to the charging pile, while the remaining power is supplied to the energy storage device. When the canopies do not generate electricity at nights, the power grid charges the energy storage battery system through the energy conversion system during the valley electricity price period. During the peak electricity price period, the energy storage system supplies electricity to the charging pile of vehicles through the energy conversion system, in order to maximize the profit from the electricity price difference.

The charging station interacts with users through the scanning codes for charging mechanism, and the charging station system includes intelligent monitoring and metering. The intelligent controller of the charging station has measurement, control, and protection functions for the charging station, such as running state detection, failure state detection, and linkage control of the charging and discharging process; the AC output is equipped with an AC intelligent electric energy meter for AC charging measurement, which is equipped with comprehensive communication functions to upload measurement information to the charging intelligent controller and network operation platform through RS485. In addition, the charging power can be adjusted, and the input and output overvoltage and undervoltage protection, short circuit protection, overcurrent protection, leakage protection, grounding detection, over temperature protection functions are complete, with IP54 protection grade.

Considering the limited available area on the roof, the use of monocrystalline silicon battery modules can bring many benefits such as high conversion efficiency, conservation of intensive land use, expansion of actual installed capacity, and good low-light performance. In response to the *Opinions on Promoting the Application and Industrial Upgrading of Advanced PV Technology Products* jointly issued by the National Energy Administration, the Ministry of Industry and Information Technology, and the Certification and Accreditation Administration of the People's Republic of China on encouraging the use of advanced technology products, single-sided 540Wp and above monocrystalline silicon components are temporarily chosen at this stage.

The Project involves constructing PV canopies. Taking into account factors such as installed capacity, system cost, increased power generation, convenience in installation, operation and maintenance, a 100kW string type inverter is tentatively planned for this stage. The main pollutants on the component board surface are floating dust, but there are also mortar

bonding after rain, as well as dust bonding caused by the large temperature difference between day and night, which results in condensation on the component board surface. Due to the self-cleaning coatings on the surface of components, the cleanliness of the component surface can generally be guaranteed after rainwater washing. However, considering that the cleanliness of the surface of the component directly affects the output efficiency of the PV power generation system, and absence of rain over an extended period can affect the output of the component, a combination of water cleaning and pneumatic blowing and suction is preliminarily selected for the Project. It is planned to use water cleaning as the main method, and to use pneumatic blowing and suction as an auxiliary solution in winter. Due to the fact that the Project is a PV canopy, manual scrubbing will mainly be adopted. It is recommended that the PV station in the parking lot of the Project be cleaned with water once a quarter, and the number of portable hair dryers will be determined based on the number of people and shift during the cleaning of the PV station.

Charging facilities installed outdoors shall not be located in low-lying areas where rainwater is prone to accumulate. Non combustible materials should be used for rain covers and canopies, and the fire resistance limit and combustion performance of the load-bearing components should meet the requirements of Class II fire resistance rating in the *Code for Fire Protection Design of Buildings* GB50016. The cable inlet inside the foundation base of outdoor charging equipment should be fireproof sealed.

III. The Sponge City Design for Parking Lot

In this design, the parking lot roads are all paved with permeable asphalt, which effectively controls surface runoff and replenishes groundwater, truly achieving a green and low-carbon ecology.

Due to site limitations, the green area of the parking lot is relatively small. A grass planting ditch is set up within the limited green area, which not only serves as a transmission mechanism, but also performs functions such as rainwater regulation, collection, and ecological purification. Therefore, the grass planting ditch in the parking lot should be comprehensive, serving as a multifunctional grass planting ditch which consists of a concave green space, a simple rainwater garden, and a grass planting ditch. The bill of quantities of sponge measures for the parking lot is shown in the table 3.2-9 below.

Table 3.2-9 Parking Lot Bill of Quantities

Table of Total Quantities of Parking Lot Project				
S/N	**Name**	**Unit**	**Quantity**	**Note**
1	Area of construction land	m^2	25500	
2	Green space	m^2	4352	

Table of Total Quantities of Parking Lot Project				
S/N	**Name**	**Unit**	**Quantity**	**Note**
3	Permeable pavement	m^2	20060	
4	Grass swale	m^2	1088	

3.2.1.3 New Energy Street Lamp Construction Project

The Project covers 5.4 km^2 of the core area of Chengdong New Area, and will install a total of 3,471 new energy street lamps on the 10 existing and 7 planned roads.

The power supply for street lamps is solar cell components: monocrystalline silicon battery 260W solar panel, lead-acid battery 150Ah × 2 (12V), street lamp input voltage 12V.

The lighting fixtures in the Project are all semi cut-off LED lamps with high luminous efficiency, low loss, and long service life. The layout and specifications of various road lighting fixtures are shown in Table 3.2-10.

Table 3.2-10 Layout and Specifications of Various Road Lighting Fixtures

Road name	Layout mode	Spacing (m)	Installation height (m)	Specification	Lamp type	Number of solar street lamp sets
Zheng Xing Road	Bilateral arrangement	20	8	120W	Solar street light (single arm)	210
Chun Lin Road	Bilateral arrangement	20	8	100W	Solar street light (single arm)	28
Lv Yuan Road	Bilateral arrangement	20	8	100W	Solar street light (single arm)	24
North Section of Yong An Road	Bilateral arrangement Bilateral arrangement	20	8	120W	Solar street light (single arm)	100
Huan Ta Road	Bilateral arrangement	25	8	100W	Solar street light (single arm)	190
G211 (Guan Miao-Huang Yang River Section)	Bilateral arrangement	20	8	120W	Solar street light (single arm)	130
G211 (Shi Ti -Zhang Tan Section)	Bilateral arrangement	20	8	120w	Solar street light (single arm)	770
Boxue Road	Bilateral arrangement	20	8	120W	Solar street light (single arm)	240
Qinba Avenue	Bilateral arrangement	20	8	100W	Solar street light (single arm)	220
Zhangshi Avenue	Bilateral arrangement	20	8	100W	Solar street light (single arm)	282
Songshan Road	Bilateral arrangement	20	8	120W	Solar street light (single arm)	158

Road name	Layout mode	Spacing (m)	Installation height (m)	Specification	Lamp type	Number of solar street lamp sets
Dongcheng Avenue	Bilateral arrangement	25	8	100W	Solar street light (single arm)	164
Mingzhu Avenue	Bilateral arrangement	20	8	120W	Solar street light (single arm)	169
Biyun Road	Bilateral arrangement	20	8	120w	Solar street lamp (single arm)	148
Antai Road	Bilateral arrangement	20	8	120W	Solar street light (single arm)	76
East Ring Avenue	Bilateral arrangement	20	8	100W	Solar street light (single arm)	352
Wangwan Road	Bilateral arrangement	20	8	100W	Solar street light (single arm)	210

3.2.2 Urban Ecological Restoration and Green Resilient Infrastructure Construction Project

3.2.2.1 Hanjiang River Riverside Ecological Green Corridor Project (Phase I)

I. Project Overview

The Project is located on the east bank of the Hanjiang River between the Jianghan Bridge and the Shiti Bridge in Ankang. It is an important ecological buffer zone, riverside landscape zone, and dynamic development zone for the Chengdong New Area in the future. On the other side are Ankang East Station and G316 National Highway. Jianghan Bridge is the main passage from Ankang East Station to Chengdong New Area and also an important entrance to the city. The Shizhang Avenue adjacent to the project area is one of the main roads planned for the Chengdong New Area. According to the regulatory plan of the Chengdong New Area, there are commercial, cultural, residential, and healthcare land distributed on both sides of Shizhang Avenue.

The Project starts from Jianghan Bridge in the south, ends at Shiti Bridge in the north, and extends from Shizhang Avenue to the red line 10m away from the river bank, with a length of 7.6 km and a total area of 93.5 ha.

The design positioning of the Project is based on ecological restoration, serving urban development and residential environment construction, constructing an ecological green corridor along the Hanjiang River, and creating a vibrant riverside leisure landscape belt in the Chengdong New Area of the city. The ecological restoration project gives priority to ecology by respecting nature, and focuses on maintaining the originality and integrity of the Hanjiang River water ecosystem. It conforms to natural laws and protects and restores the ecological functions of the right bank of the Hanjiang River in the Chengdong New Area of Ankang. The

Project will adopt natural restoration as the main approach, supplemented by artificial restoration; work to main ecological security by selecting local species.

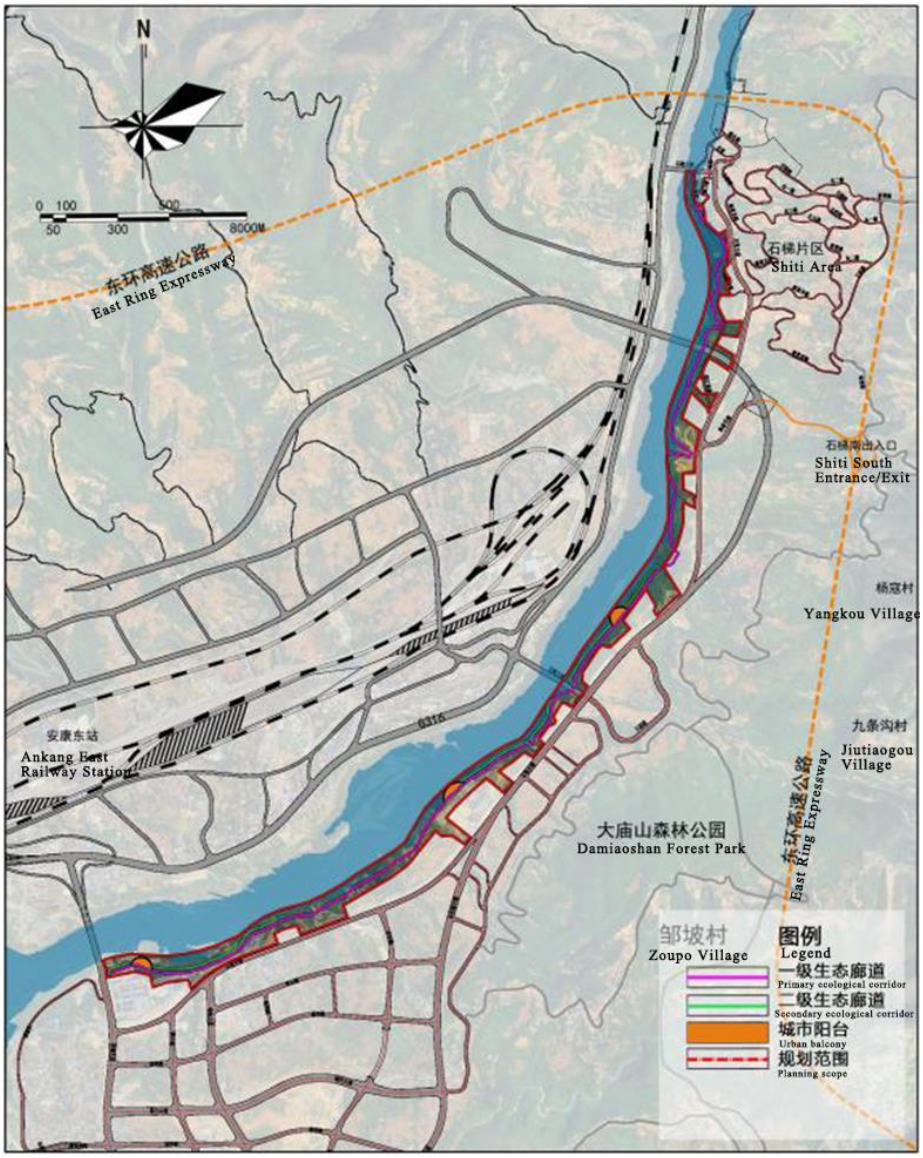


Figure 3.2-5 Overall Planning Layout Map

2. Project composition

The design content of the Project mainly includes two parts: The first part is the foundation layer, with the aim of maintaining and repairing the ecological function of the Hanjiang River Green Corridor, ensuring ecological security, maintaining ecosystem stability, and unleashing ecological value and benefits. The second part is the expansion layer, which, on the basis of ensuring ecological functions, serves to display urban image and cultural charm, improve residential environment, and provide residents with venues for daily leisure and fitness activities. It serves the needs of the ecosystem, promotes human health, and achieves coordinated development of the environment, economy, and society.

The planned area is a strip of green space. Most of the land within the planned range is within the once-in-10-years flood inundation area, so buildings and structures will not be constructed within the flood inundation area to ensure the flood discharge demand of the river channel.

The terrain of the section from Wangmiao Bridge to Hanjiang Bridge is relatively flat, with good vegetation coverage. The planned area mainly involves constructing a first-class ecological corridor, and setting up a core observation node - urban balconies - in order to achieve better landscape effects. The main purpose of the ecological corridor and its spatial landscape located within the flooded area is to focus on immersible landscapes, ensuring the service life of the landscapes. In combination with the construction of many healthcare and commercial facilities in the surrounding area, more residents will come to this section for leisure and recreation in the future. Therefore, necessary management facilities should be set up, such as tourist service centers, management rooms, etc. (located outside the flood inundation area). Meanwhile, certain rest facilities (such as waterside platforms, shaded squares, activity spaces, leisure seats, etc.) will be provided to meet the tourists' needs for stay, rest, and sightseeing. Combined with the characteristics of the site, cultural themes will also be incorporated into the design.

The main ecological footpath planned in this section is the main road of the slow traffic system, which, in conjunction with the secondary footpaths, enriches the transportation system within the site and forms the slow traffic system in this section. Meanwhile, corresponding transitional spaces are arranged between the main ecological footpaths and urban main roads to build transportation connections, connecting and integrating the internal and external transportation of the Project. The main ecological footpath serves as the main road of the slow traffic system, mainly connecting various landscape milestones such as leisure squares, waterside platforms, and plank paths, which form the main axis of riverside landscapes. The ecological footpath of the Hanjiang River Riverside Ecological Green Corridor Project starts from the Jianghan Bridge in the south, crosses the Youfanggou and Langou to the Shiti Bridge, with a total length of 3,700 m. The ecological footpath is a tourist facility, with a once-in-10-years flood prevention standard in the Hanjiang River. The foundation of the ecological footpath revetment is designed to resist once-in-20-years flood water. The type of bank protection in the project area is a slope type ecological slope protection.

The ecological footpath connects the ecological parks, waterfront green spaces, flower world and other landscapes along the line. The construction scope includes main leisure footpath, landscape elevated footpath, ecological revetment, observation platform, pavement, greening and other projects.

The section from Wangmiao Bridge to Shiti Bridge is mainly used for agricultural and forestry purposes, and its properties are kept unchanged in the design. The natural farmland and

forest landscape are preserved. The current height difference is large on the site, and a large number of steep ridges are formed due to river erosion. There is much agricultural and forestry land, which is not highly available and requires minimal artificial intervention. It is advisable to set up bubble wetlands and flexible spaces for agricultural and forestry ecological conservation. The plan focuses on conservation and preservation of this section, and on the basis of maintaining the current ecological environment, it will also develop an agricultural, forestry, and wetland conservation area.

(1) Ecological restoration

The Hanjiang River passes through the urban area of Ankang City. In recent years, significant results have been achieved in the ecological governance of the Hanjiang River. The water quality of the Hanjiang River has reached the national surface water quality standard of Class II or above, and the river and lake shorelines have been effectively controlled. The restoration of the water ecological environment is showing a continuous trend of improvement. However, the mountainous site conditions on both sides of the Ankang water source section of the Hanjiang River are poor, the soil layer is barren, and the water and fertilizer retention performance is poor. Moreover, there is little rain in winter and spring, and also drought in summer. Water shortage in afforestation could result in low survivl and preservation rate, and the vegetation is sparse in the area. Most steep slope farmland are faced with moderate or potential water and soil loss, further deteriorate the ecological environment.

The Hanjiang River Riverside Ecological Green Corridor Project (Phase I) is located on the south bank of the Hanjiang River in the Chengdong New Area of Ankang, and is also part of the Hanjiang River ecological buffer zone. The soil vegetation on some slopes and ditches in the project area is relatively sparse, with poor and loose soil that contains large amounts of impurities. Moreover, the slope stability is poor, and the risk of water and soil loss is high. At the same time, along with the development of the Chengdong New Area, commercial, residential, and public activities are bound to generate certain pollutants, which will have a certain degree of pollution and impact on the Hanjiang River channel.

The ecological restoration program of Hanjiang River Ecological Green Corridor Project aims to control water and soil loss, water environment pollution, congestion, lack of landscape, etc. through ecological measures, ecological engineering and other technical means, so that Hanjiang River will restore its natural attributes, perform functions of leisure and entertainment, and become the display corridor of Chengdong New Area, Ankang. In the planning, the overall idea is "ecological protection first, scientific restoration, appropriate development, and reasonable utilization". It is planned to design ecological slope protection for ecological restoration.

Based on the actual situation of the slope in the project area, we have compared all options and decided to adopt the combination of ecological bag slope protection and hanging net alien soil spraying slope protection. The hanging net alien soil spraying slope protection is implemented in the slope area with a larger slope, and the ecological bag slope protection is implemented in the slope area with a smaller slope.

The ecological slope protection works of the Project cover the range from Shiti Bridge to Hanjiang Bridge. According to the actual situation on site, seven ecological slope protection restoration projects were carried out from north to south, with a total length of 6,121.5 m and a total area of 294,000 square meters. The positions of slope protection No. 1-7 are shown in the figure:

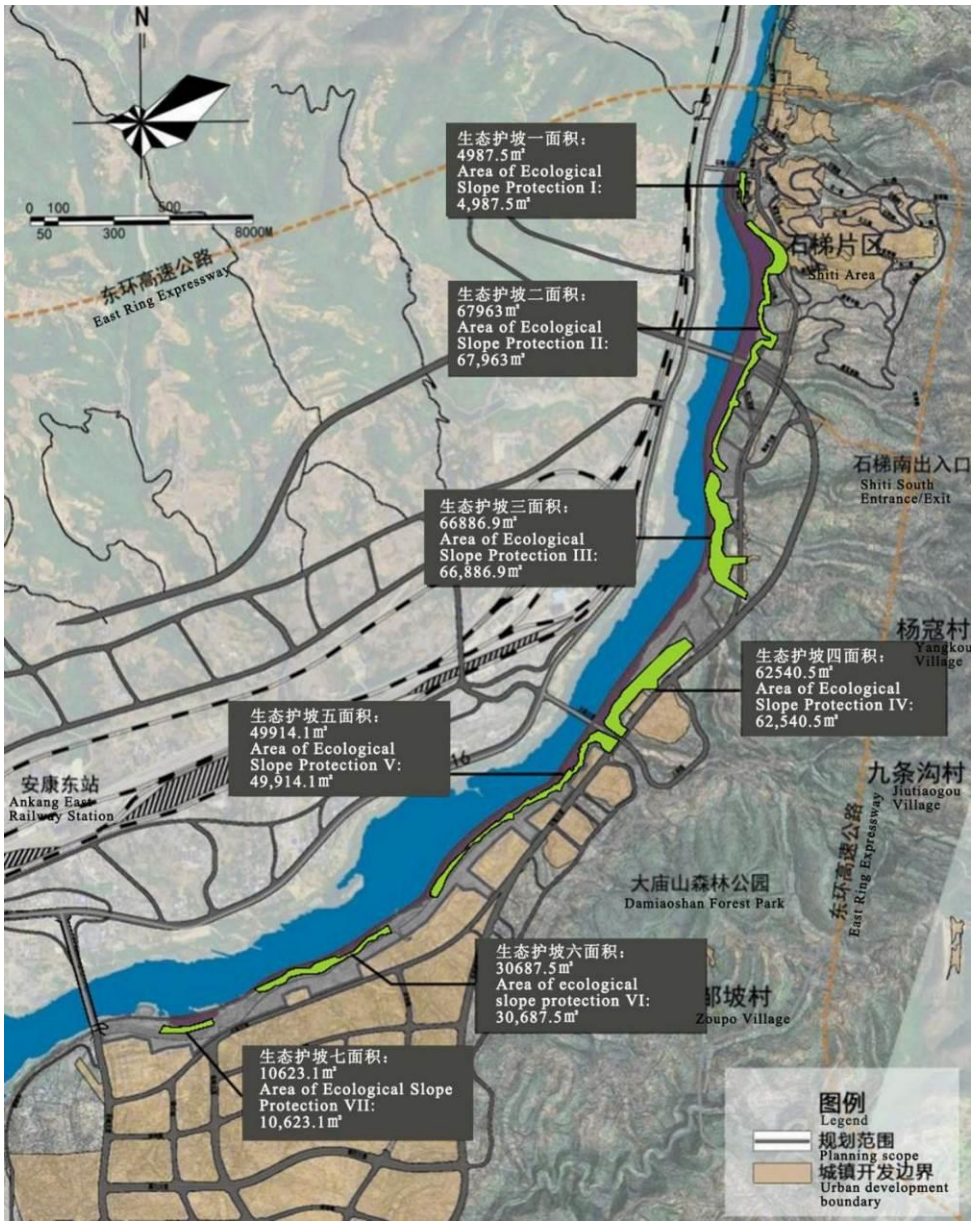


Figure 3.2-6 Ecological Slope Protection Location Map

The basic situation of slope protection No.1 to No.7 is shown in Table 3.2-11:

Table 3.2-11 Basic Situation of Slope Protection

Slope protection No.	Area (m2)	Average width (m)	Length (m)
1	4987.5	10-40	220.6
2	67963.0	35-80	1800.5
3	66886.9	45-215	771.1
4	62540.5	60-120	725.0
5	49914.1	20-95	1464.3
6	30687.5	20-67	828
7	10623.1	35-40	312

(2) Riverside Ecological Footpath

According to urban planning and flood control planning, combined with the status of flood control and flood disasters, the Project aims to construct an ecological leisure footpath from Wangmiao Bridge to Hanjiang Bridge, to serve the needs for urban development and residential environment improvement. Meanwhile, an ecological green corridor will be built along the Hanjiang River, to create a vibrant riverside leisure landscape belt in the Chengdong New Area of Ankang. The ecological footpath of the Hanjiang River Riverside Ecological Green Corridor Project starts from the Jianghan Bridge in the south, crosses Youfanggou and Langou to end at the Shiti Bridge, with a total length of 3,700m. The length and section type of the ecological footpath are shown in Table 3.2-12 below.

Table 3.2-11 Length and Section Types of Ecological Footpath

Project name	Pile No.	Length (m)	Structural type
Ecological footpath	BD0+000.00~BD0+098.86	98.86	Reconstruction of existing roads
	BD0+098.86~BD0+223.21	124.35	Ecological slope protection+footpath
	BD0+223.21~BD0+455.30	232.09	Ecological slope protection+footpath+ecological slope protection
	BD0+455.30~BD0+717.70	262.4	Pile foundation footpath
	BD0+717.70~BD1+892.97	1175.27	Ecological slope protection+footpath+ecological slope protection
	BD1+892.97~BD1+958.11	65.14	Pile foundation footpath
	BD1+958.11~BD3+090.14	1132.03	Retaining wall+footpath
	BD3+090.14~BD3+700.00	609.86	Retaining wall+footpath

(3) Landscape layout

Based on the current site space, resource background, and the relationship with the land use functions of surrounding cities, the overall structure of the Project can be summarized as "one

corridor, five axes, two zones, and eight landscape nodes". The specific landscape layout is based on the design documents for the project.

One Corridor - Main Landscape Corridor

Five Axes - Refers to the east-west axes crossing the main road and bridge of the project site, as well as the intersection of the Hanjiang River and inland rivers. The terrain near the bridge or main road in the area is relatively flat, and there are certain waterfront conditions near the water area; since there are multi angle landscape viewing interfaces at the intersection of the river as well as at the intersection of the river and the inland river, landscapes such as squares, pavilions, waterfront wooden walkways, urban balconies, waterfront leisure activity venues and facilities are set up to maintain permeability of plants in the area.

Two Districts - Ecological Leisure and Health Area, Agriculture and Forestry Wetland Conservation Area

Eight Scenic Spots - Eight Major Characteristic Landscape Nodes

The landscape layout is shown in Figure 3.2-7.

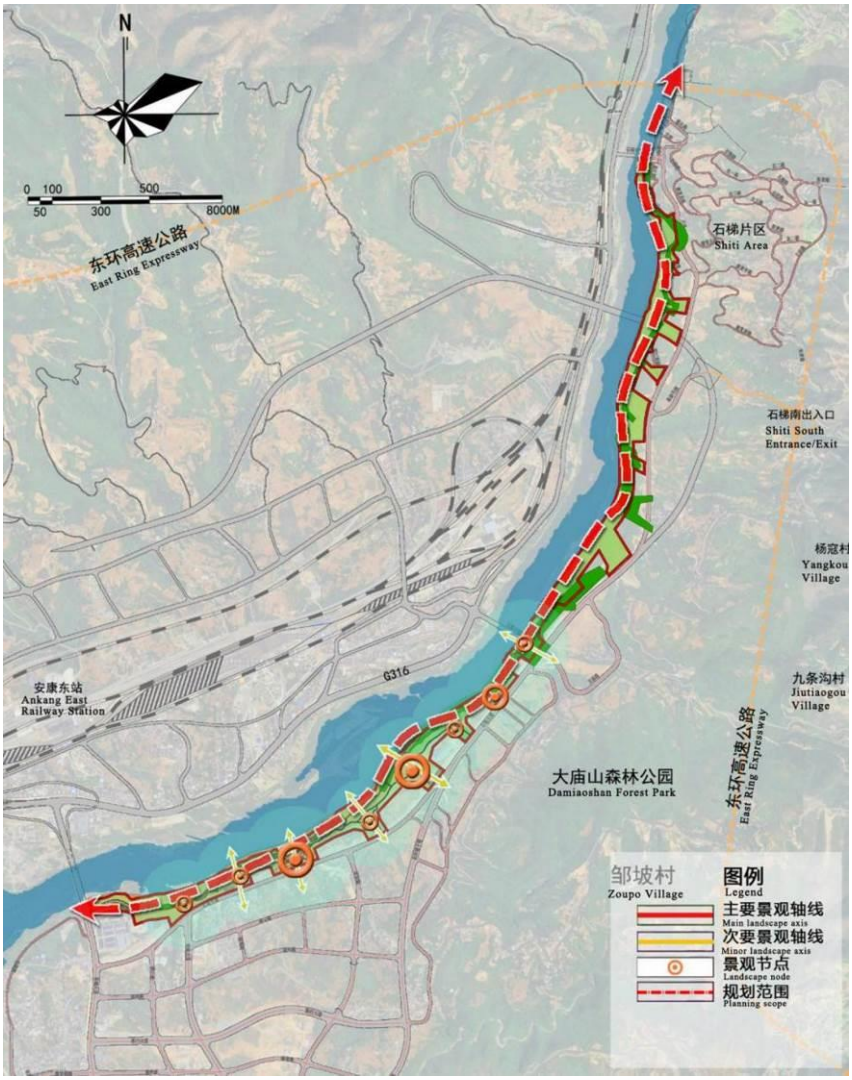


Figure 3.2-7 Landscape Layout of Hanjiang River Ecological Green Corridor

1) Landscape corridor

It is the main landscape corridor that runs through the project area from north to south, serves as the main traffic line within the design scope, connects various landscape spaces and resources within the site, allowing people to experience the unique Hanjiang River as they stroll around. Meanwhile, it is connected to the urban roads that cross the east and west of the design area, providing outdoor leisure and viewing space for people gathering in commercial, cultural, residential and other business formats at the intersection of the project site.

2) Ecological Leisure and Health Area

The nature of the land in this section is for park green space, which is connected with Dian'an Park to form a riverside landscape system.

The terrain of this area is relatively flat, with good vegetation coverage. According to the planning for the surrounding areas, it will accomodate a large passenger flow in the future and can be created as a key waterfront spaces that drive sustainable development of waterfront ecology and better integrate the waterfront landscapes and the city. The Wangmiao Bridge can be used as a transitional area, using plants with a good landscape image for landscaping. Considering the future urban development and construction needs, we plan to construct four ecological parking lots to meet future parking needs and guarantee the parking services of this section.

3) Agricultural and Forestry Wetland Conservation Area

This section is mainly for agricultural and forestry purposes, and its land properties remain unchanged for this design. The natural farmland and forest landscapes will be preserved, with minimal artificial intervention. The main focus will be on restoration and conservation. While using wetland plants to restore the wetland landscape on the revetment, local agricultural plants are used to enrich the existing natural agricultural and forestry landscape. Natural stone roads are planned to connect various areas without disturbing the existing landscape, and to form a flower landscape under the forest.

(4) Service facilities

The planned area is adjacent to the main urban road, with a total of 6 main entrances and exits planned in easily accessible and crowded areas, making it easier for people to enter the park for leisure and sightseeing in different sections. A total of 4 ecological parking lots are planned, with a total parking area of 4,350m^2, and tourist signs are provided in the planned area.

(5) Infrastructure

1) Water supply system

Based on the pressure on municipal water supply, the terrain elevation within the park, and the end users of water, the park uses the municipal water supply. The domestic water supply system adopts a water supply system that combines domestic and fire hydrant systems. Three underground fire hydrants, SA100/65-1.0 are installed on the water supply pipeline, less than 2 meters from the road and more than 4 meters from the buildings. To meet the different needs of trees, shrubs, and grass, as well as the irrigation water for green spaces, the Project considers using an electronic sprinkler system with a quick water intake valve, with a spacing of about 40 m, to be installed in a concealed and convenient water intake location.

2) Drainage system

The drainage adopts a separate sewage system, where rainwater is discharged to the nearest water body. The sewage is collected in a septic tank and connected to the municipal sewage pipe network, and discharged to a sewage treatment plant for unified treatment.

3) Power and Telecommunications Works

Based on the load distribution, the power and telecommunications facilities are provided within the park. In the later stage, electricity and transformer capacity can be reasonably allocated based on the actual building distribution and electricity requirements.

A total of 16 broadcast speakers are set up in the project area to provide background music for the scenic area. A monitoring room is set up in the management building, and 10 monitoring systems are set up in the main activity area to effectively guide visitors during peak hours, while also providing safety monitoring services.

4) Environmental sanitation works

A system for waste collection, transportation, and clearance has been established. Garbage bins are provided on both sides of the square and the road, with a spacing of 50-100 m along the road to facilitate tourists in the disposal of waste. Garbage is regularly and promptly cleared and transported by dedicated personnel. The garbage in the area is classified, collected and sealed for treatment, and uniformly transfered to the garbage transfer station, which is then transported by sanitation vehicles to the city's garbage landfill.

The service radius of the toilets on the main road for sightseeing is 300 m, and in areas with less pedestrian flow and branch roads, the service radius is 500 m. There are a total of 3ecological toilets in the area.

5) Identification and explanation system

A general layout, bulletin boards for pedestrian diversion, vehicle diversion, cultural publicity, warm reminder signs, warning signs, guide signs, explanation signs, and a smart guide system for the scenic area are planned to provide convenience for tourists.

6) Landscape revetment

The shoreline within the project area is 7.6 km long, and there are significant differences in the waterfront environment between different sections of the area. In view of the current conditions of the waterfront and the expected landscape effect, different waterfront spatial treatment methods should be adopted for different waterfront environments.

The style of revetments includes natural gentle slope revetment, ecological green plant revetment, stacked stone revetment, wooden platform revetment, stepped revetment, vertical revetment, etc.

3.2.2.2 Huangyang River Water Environment Improvement and Ecological Restoration Project

I. Project Overview

The site of the Project is located on the flood land on the east bank of the Huangyang River between the old downtown and the Chengdong New Area of Ankang. The planned Chengdong-Dongba Bridge and Huangyang River Bridge cross the project area, which will be the main channel connecting the old downtown and the new district in the future, making the project area a necessary passage between the old downtown and the new district in the future.

The total planned area of the project is 144.7 ha, and the project facilities are distributed along the river bank with a total length of approximately 3.7 km. For the Project, the narrowest part is at the intersection between the Hanjiang River and the Huangyang River on the north side, with a width of about 65 m. The widest part is at the middle section of the project on the south side of the Huangyang River Bridge, with a width of about 880 m. The two land parcels on the north side are currently wasteland, while the land parcel on the south side is interspersed with a large amount of farmland, and the overall terrain is flat.

The design positioning of the Project is based on ecological protection and restoration, aiming to establish a benign and orderly development model between the Huangyang River riverside area and the city, restoring the memory of the Huangyang River site, protecting and restoring the scenery along the Huangyang River, and creating a suburban wildlife park featuring harmonious development between humanity and nature.

The design of the Project is based on ecological restoration and environmental protection. With landscape as the expression form, it fully integrates urban ecological goals with practical needs. While ensuring ecological safety, it meets the needs for sustainable urban ecology, high standard quality of life, urban image and cultural display, residents' leisure, recreation, fitness and other activities, and leverages the multiple functions and benefits of ecological green spaces along the Huangyang River.

2. Project composition

The design content of the Project mainly focuses on maintaining and restoring the riverside ecological functions of the Huangyang River, and ensures the riverside ecological security and good landscape environment through environmental remediation and protection..

Most of the land within the planned range is within the once-in-10-years flood inundation area, so buildings and structures will not be constructed within the flood inundation area to ensure the flood discharge demand of the river channel.

The Project can be planned and constructed into four major areas from south to north: ecological agriculture leisure area, ecological science popularization and education area, waterfront leisure activity area, and natural ecological conservation area.

Natural ecological conservation area: Located at the northern end of the project, the section presents a long and narrow strip, with complex height difference within the site and limited available space. The planning red line at the northern end of the site borders with the planned special park — Dian'an Park, jointly creating an excellent riverside landscape system with diverse ornamental contents and rich landscape forms. A small amount of artificial intervention in the section is mainly created by vegetation community, and the plant theme park and wetland plant landscape can be set up outside the area to jointly create the landscape of the area with the first-class ecological corridor. Corresponding protective railings shall be set up for some waterfront sections to ensure the safety of tourists. The construction of the planning area shall bypass the scope of basic farmland, and the country park construction shall be carried out outside the scope of basic farmland.

Waterfront leisure activity area: It is located in central area of the middle section of the project, with a relatively wide site, a relatively flat terrain and a certain waterfront space. It can be built as a key area to form waterfront space and promote the sustainable development of waterfront ecology. Outside the project scope, core viewing sites, such as the bird watching area, sightseeing platform, wooden trestle, tree-lined square and other landscapes, are arranged in places with better landscape effect, with cultural theme design properly integrated. The construction of the planning area shall bypass the scope of basic farmland, and the wetland restoration construction shall be carried out outside the scope of basic farmland.

Ecological science popularization and education area: It is located in the middle section of the project, near the city side and at the confluence of river systems, with a relatively flat terrain and certain construction space. There is a certain available construction area outside the block, which can be arranged with pavilions and corridors for people to stay, leisure squares for people to gather and stay, and science popularization sites of animals and plants, jointly creating the landscape of the block combined with wetland leisure landscape and ecological revetment.

Ecological agriculture leisure area: It is located in the south section of the project, with a spacious site and a flat terrain, and the Huangyang River Bridge crosses the site. This block has less available land for construction, and currently is an agricultural and forestry area with good vegetation coverage. Based on the shape resources, it is recommended to preserve the landscape of this area, with less artificial intervention and much attention to restoration and conservation. In addition, multi-species of local agricultural plants should be added to form a diversified eco-agricultural landscape.

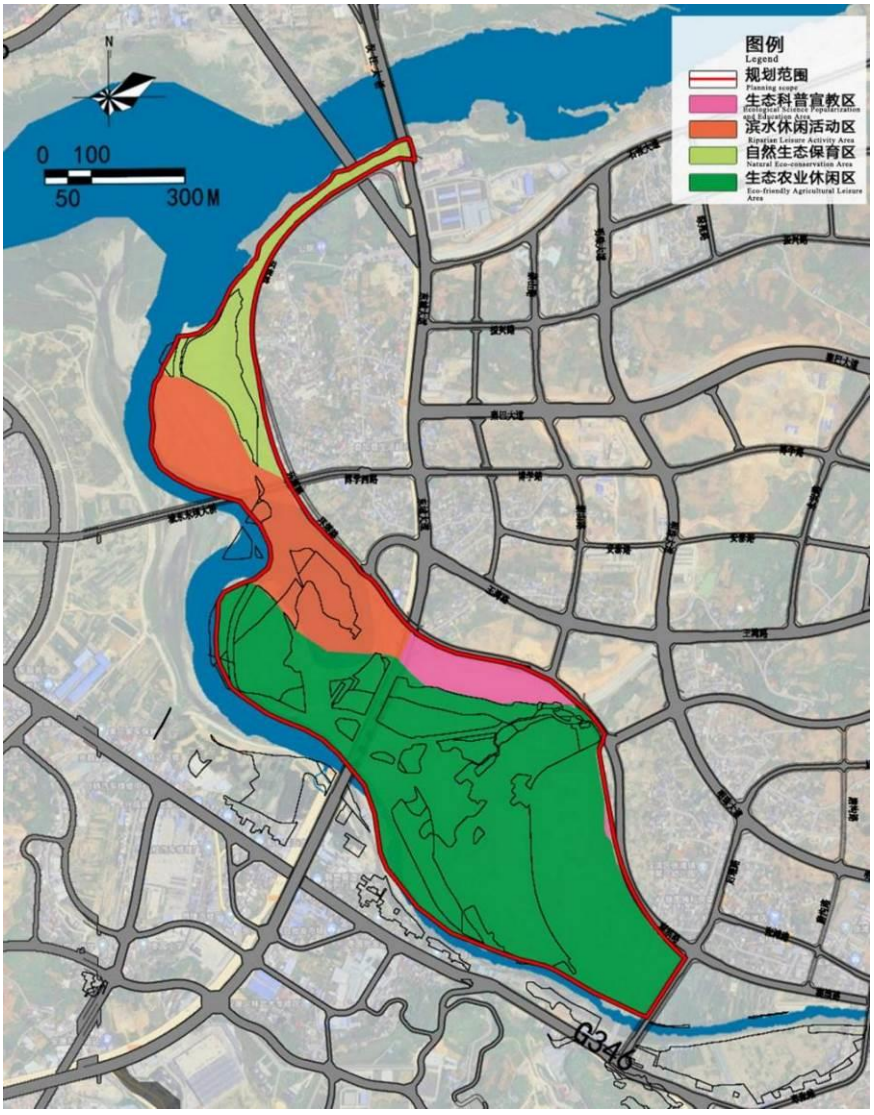


Figure 3.2-8 Functional Zoning Map

3. Ecological restoration

The ecological restoration of Huangyang River Water Environment Improvement and Ecological Restoration Project is to control water and soil loss, water environment pollution, congestion, lack of landscape, etc. through ecological measures, ecological engineering and other technical means, so that Hanjiang River will restore its natural attributes, perform functions of natural environment restoration and biocoenosis habitat, and become the

ecological green lung of Chengdong New Area, Ankang City. In the planning, the overall idea is "ecological protection first, scientific restoration, appropriate development, and reasonable utilization".

The Ecological Restoration Project includes the Ecological Slope Protection Project, with an area of 59,011.8m^2; Water Level Fluctuation Area Greening Restoration Project, with an area of 27,587m^2 for Area 1 and 11,815m^2 for Area 2; and the Land Buffer Zone Greening Restoration and Hedge Isolation Belt Construction Project, with an area of 278,911m^2.

Figure 3.2-9 Ecological Restoration Layout of the Huangyang River

1) Ecological slope protection project

According to the actual situation of the on-site slope in the engineering area, the form of hanging net and borrowed soil spray seeding is selected for slope protection through comprehensive comparison.

The Ecological Slope Protection Project of the Project ranges from the Hanjiang River Second Bridge to the Chengdong - Dongba Bridge, with a total length of 1,297.8m and a total area of 59,000m^2.

Based on the implementation experience of relevant projects in this area, the plant seeds of Elymus breviaristatus, Lolium perenne and tall fescue are selected for mixed sowing, with a mixed sowing ratio of 1:1:1 and a mixed sowing amount of 12kg/*mu*.

2) Water Level Fluctuation Area Greening Restoration Project

According to the field investigation, two greening restoration projects will be carried out in the water level fluctuation area, with an area of 27,587m^2 for Area 1 and 11,815m^2 for Area 2.

The plant restoration of this project focuses on creating a planting area of wet plants, and the plant disposition is based on the design layout of "embodying nature based on ecology; making an overall layout with consideration to functions; focusing on water quality purification function with consideration to economy, natural aesthetics, and ecological laws". Four kinds of wet plants, i.e. reed, *Lythrum salicaria*, cattails and *Scirpus tabernaemontani*, are mainly selected and planted as per the ratio.

Table 3.2-13 Length and Section Type of Ecological Footpath

S/N	Riverside wetland plant restoration project	Unit	Quantity
1	Surface clearing works	m²	39402
2	Excavation and backfilling (40cm thick)	m³	15760.8
3	Reed (10 clumps/㎡, 2-3 plants/clump)	m²	13790.7
4	*Lythrum salicaria* (25 clumps/㎡, 3-5 buds/clump)	m²	9850.5
5	*Acorus calamus* (16 clumps/㎡, 4 buds/clump)	m²	7880.4
6	*Scirpus tabernaemontani* (6 clumps/㎡, 15 buds/clump)	m²	7880.4

3) Land Buffer Zone Greening Restoration and Hedge Isolation Belt Construction Project

The total area of the Land Buffer Zone Greening Restoration and Hedge Isolation Belt Construction Project is 278,911m^2. The plant design shall, on the basis of protecting the existing buffer strip, improve and restore the damaged buffer strip, and preserve the existing plants as much as possible. Restoration and transformation shall be carried out for areas with poor growth or landscape effect and unsatisfactory landscape ecological functions to enhance the landscape value and characteristics. The restoration shall follow the principle of prioritizing indigenous plant and reflect the characteristics of local plant community and buffer strip. Through the combination of arbors, shrubs, herbs and different types of buffer strip

plants, a multi-level and diversified community form is formed, increasing the vitality and participation of the river landscape.

This is only a preliminary design, and it is necessary to fully consult the opinions of relevant experts in ecology and botany regarding the plant disposition in the actual construction process of the project to ensure that no alien species are introduced.

Table 3.2-14 Length and Section Type of Ecological Footpath

Planting area	Plant name	Specification	Quantity
Arbor planting area	*Fraxinus chinensis*	H4-4.5m, P2-2.5m, φ10-12cm	3,514 trees
	Platanus orientalis	H4-4.5m, P2-2.5m, φ10-12cm	2,342 trees
	Pinus thunbergii	H3-3.5m, P1.8-2.0m, φ10-12cm	3,904 trees
	Dragon juniper	H3-3.5m, P1.8-2.0m, φ10-12cm	3,904 trees
Shrub planting area	Mountain peach tree	H1.5-2.0m, P1.5-2.0m, φ6-8cm	4,184 trees
	Malus 'Radiant'	H1.5-2.0m, P1.8-2.0m, φ6-8cm	4,184 trees
	Purple leaf flowering peach	H1.8-2.0m, P1.5-2.0m, φ6-8cm	4,184 trees
Hedgerow planting area	Big leaf boxwood hedge	H1m, P0.4m	6972.8m^2
	Leaflet boxwood hedge	H0.5m, P0.3	13945.6m^2
	Ligustrum vicaryi hedge	H1m, P0.4m	6972.8m^2
Ground cover planting area	Mixed sowing of Elymus breviaristatus and Poa crymophila	The mixed sowing ratio is 1:1, and the mixed sowing amount is 18g/m^2.	84,000 m^2

3.2.2.3 Protection Zone 1 Project of Zhangtan Town Section Protection Engineering

I. Embankment project

The Protection Zone 1 Project of Zhangtan Town Section Protection Engineering are located in the downstream of the Huangyang River, close to the mouth where it meets the Hanjiang River. The current riverbed is relatively wide, with gentle water flow, and a large area of flood land is distributed on both sides. The original design flood control standard for this river channel was once-in-20-years flood. According to the *Flood Control Assessment Report of Xunyang Hydropower Station on the Hanjiang River* prepared in January 2008, the design water level for inundation treatment is 242m after the reservoir is built. A levee is built outside the river channel, and cushion engineering is implemented between the levee and the municipal road, with a cushion elevation of 242m. There is still a flood land in the levee, which is recently a natural hydro-fluctuation belt of the Huangyang River. After the reservoir is built

at Xunyang Hydropower Station, it will be an inundation area, which will have a certain impact on residents in the urban areas along the bank. In addition, with the construction and development of urban areas and the increase of personnel activities, the increase in the discharge of three wastes will produce certain pollution to the Huangyang River within a certain period.

Following the principle of relative importance or urgency, Protection Zone 1 of Zhangtan Town is selected as the scope of recent flood control on the basis of *Hanjiang River Integrated Improvement Planning in Shaanxi Province*, in accordance with the importance of the protection object, the status of flood control and flood disaster, the urgency of engineering construction, and limitations by funds.

The Protection Zone 1 Project of Zhangtan Town is located in the downstream section of the Huangyang River, starting from 230m upstream of Zhangtan Bridge and ending at the mouth of Mogou River. There are no flood control facilities in the protection zone, and the flood control height of natural bank slope is not enough. The elevation of most of the ground in the protection zone is 235~252m, which is lower than the once-in-20-years flood level of the Hanjiang River.

Combined with the importance of the protection object, the urban master planning of Ankang city, the master planning of each town, and the protection status and future development planning of the protection zone, it is determined that the flood control standard of Protection Zone 1 of Zhangtan Town shall be designed to resist the once-in-20-years flood according to the *Standard for Flood Control* (GB 50201-2014), *Code for Design of Urban Flood Control Project* (GB/T 50805-2012) and *Code for Design of Levee Project* (GB50286-2013), and the embankment project shall be designed as Level 4 according to the *Code for Design of Levee Project* (GB50286-2013). The type of embankment in the project area is a slope type ecological slope protection.

According to urban planning and flood control planning and combined with the status of flood control and flood disaster, it is determined that the flood control project aims to construct the embankment project in Zhangtan Town, as well as the bank protection works at the left bank exit section of the Yellow River, the left bank exit section of Mogou River and the right bank exit section of Mogou River with the main task of ensuring the embankment safety of Zhangtan Town.

At present, there are a lot of farmlands on the left bank of Huangyang River. The Project starts from 230m upstream of Zhangtan Town Bridge (chainage Huangyang 4+450) and is arranged along the Huangyang River to chainage Huangyang 3+970, and then arranged northward along the periphery of the town. After crossing Mogou (chainage Mogou 1+060), it is arranged

along the left bank of Mogou to chainage Mogou 1+920, forming a closed flood control area. The embankment line is 2,490m long, of which 500m has been completed at Zhangtan Town Bridge, and the total length of the embankment line in this design is 1,990m. Zhangtan Protection Zone is low-lying, without any flood control facilities, and the river bank line is unstable due to backward flowing flood of the Hanjiang River. The construction of Protection Zone 1 Project of Zhangtan Town Section Protection Engineering is a prerequisite for ensuring the implementation of the *Controlled Detailed Planning of Zhangtan Area*.

Protection Zone 1 of Zhangtan Town has an internal embankment line of 1,990mm, which is located on the natural bank slope, high flood land or terrace front outside Zhangtan Town.

The project area includes Huangyang River (chainage Huangyang 3+540 to 4+350) and Mogou (chainage Mogou 1+070 to 1+900). The Huangyang River and Mogou River are relatively narrow in width, and the river cross-sections consist of river channels and bank slopes. The selection of embankment type in this river reach is influenced by the terrain and geological conditions, as well as the houses and buildings already built on the upper part of bank slopes. Considering the actual conditions of this river reach and combined with the types of embankments built for Protection Zone 2 and Zone 3 in the early stage, the cross-section of embankment in Zone 1 is preliminarily proposed with the type of ecological slope protection + retaining wall, with ecological slope protection adopted in Phase II and ecological retaining wall adopted in Phase I. Considering the requirements of flood control and emergency rescue, two-way traffic, personnel evacuation and dredging, embankment top greening and urban planning, the width of embankment top is 20m (3m sidewalk +12m roadway +1.5m green belt + 3.5m sidewalk). The elevation of embankment top is 251.40m.

The ecological slope protection ratio is 1:2.5. The face wall adopts 10cm thick C25 precast concrete hinged modules, with a 10cm thick sand gravel cushion laid behind the modules, and polyester long fiber non-woven fabrics with a specification of 300 g/m^2 laid below; the face wall modules are connected by anchor rods made of glass fiber; the bottom of foundation is laid with M7.5 grouted rubble with a size of 1.0m×1.0m (W×H), and a 20mm wide deformation joint is set every 10m, which is filled with foam board; the silty clay is used as backfill soil, and shall be compacted in layers, with the compacting factor not less than 0.92.

The face wall of ecological retaining wall in Phase I adopts 15cm thick C25 precast concrete self-embedded modules, with a geogrid laid behind the modules, and the grid is connected to the modules by anchor rods. The embankment top road adopts 20cm thick C20 cast-in-place concrete; the face wall modules are connected by anchor rods made of glass fiber, with a diameter of 10mm and a length of 20cm, and the anchor rods must pass through the grid; a layer of geogrid is laid every 3 modules, with an interlayer spacing of 0.45m and a length of 6.0m; the bottom of foundation is laid with M7.5 grouted rubble, and a 20mm wide

deformation joint is set every 10m, which is filled with foam board; the clinosol is used as backfill soil, and shall be compacted in layers, with the compacting factor not less than 0.92.

The type of proposed embankment in Protection Zone 1 is shown in Figure 3.2-10.

II. Embankment ancillary works

(1) Embankment top road

The top surface is 0.2m thick C20 concrete pavement, and a 15cm thick 2:8 lime-soil cushion is laid below. The bottom is backfilled with sand gravel, with a relative density of not less than 0.65. The pavement drainage slopes towards the river center, with a slope of 1.5%. A solar lamp is set every 30m along the backwater side of the road. The solar lamp is 5.0m high, with LED lamp tube and power of 40w.

(2) Embankment slope regreening

The outer slope of the pavement is 1:1.5, and is re-greened with high-performance ecological substrate after being covered with 0.6m planting soil. The high-performance ecological substrate adopts an ecological formula composed of fine hot-melt wood fiber, artificial fiber, high molecular polymer water-retaining matrix, microporous particles, growth promoter, etc. It is mixed with seeds and sprayed with professional equipment to perform functions of water retention and heat preservation, accelerating vegetation germination and root development.

III. Main quantities

According to the design task requirements, the natural building materials needed for the flood control project in Zhangtan Town include coarse and fine aggregate for concrete, filling materials, masonry materials, etc. The project requires approximately 2 million m^3 of filling materials according to the calculation,including cement, sand, gravel, pebbles, blocks, commercial concrete, etc. The major engineering quantities are shown in Table 3.2-15. Among them, the permanent area of the project is 74.54 mu, the clearing depth is 0.5~1.0m, the excavation depth of the local retaining wall is 3~5m, and the excavation volume is 98608.25m^3, the backfill volume is about 278919.42m^3, and the excavation volume is about 10664.2m^3.

Table 3.2-15 Bill of Main Quantities

S/N	Name	Unit	Quantity	Note
1	**Zhangtan Town Section Protection Engineering (Zone 1)**			
1.1	**Embankment project (1,990m long)**			

1.1.1	Foundation soil cleaing and transportation for 3km	m^3	129298	
1.1.2	Backfilling of purchased clinosol	m^3	706166	
1.1.3	M7.5 grouted rubble foundation	m^3	3431	
1.1.4	Cast-in-situ C25 concrete coping	m^3	743	
1.1.5	Formwork	m^3	14934	
1.1.6	C25 buried stone concrete retaining wall	m^3	6829	
1.1.7	Geotextile	m^2	33627	
1.1.8	Geogrid	m^2	190556	
1.1.9	Slope grassing	m^2	54902	
1.1.10	Planting soil backfilling	m^2	2196	
1.1.11	Interlocked precast block slope protection, 100mm thick	m^2	4003	
1.1.12	Sand gravel cushion, 200mm thick	m^3	4003	
1.1.13	Geotextile 300g/m²	m^2	40033	
1.1.14	Slope compaction and leveling	m^3	54902	
1.1.15	Cast-in-situ C20 concrete pavement (20cm) at the slope toe	m^2	1194	
1.1.16	C25 precast concrete curb at the slope toe	m^2	143	
1.1.17	Covering planting soil at the slope toe (purchased)	m^2	597	
1.1.18	Road greening at the slope toe	m^3	2984	
1.1.19	Dry rubble paving behind the slope, 400mm thick	m^3	6723	
1.1.20	Crushed stone inverted filter behind the slope, 300mm thick	m^2	5043	
1.1.21	C25 concrete drainage ditch behind the slope	m^3	597	
1.1.22	Covering planting soil behind the slope (purchased)	m^3	5968	
1.1.23	Road greening behind the slope	m^3	29838	
1.2	**Embankment top road (1,990m)**			
1.2.1	Earth excavation	m^3	2984	
1.2.2	2:8 lime-soil cushion	m^3	8951	
1.2.3	Precast C20 concrete sidewalk	m^3	430	
1.2.4	Cast-in-situ C20 concrete pavement (20cm)	m^2	42768	
1.2.5	Solar street lamp (H=5m)	m^2	67	
1.2.6	Railing (H=1.2m)	Set	3979	
1.2.7	Covering planting soil (purchased)	m	3382	
1.2.8	Road greening	m^3	16908	
1.3	**Slope regreening**			
1.3.1	Covering planting soil (purchased)	m^3	14145	
1.3.2	High-performance ecological substrate slope protection	m^2	30691	

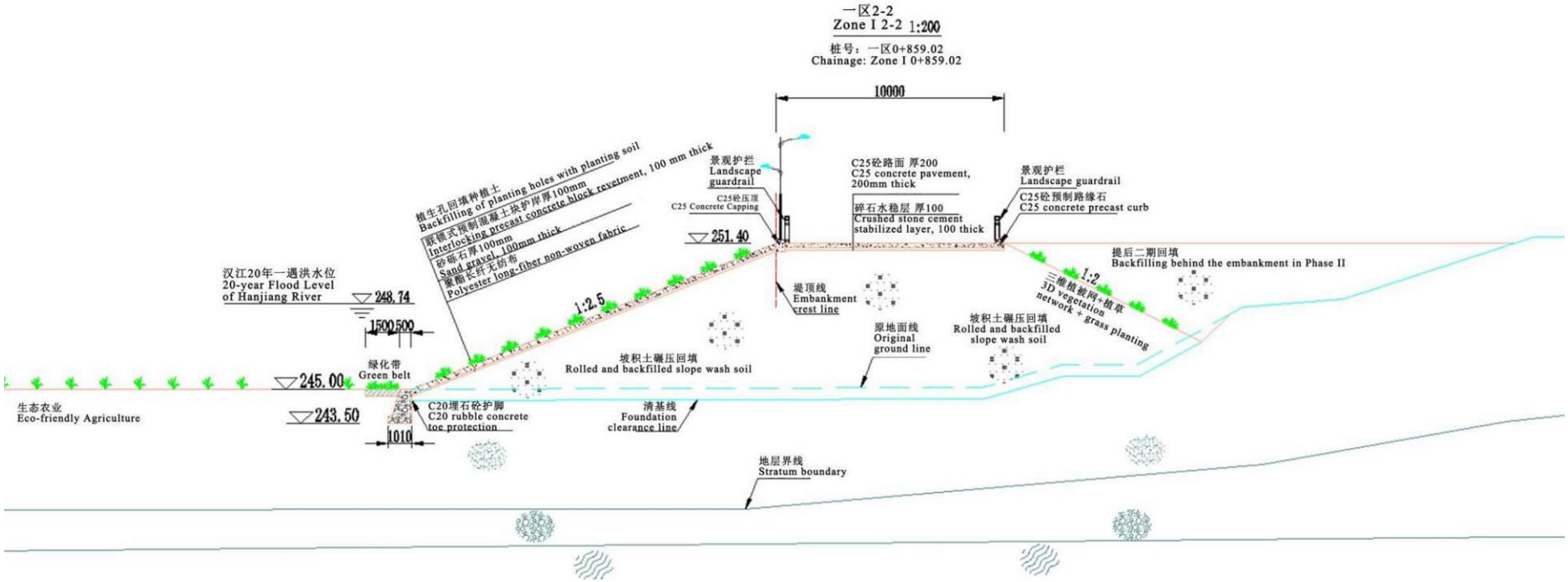


Figure 3.2-10 Form of Proposed Embankment in Protection Zone 1 (Yellow Sea Elevation)

3.2.3 Ecological park and urban integrated waterlogging prevention and control system project

3.2.3.1 Chengdong Sports Park in Ankang

I. Project Overview

The ecological park is positioned as an ecological leisure sports park. The park is designed with the theme of "health and vitality, close to nature, abundant facilities, and unique leisure". The road network system of the whole park is connected through the Ring Road, and intelligent facilities are added to create a more intelligent and modern urban central park landscape. The sports venue area is on the west side. One side of the venue is "inlaid" in the mountain by utilizing the current vertical height difference according to local conditions, while the other side faces Ankang Avenue, exhibiting the diverse style of the sports park through the beautifully curved building facade. In the middle area, the leisure square, children garden and other good places for children leisure and entertainment are designed. The outdoor sports and fitness activity area is on the east side, and the all-age sports court meets various needs of all people in the city, with diverse projects and rich types.

The planned land area for the project is 174,747.62m^2, approximately 262.12 *mu*, which includes: the main entrance plaza of 9,635.96m^2, park roads of 19,674m^2, outdoor sports facilities of 3,082m^2, outdoor plazas and children's activity areas of 8,431.56m^2, 200 parking spaces, a green area of 139,867.06m^2, with a green coverage rate of 80.04%; supporting infrastructure such as water supply and drainage pipelines will also be constructed.

II. General layout

The main entrance and exit of the Project is set on the west side and the parking lot is set on the south side. The Project is divided into four theme zones from west to east, namely "form", "sound", "touch" and "feeling". “Form”: Undertake entrance image display and sports venue experience functions in such ways as landscape walls, grassy slopes, staircase landscapes, and spiritual fortress logos. "Sound": Create a venue of sound sports experience and a smart fitness activities. "Touch": Create a colorful children sports field by means of jogging tracks, jumping pits, sunshine lawns and unpowered amusements facilities. "Feeling": Build a fitness square and outdoor sports field, which can also be used for a variety of sports and leisure activities, such as rock climbing, picnicking, hiking, sightseeing and camping in addition to sports activities.

At the same time, various functional sports venues such as football fields, gateball courts, tennis courts, table tennis courts, multifunctional sports venues, and outdoor fitness squares

will be reasonably provided, which will be subtly connected through fitness trails and leisure trails to facilitate passage and ensure convenience.

III. Supporting works

(1) Service facilities

1) Construction content

Reasonably arrange service facilities according to park design standards. In this plan, two public restrooms will be provided along the main loop line. Basic service facilities such as drinking water points and hand sinks are provided in conjunction with public restrooms that are provided every 300m of service radius along the road. Waste bins are provided along the park ring road, one per 50m, divided into recyclable and non-recyclable.

2) Water supply system

The overall water supply main pipe is laid along the ring road, and the landscape water is supplied from the landscape water supply reserve point of the integrated municipal pipeline network. The starting water supply pressure should be ≥ 0.30MPa, and PE water supply pipe with a nominal pressure of 1.0MPa should be used.

3) Sewage drainage system

The sewage discharge trunk pipe of the Project is arranged between the two public restrooms in the park. The sewage pipe adopts DE300 HDPE steel plastic wrapped drainage pipe, connected with stainless steel clamps. The pipe network is arranged according to the terrain and road longitudinal slope. The sewage pipes generally flow from east to west, collected in the septic tanks and discharge to municipal sewage wells.

4) Rainwater engineering

The overall rainwater trunk pipe is laid along the outer ring of the ring road, vertically draining from high to low along the road. A rainwater collection outlet is set along the road at 25m, and the pipe is made of DN300 PVC-U double wall corrugated pipe, with the end connected to the municipal rainwater well.

(2) Football field

Based on the current economic development of Ankang City, artificial turf and cement concrete foundation will be selected for the football field lawn in the Project.

(3) Other supporting works

The entire sports park adopts solar-powered landscape lights.

Ecological configuration in landscape greening works will be focused on to maximize the ecological benefits of greening.

The heating of each individual building in the Project is achieved with central air conditioning. Equipment rooms and other places are provided with mechanical air intake and exhaust systems.

The land parcel is located in Zhangtan Town, Hanbin District, and the external transportation is under construction, laying a solid foundation for the implementation of the Project. The road planning of the Project organically connects the general planning of the Project, and takes into account the zoning planning of the area and the connection between the current situation of the district and the planned roads in the urban area.

The road network design of the park consists of a primary road that combines carriageways and running tracks to connect the entire park road network. Then, combined with the design of secondary walkways and hiking trails in each area of the park to form the entire park transportation network system.

The park has one main pedestrian entrance, three secondary pedestrian entrances, and one main vehicle entrance to improve the accessibility of surrounding residential areas. The southwest sports center is equipped with service facilities such as ground parking spaces and bicycle parking stations etc.

(4) Landscape layout

In terms of design structure, it is divided into one belt, two axes, and three zones based on the characteristics of the site and the needs of the surrounding population.

One belt: Landscape activity experience belt;

Two axes: Mountain flower belt axis and sports impression axis;

Three zones: Entrance venue experience zone, youth & children activity zone, and sports & fitness area.

Reasonably arrange landscape sketches according to park design standards, including landscape corridors and pavilions, landscape sculptures, curved flower racks, special gallery frames, sightseeing platforms, landscape waterfalls, resting benches, tree pool benches, landscape stones, etc., to meet people's needs for rest, sightseeing, and communication, and to enrich and improve the landscape functions of the sports park. The specific landscape

layout of the Project relies on the detailed design documents during the implementation phase.

IV. Sponge design

There are various implementation plans for the sponge design of urban sports parks. The Project adopts the following six plans based on the site terrain conditions, regional location, and functional requirements:

(1) Rainwater wetlands — water ecology

The rainwater wetland plan covers an area of approximately 3,750m^2 and serves as one of the surface rainwater collection sites in the entire park, storing approximately 4,000m^3 of water that is reused after being treated or "purified" by an artificial lake water ecosystem (for irrigation and landscape water source). As one of the sponge city transfer stations in the park, the rainwater wetland collects, purifies, and reuses the rainwater for landscape. As a highlight of the landscape, it attracts visitors to stay and enjoy the scenery.

(2) Rainwater module

The park rainwater module plays a crucial role in "storage", "purification", and "secondary utilization" of water in the sponge city, and is divided into regulation and storage module and collection module.

The process flow of the regulation and storage module: collect the overflow water from the water body to the regulation and storage filter pool for regulation and circulation, reduce the external discharge of the landscape water, reduce the pressure on the municipal pipeline network, and achieve the utilization of water resources. Provide a sand settling well at the front of the water pool, and after the sand settling, the rainwater enters the rainwater storage module pool, lifted by a pump to the upstream of the landscape water, and the abandoned rainwater is discharged into the downstream rainwater pipeline.

Process flow of rainwater collection module (integrated utilization of rainwater): the rainwater collection system adopts a new PP material rainwater collection module combination pool, which provides an initial rainwater diverting well at the front of the pool. After overflowing, the rainwater enters the rainwater collection pool, which is filtered by a fully automatic self-cleaning filter and sterilized online by a UV sterilizer before being sent to the park greening system and road flushing system. Abandoned rainwater is discharged into downstream rainwater pipelines.

(3) Sunken green space

As a "drainage" and "infiltration" in the sponge city, sunken green spaces play a role in rapid drainage and infiltration during rain and flood storms, reducing disasters such as waterlogging, water accumulation, and inundation.

(4) Ecological grass ditches

The ecological grass ditches of the park in the Project are located on both sides of the carriageway and relatively low in the entire land parcel. They are used to collect road catchment water and park runoff drainage to the rainwater module for filtration, disinfection, and use as secondary landscape water.

(5) Green space terrain of the park

The park of the Project fully utilizes the current conditions and combines the design concept to divide the land into different elevation terrains such as "hills" and "valleys".

The rainwater runoff in the green area of urban sports parks should be pooled and drained in a well-organized way. After pre-treatment such as sewage interception, the rainwater should be infiltrated, purified, regulated, and stored and reused through various sponge facilities within the site. When collecting and dissipating rainwater runoff in the area, the excess value of rainwater should be calculated, which should be discharged into the municipal rainwater pipe through the overflow port.

(6) Green roof

Design the roofs of supporting service buildings such as the public toilets, and management rooms in the park as green roofs with rainwater regulation and storage functions. The thickness of the greening substrate layer should not be less than 300mm, effectively controlling roof runoff and rainwater erosion and loss.

The quantities of sponge measures for the sports park is shown in the table below:

Table 3.2-16 Quantities of Sponge Measures for the Sports Park

S/N	Name of sponge facilities in the sports park	Unit	Quantity	Note
1	Green roof (green roof, substrate layer thickness ≥ 300mm)	m^2	3746.02	
2	Hard roof, unpaved flat roof, asphalt roof	m^2	3266.02	
3	Unpaved soil pavement	m^2	100	Sandpit
4	Green space	m^2	115195.95	
5	Water surface	m^2	500	
6	Permeable paved ground	m^2	33430.08	
7	Grass swale	m^2	1187.587	Concave depth 0.2m
8	Rain garden	m^2	2375.174	Concave depth 0.4m

3.2.3.2 Community ecological park

I. Project Overview

According to the geographical location and service targets of the park, and in accordance with the development plan of the local area of the park, the community park of the Project should be planned and constructed in the form of a leisure, entertainment, and public municipal parks, strengthening supporting service functions, and comprehensively arranging activities such as sightseeing, sports, leisure, entertainment, and health care. Therefore, the community parks of the Project is positioned as two major theme parks, namely the water theme park and the health care theme park. Located on the southwest side of Boxue Road and Chongshan Road and on the southwest side of Biyun Road and Yong'an Road respectively, covering an area of 1.19ha and 1.20ha, totaling 2.39ha

Based on the specific terrain within the proposed community park area of the Project, it is preliminarily estimated that the reasonable tourist capacity of the park is 359 people per visit.

The engineering indicators of community parks are shown in Table 3.2-17 below.

Table 3.2-17 Table of Engineering Indicators for Community Parks

S/N	Project	Area	Unit	Scale	Note
1	Total area	23900	m^2		
2	Greening area	17447	m^2	73.00%	
3	Management buildings	65	m^2	0.27%	
4	Service buildings	445	m^2	1.86%	
5	Garden road and pavement	5944	m^2	24.87%	
6	Landscape identification	1	Item		
7	Landscape illumination	1	Item		
8	Garbage bin	1	Item		

II. Functional zoning

(1) Water theme park

In order to achieve the operational goal of four seasons a year, the water theme park project is divided into two parts.

1) From May to September, the main focus is on water sports.

Create a water theme park with a certain anime cultural connotation by constructing mainly with movable support pools and inflatable pools of different sizes, shapes, and depths, while using water slides and water crossing competition as stimuli.

2) From October to April: Mainly featuring inflatable bouncing beds and inflatable land challenge games.

(2) Healthcare theme park

By creating a "close to nature" ecological landscape and utilizing the health function of forest ecological environment, the design aims to create an ideal resting place for urban residents that integrates leisure vacation, health care, walking and fitness, and forest bathing. The specific landscape design is based on the detailed design during the project implementation phase.

III. Buildings

The Project will construct several new public restrooms, landscape pavilions, and landscape corridors, each located on the two plots of the land parcel. The public restrooms, landscape pavilions, and landscape corridors will be designed based on the actual situation of the Project, with a building height of 4.30m and one floor.

IV. Vegetation planting

The greening of the Project is mainly divided into six areas, including two major theme parks: water theme park and health care theme park. According to the different theme landscapes in each area, the types of vegetation planting are also slightly different.

For example, catalpa trees are planted on the east and west sides of the main entrance of the park. In the tree pool near the center of the park, dryland willows are chosen for arbor trees, and Euonymus japonicus is chosen for shrubs. Other trees in the pool should choose fraxinus chinensis, while shrubs should choose Euonymus japonicus. Shrubs and arbor trees shall be planted according to the actual design requirements, and lawns shall be planted under the arbor trees through mixed sowing. The specific greening plan of the park shall be carried out according to the subsequent design.

Through an analysis of the existing types of green vegetation in Ankang and the local climate, soil, environment, water quality, etc., it is found that Hanbin District has four distinct seasons, low annual average precipitation, high evaporation, and high summer temperatures and severe winter climate. Therefore, it is essential to choose vegetation types that are resistant to cold, drought, and high temperatures. Based on the current municipal greening around the Project, the following vegetation is mainly chosen for the landscaping of the community park in the Project (the specific tree species will be designed by the Designer Unit, and this plan is only for reference).

Evergreen trees: Chinese pine, spruce, etc;

Deciduous trees: catalpa, white birch, white wax, dryland willow, euonymus bungeanus, etc;

Small arbors: boxwood, Prunus cerasifera, clustered Prunus cerasifera, acer ginnala, lilac, etc;

Flowery shrubs: Euonymus japonicus, Bauhinia, Forsythia suspensa, Caryopteris clandonensis, Sorbaria sorbifolia, etc;

Small shrubs: ulmus pumila, Spiraea cantoniensis Lour., Caryopteris clandonensis, redwood, etc;

Flowers: Purple Magnolia, floribunda rose;

Grass: mixed sowing and spread the lawn fully.

V. Water supply and drainage and irrigation works

(1) Water supply and irrigation works

The water source for greening in the Project comes from the municipal water supply network and rainwater collection system in Hanbin District, Ankang City, with a designed flow rate of 50L/h. Install check valves in the municipal and landscape water supply pipes to prevent the landscape water from flowing back into the municipal water supply pipeline.

The Project adopts sprinkler irrigation technology and uses VB-708 valve box "fish birds" to irrigate the landscape and vegetation in the square.

The water used in the community park of the Project mainly includes water for irrigation systems, public restrooms, pavement cleaning, mirror water surfaces, scenic stones, and dry fountain systems. Among them, the mirror water surface, scenic stones, and dry fountain systems adopt circulating system, which replenishes their required water during operation every day except for the first time when water needs to be discharged into the storage pool.

The sprinkler irrigation system generally consists of water source works, water supply pipelines, and irrigators. The water supply network of the municipal landscape system in Hanbin District has been laid near the Project, sourced from the municipal landscape water supply system and the rainwater collection system in the square. Install check valves in the municipal and landscape water supply pipes to prevent the landscape water from flowing back into the municipal water supply pipeline. To ensure the stable operation of the irrigation system, pipelines should be laid and quick water intake valves should be set up according to the needs of landscape planting and irrigation. Quick water drainers should be installed flush with the ground to facilitate quick water intake.

(2) Drainage works

Drainage system: The drainage of the community park in the Project adopts a rainwater and sewage separation system; the sewage pipe network is connected to the municipal drainage network in Hanbin District. Double wall corrugated pipes are directly buried and laid at a depth of 1,200mm, and the sewage is discharged into the municipal drainage network.

The rainwater system adopts natural drainage; areas with greenery are designed with vertical slopes so that the rainwater is naturally discharged into the greenery area; The roads in the park have a 2% slope, and rainwater can be directly discharged to the surrounding green belts on the slope. The rainwater from the hardened pavement is discharged to the nearest municipal rainwater wells along the slope of the site, and the rainwater from the entrance and exit of the park is discharged to the nearest municipal road rainwater wells connected to the entrance and exit.

VI. Other ancillary facilities

The service radius of the garbage bin in the community park of the Project is designed to be 20m, and the garbage bin should be provided near the rest seat.

Arrange leisure benches on one side of the landscape corridor in accordance with the relevant requirements of the *Park Design Specification*, and provide rest seats in other locations of the park. The layout of rest seats should consider the reasonable tourist needs, and wheelchair parking positions should be provided next to the seats, at a number no less than 10% of the rest seats.

The Project will provide fitness equipment in two theme parks according to actual needs, including Cardio Cruiser, cycling equipment, treadmill, combination trainer, and a sit-up bed.

The roads of the Project are all provided with blind sidewalk. Special wheelchair ramps are provided at the entrances and exits of the green belt and at places with steps. The width and slope are designed according to the *Code for Barrier-Free Design*. Barrier free signs are set up at the locations of barrier-free facilities. Barrier-free toilet spaces are provided in public toilets.

In addition, the supporting electrical works required for the construction of the ecological park will also be provided, including power distribution systems, lighting systems, etc.

VII. Sponge design

The park of the Project fully utilizes the current conditions for sponge facility design, mainly including green roofs, permeable paving, grass planted ditches, and rainwater gardens.

Although there are not many management buildings and service buildings in community parks, designing roofs as green can expand the green area; provide rainwater buffer area to alleviate rainwater roof overflow; purify the air; extend the lifespan of roof building materials; reduce ambient temperature, regulate indoor temperature, save energy, and enhance urban biodiversity; and alleviate the urban heat island effect as well. Effectively mitigate and regulate the impacts of climate change.

The quantities of sponge city facilities in community parks are shown in the table below:

Table 3.2-18 Quantities of sponge city facilities in community parks

S/N	Name of sponge city facilities in community parks	Unit	Quantity	Note
1	Green roof (green roof, substrate layer thickness ≥ 300mm)	m^2	491.86	Green roof rate 96.62%
2	Hard roof, unpaved flat roof, asphalt roof	m^2	17.21	
3	Large stones etc. used for paving roads and squares	m^2	128.983	
4	Green space	m^2	16923.59	
5	Permeable paved ground	m^2	5814.95	Permeable paving rate 97.83%
6	Grass swale	m^2	174.47	Concave depth 0.2m
7	Rain garden	m^2	348.94	Concave depth 0.4m

3.2.3.3 Urban integrated waterlogging prevention and control system

The construction content of this project includes two aspects: sponge facilities in the eastern new area of the city and the treatment of rainwater waterlogging points.

I. Sponge facility design

The main purpose of this design of sponge facilities is to increase permeable sidewalks. The newly built square and parking lot are designed as ecological permeable type. Facilities including sunken green spaces, rainwater gardens, and other facilities in squares, green spaces, parks, etc. will also be designed. Arrange artificial storage pools (catchment lakes) in the lower areas and areas with concentrated runoff mentioned above combining the landscape needs of surrounding green spaces, parks, and wetlands according to the

rainwater catchment zoning and flow direction. The artificial storage pool has the triple function of landscape water system, rainwater collection, and reducing the load of urban drainage facilities.

Based on the conclusion of climate change, it can be concluded that the total length of the newly built rainwater collection pipeline network of the Project is 12,698m, with pipe diameters ranging from D500 to D1500mm. The drainage pipes are all reinforced concrete pipes.

II. Control of waterlogging points

At present, most of the area in Chengdong New Area are undeveloped without systematic drainage network or sewage collection and treatment facilities. Except for some units or enterprises that have their own sewage treatment facilities, rainwater and sewage in other areas are discharged into existing roadside ditches, river channels, or low-lying areas in a combined flow.

According to drainage planning and vertical road planning, the risk of river water backflow in the area near the Haniang River on the north side of the New Area is relatively low, but the areas near the water system on the west and south sides of the New Area are at a higher risk of waterlogging in the drainage pipelines due to climate change. The designers visited local villagers and found that the areas of Zhangshi Avenue (600m west of Yong'an Road), the intersection of Dongcheng Avenue and Boxue Road, and the intersection of Chongshan Road and Hubin Road are located in relatively low-lying areas of the New Area (including Zhangtan Village on the west side of the intersection of Hubin Road and Houyan Road), which often suffer from waterlogging that affects the normal passage of residents and vehicles. A total of 4 waterlogging prone points are selected in the eastern New Area of the city. Generally, the treatment measures for these points include increasing drainage pipelines (including gravity flow and pressure pipelines), drainage outlets, rainwater collection facilities, drainage pump stations, anti backflow facilities, and maintenance and dredging of existing drainage facilities. The designed waterlogging control locations and engineering measures are shown in Table 3.2-19 below.

Table 3.2-19 Waterlogging Control Locations and Engineering Measures

S/N	Waterlogging locations	Engineering measures to alleviate waterlogging	Pump station parameters
1	600m west of the intersection of Yong'an Road and Zhangshi Avenue	Add a 120m long d1500 drainage pipeline and one d1500 rainwater outlet around Zhangshi Avenue; one drainage pump station and a 90m long DN250 drainage pressure pipeline will be added to the south side of the intersection of Yong'an Road and Zhangshi Avenue.	Pump station parameters: Q=2000m³/h, P=110kW

2	Intersection of Dongcheng Avenue and Boxue Road	Add a 650m long d1000 drainage pipeline and one d1000 rainwater outlet around Boxue Road; add one drainage pump station, a 110m long DN200 drainage pressure pipeline, and a set of anti-backflow facilities at the northwest corner of the intersection of Dongcheng Avenue and Boxue Road.	Pump station parameters: Q=1500m³/h, P=75kW
3	Intersection of Hubin Road and Chongshan Road	Add a 100m long d1000 drainage pipeline and one d1000 rainwater outlet around Chongshan Road; add a drainage pump station, a 100m long DN200 drainage pressure pipeline, and a set of anti backflow facilities at the northeast corner of the intersection of Hubin Road and Chongshan Road.	Pump station parameters: Q=1500m³/h, P=75kW
4	Zhangtan Town (west side of the intersection of Hubin Road and Houyan Road)	Add a 110m long d1000 drainage pipeline and one d1000 rainwater outlet around Houyan Road; add one drainage pump station, a 90m long DN200 drainage pressure pipeline, and a set of anti backflow facilities at the southwest corner of the intersection of Zhangshi Avenue and Yong'an Road.	Pump station parameters: Q=1500m³/h, P=75kW

The construction of pump stations and pipeline networks can effectively reduce the probability of urban waterlogging and increase urban resilience.

Based on the list of identified waterlogging prone points and combined with the existing drainage network, terrain, and water system, the causes of waterlogging in each waterlogging prone point is analyzed for proposal of targeted root-cause control measures to ensure that the goal of preventing light rain from accumulating water and heavy rain from causing waterlogging in the urban area is achieved.

The drainage pipes at waterlogging prone points in this design need to cross existing roads. During project implementation, the existing road surface needs to be removed for construction. After the construction of the drainage network is completed, the removed road surface shall be restored.

Due to the need to connect the downstream of the drainage pipeline of waterlogging prone point 3 in this design to the river channel, and the existing river channel at the waterlogging prone point 3 has river embankment retaining wall that needs to be removed for pipeline construction. After the pipeline construction is completed, the removed retaining wall shall be restored to its original appearance.

III. Management measures

(1) Improve the flood and waterlogging control command system in the project area, further leverage the effectiveness of the urban flood control command system in urban waterlogging prevention and control on the basis of the urban flood control office, and strengthen the construction, maintenance, scheduling management, and organizational coordination work related to urban flood control and drainage projects.

(2) Establish a flood disaster warning and forecasting system; by relying on existing flood prevention systems and institutions, carry out potential risk identification and rectification, as well as facility cleaning, dredging, and maintenance before the flood, and set up monitoring equipment and warning signs on sections prone to waterlogging to strengthen monitoring and prediction of flood disasters, thereby minimizing disaster losses. In the later stage, the construction of the digital information management and control platform for urban drainage and flood prevention will be combined to improve the accuracy and real-time performance of flood forecasting and scheduling. Establish an integrated analysis and prediction system for flood control scheduling, consultation, expert system, and computer-aided decision-making.

(3) Improve flood and waterlogging control plans

During the flood season, well prepare flood control materials, carry out pre flood inspections, store emergency materials, and organize and train rescue teams. Flood control scheduling should be carried out as regulated. On the basis of improving the accuracy of short-term and medium to long-term climate forecasts, government departments should prepare flood control and drainage plans. Each responsible unit should prepare flood control equipment and rescue tools, establish flood control and rescue teams to station in various dangerous sections to be ready for rescue at any time. The vehicles of the units should comply with unified scheduling. When rainfall exceeding the urban waterlogging prevention and control standards occurs, various departments including those for urban construction, water conservancy, transportation, landscaping, and urban management should work together, and if necessary, effective measures can be taken to avoid casualties and significant property losses, including suspension of classes, work stoppages, and road closures.

(4) Cleaning, maintenance, and dredging of existing drainage pipes (channels)

The relevant regulatory authorities should strengthen regular inspections of the existing drainage pipes (channels), rainwater and drainage outlets within the New Area, and replace damaged facilities in a timely manner. Blocked pipelines or rainwater outlets should be dredged and maintained to ensure that the pipes (channels) and water outlets can work properly. Drainage belongs to systematic engineering, while constructing drainage facilities, it is also necessary to strengthen routine maintenance and management. Only with the joint

efforts of all parties can drainage facilities maximize their functionality and fundamentally solve the problem of waterlogging.

3.2.4 Green and low-carbon urban operation system

I. Project Overview

Main construction content of the Project is to build a green and low-carbon urban operation management and data center.

The project is located at the northeast corner of the intersection of Dongcheng Avenue and Qinba Avenue. The total area of the Project is 13,087.03m^2 (approximately 19.63 mu), with a planned total construction area of approximately 49,950.00m^2, including 33,000.00m^2 of above-ground construction area for the Green Industry Economic Center, Green City Management System, Green City, and Building Achievement Exhibition Center. The underground construction area is 16,950.00m^2, including underground garage, civil air defense facilities and equipment rooms. The green space ratio is 30.06%, the plot ratio is 2.52, the building density is 28.65%, and 396 parking spaces are constructed, including 40 above ground parking spaces and 356 underground parking spaces. Charging points are built at a ratio of 20%. There are 990 non-motorized parking spaces, all underground, with 30% non-motorized vehicle charging points. The specific scale is shown in Table 3.2-20:

Table 3.2-20 Construction Content and Scale of Green and Low Carbon City Operation and Management Center

S/N	Item	Unit	Qty	Remarks
1	Covering area	m^2	13087.03	19.63 *mu*
2	Total building area	m^2	49950.00	
2.1	Overground building area	m^2	33000.00	
2.1.1	Green Industry Economic Center	m^2	10000.00	
2.1.2	Green City Management Center	m^2	16000.00	
2.1.3	Exhibition hall for low-carbon cities and low-carbon buildings	m^2	7000.00	
2.2	Underground building area	m^2	16950.00	Including civil air defense area 3,800.00m^2
3	Building footprint	m^2	3750.00	
4	Building density	%	28.65%	
5	Floor area ratio	/	2.52	
6	Greening area	m^2	3926.00	
7	Afforestation rate	/	30.06%	
8	Parking space	Each	396	
8.1	Ground parking spaces	Each	40	
8.2	Underground parking spaces	Each	356	
8.3	Non-motor vehicle parking space (underground)	Each	990	

II. General layout

The planned area of the Project is 13,087.03 m^2 (approximately 19.63 *mu*), adjacent to Qinba Avenue on the south side. Combined with the terrain, it is constructed as a north-south slab high-rise, with a four-story podium on the east side.

The overall construction area of the project building is 49,950.00 m^2, including 33,000.00 m^2 of above ground construction area, which includes three parts: the Green Industry Economic Center, Green City Management System, Green City, and Building Achievement Exhibition Center.

(1) Integrated office area

The overall theme is green and low-carbon, divided into Green Industry Economic Research Center, Green City Management Center, Green City and Building Exhibition Hall.

The Green Industry Economic Research Center is located on the 9-13 floors of the western integrated office building, with a designed building area of approximately 10,000m^2. Its main functions include an e-commerce operation and management center for health care, selenium-rich food, Chinese herbal medicine, low-carbon industry investment center, emerging green intelligent economy industry center, and Qinba carbon trading center.

The Green City Management Center is located on the 2-8 floors of the integrated office building on the west side, with a designed building area of approximately 16,000m^2, mainly serves the functions for construction of urban waterlogging, flood monitoring and command system, sponge city water cycle monitoring center, carbon emission monitoring center, smart city management center, traffic control and route guidance integrated traffic flow management system (traffic signal optimization, intelligent reversible lane control to improve the smart city transportation efficiency), urban low-carbon transportation system (environmentally friendly electronic signs, vehicle perception base stations, environmental monitoring base stations, and regulatory control platforms), online dust monitoring system, and other urban operation management platform etc.

The Green City and Building Exhibition Hall is located in a 4-story podium, with a designed building area of 7,000m^2; the main functions include a new technology and materials exhibition hall, a green building standards and achievements exhibition hall, an interactive and integrated scene experience hall, and a carbon point consumption popularization hall.

(2) Ecological square greening area

The ecological green area includes central public green space and local landscape green space. The central public green space is located on the south side of the integrated office

building, forming a simple and irregularly shaped square paving and green lawn space by the cutting of geometric lines. The local landscape green space is located on the north and east and west sides of the integrated office building. The landscape nodes of the area are formed by planting suitable local plants and adopting the planting method of ground cover plants, shrubs, and tall plants.

III. Project composition

(1) Road traffic

The south side of the project is adjacent to Boxue Road, so the entrance for the Project is designed on the south side. According to the principle of separating people and vehicles, the entrances and exits of the carriageway are located on the east and west sides of the land parcel, forming a circular road network internally. The width of the road is 5.0m to meet logistics management and fire protection needs; the pedestrian entrance and exit are located in the center of the south side of the land parcel, and the entrance and exit of the underground garage are located in the southeast corner of the land parcel.

As calculated, the Project requires the construction of 396 parking spaces, including 40 above ground parking spaces along the internal ring road; 356 underground parking spaces and 990 non motorized parking spaces, all underground.

(2) Water supply and drainage works

Mainly including outdoor water supply and drainage systems, indoor domestic water supply systems, hot water systems, and drainage systems; outdoor and indoor fire hydrant water supply systems, automatic sprinkler fire extinguishing systems, gas fire extinguishing systems, and fire extinguisher provision.

1) Domestic water supply and drainage

Municipal water supply is directly used for the second and lower floors of the Project, while domestic water tanks and variable frequency pumps are used for pressurized water supply for the third and upper floors. The domestic water tank is considered to be installed on the basement floor, with an effective volume calculated at 20% of the total daily water consumption.

The Project adopts a decentralized electric heater water supply system.

The indoor domestic drainage of the Project adopts a separate system design, which means that the sewage and wastewater have vertical pipes designed separately. The sewage from the bathroom needs to be treated in a septic tank before being discharged into the outdoor

sewage pipe network, and then discharged into the municipal sewage pipe network.

2) Fire water supply

The Project connects a DN200 municipal water supply pipe from two different municipal roads, and provide with a main meter for production water supply, fire water supply, and greening water supply respectively after entering the land parcel. A backflow preventer is installed in front of each water meter. The outdoor fire hydrant system is considered based on two municipal water inflow routes, forming a DN150 outdoor fire hydrant ring pipe within the land parcel, and connecting the outdoor fire hydrant ring pipe to the outdoor fire hydrant. The water stored in the basement fire pool is not used for outdoor fire hydrants. The basement fire pool stores the 3-hour water consumption of indoor fire hydrants and 1-hour cold water for spraying. The fire pool is located on the first basement floor. The water consumption for indoor fire hydrants is 40L/S for 3 hours; the automatic spraying is 60L/S, 1 hour; the water consumption for outdoor fire hydrants is 40L/S for 3 hours. As calculated, the effective volume of the fire water pool is 1,080m^3.

The Project is provided with a high-level fire water tank on the highest roof, with an effective volume of: 18m^3.

Valuable equipment rooms such as LV distribution rooms, HV distribution rooms, and weak-current machine rooms are all provided with gas fire extinguishing systems (use of heptafluoropropane fire extinguishing systems is designed).

(3) HVAC

The Project provides a comfortable central air conditioning system, which provides cooling in summer and heating in winter.

Air conditioning cold source and water system: the air conditioning cold and heat source of the Project is considered to be provided by the ground source heat pump system, with a cooling load of 2,664kW and a heating load of 2,915kW. The ground source heat pump room is located on the first floor of the basement, provided with four screw type ground source heat pump units. The load side and ground source side are both equipped with water pumps and closed expansion tanks for constant-pressure replenishment. The constant pressure point is set on the suction side of the circulating pump. The user side air conditioning water system adopts a primary pump variable flow system, and the circulating pump operates with variable frequency. A bypass pipe and an electric bypass regulating valve are provided between the main supply and return pipes.

A well drilling location for the buried pipes of the ground source heat pump system is reserved in the parking lot area on the west side of the site. As to the design of the soil heat exchange holes and buried pipes of the ground source heat pump system, and the outdoor supply and return pipes on the ground source side, the Designer Unit shall first determine the manufacturer, who shall cooperate with the secondary design; while the cost discipline shall reserve this part of the cost based on the project scale.

The air conditioning heating adopts hot water boilers for heating, and the hot water boiler room will be built by Party A. This design only reserves the installation location of heating circulating pumps in the refrigeration room, and two hot water circulating pumps (one for use and one for backup) will be selected as supporting equipment. The hot water circulating pumps will be installed in the refrigeration room.

(4) Others

The buildings and electrical systems of the Project are designed and planned in accordance with the *Assessment standard for green building* GB/T50378-2019 for green buildings. Buildings, water supply and drainage, HVAC, electrical systems, etc. all adopt energy-saving design. Through overall planning and optimized design of individual buildings, dynamic balance is achieved with the surrounding ecosystem, saving resources and reducing emissions, improving the comfort of the environment in the area, while incorporating the concept of green environmental protection throughout the entire life cycle of project design, construction, and operation.

Among them, prominent green building designs include:

(1) Refined exterior wall system design:

Considering the energy-saving requirements of ultra-low energy buildings, window wall system is adopted for most building facade. The Project adopts reverse prefabricated shear walls of silicon graphene and silicon graphene cast-in-place shear walls of non-dismantling formwork, and the application proportion of the integrated external wall insulation system exceeds 80%. It adopts non-thermal bridge design to ensure the balance of indoor temperature, so as to avoid condensation and local low temperatures. It is featured with high durability and no need for external finishes. Integrated building photovoltaic systems are installed on the east, west, and south facades. A partial glass curtain wall system is adopted in the atrium, corridor, and multifunctional hall spaces to maximize the introduction of natural lighting. It is featured with continuous and complete airtight design, which avoids unexpected airflow infiltration and ensures living quality and comfort. It adopts 3-glass 2-cavity hollow glass windows of high-performance that are filled with argon gas and louvers to achieve better insulation and effective reduction of energy consumption for air conditioning and heating.

(2) Photovoltaic modular integration technology

The roof system adopts an integration of conventional photovoltaic power generation modules with PVT photovoltaic photothermal modules. While generating photovoltaic power, the heat absorbed by the photovoltaic panels is utilized to preheat domestic hot water. In addition, photovoltaic power generation systems are installed on the east, west, and south facades with good solar radiation conditions and less building obstruction. Unlike traditional amorphous silicon PV film systems, the Project sets colored crystalline silicon power generation glass around the window frame, with colors that are almost identical to the exterior facade, which not only does not affect the facade effect but also ensures PV power generation efficiency. In addition, efficient solar energy storage street lights will be used in the park. It increases the utilization of solar energy, reduces energy consumption, and provides effective measures for carbon reduction.

(3) Air source heat pump system

The Project adopts air-cooled heat pump unit of primary energy efficiency as the cooling source for the fan coil unit and the heat source for floor heating, achieving the goals of low energy consumption and high comfort. The full heat exchange fresh air unit with haze removal and purification function is for ensuring good indoor air quality. The proportion of solar energy used in the Project to provide domestic hot water reaches 50%. Many types of software are used for review to ensure that the ultra-low energy consumption plan of the Project can meet the actual requirements.

(4) Utilization of recycled low-carbon materials

The Project adopts concrete products with green building material certification; the ultra-high performance concrete UHPC used in the facade utilizes recyclable fiberglass concrete, and the overall structure adopts a steel frame structure to achieve high assembly rate. Full consideration for the use of low-carbon landscape paving and landscape sketches is considered in the landscape to reduce the hidden carbon content of the building.

3.3 Key project design and construction plans and requirements

According to the Feasibility Study Report of Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project, the Project is currently in the engineering design stage and there are no clear provisions on the construction plan, construction period, and progress. This assessment proposes brief construction requirements for the project in three categories. The three categories of works are low-impact and resilient road works, urban ecological restoration works (including the first phase of the ecological green corridor project along the Hanjiang River, the Huangyang River environmental governance and restoration project, the ecological park and urban integrated waterlogging control system project), and the Protection Zone 1 Project of Zhangtan Town Section Protection Engineering that not only involves the impact on the surrounding residents and environment during construction, but also involves the diversion of the Huangyang River and other projects, which will temporarily

change the current ecological environment during the construction period. Therefore, it will be mainly introduced.

3.3.1 Construction scheme for the Protection Zone 1 Project of Zhangtan Town Section Protection Engineering

The construction plan includes five major parts: construction conditions, construction diversion, main project construction, construction traffic and general layout, overall construction progress, and construction management.

I. Construction conditions

The construction conditions mainly include the selection of natural building materials such as gravel and filling materials.

The Hanjiang River is rich in high-quality sand and gravel materials of abundant reserves. At present, the location of the borrow area has not been determined in the design stage. The assessment requires that the borrow area be located in the Xinba Town section. The sand and gravel materials used for concrete and embankment filling should be from the normally operating borrow areas or in accordance with the requirements of the *River Sand Mining Management Measures of Shaanxi Province* regarding the permission system for river sand mining, and the construction quality should be controlled.

II. Construction diversion

(1) Diversion standards and time periods

This flood control project is located downstream of the Ankang Reservoir. The inflow of water from the downstream river channel has been changed since the impoundment of the Ankang Reservoir on December 26, 1989. The embankment and main buildings is Level 4. According to clause 3.0.2 of the *Construction Specification for Embankment Engineering* (SL260-98) and in combination with the actual situation of the Project, the construction is carried out during the dry season, with a 5-year return period (November to April) flood selected as the diversion flood standard. It meets the construction requirements based on the comprehensive consideration of the diversion period during the dry season and the work quantities to be completed during the dry season.

(2) Mode of water diversion

The Embankment Engineering of Zhangtan Town Protection Zone 1 is located in the downstream of the Huangyang River, and arranged to be constructed in the dry season. In case of the once-in-five-year flood in the riverway in the dry season, the level in the riverway is

234.09~242.73m in the engineering area based on the return water results. The river in the riverway is about 1~2m deep averagely, which is small relatively. In the section with the chainage of M2+788.560-M3+656.08, the dyke foot is about 4~5m lower than the level of riverway, and the original ground at the roof of foundation pit is only about 1m lower than the flood level in the dry season. Therefore, water is directly retained by stacking the earth and stones from banket excavation during construction at the riverfront, and the scheme of open trench excavation for river diversion is adopted according to the actual situation of riverway to make the river flow into the main channel. Besides, mechanical drainage is assisted.

(3) Foundation pit drainage

Foundation pit drainage exists for the embankment construction of the Project. Initial drainage mainly includes the water accumulated in the foundation pit and the seepage from the foundation pit of cofferdam. Regular drainage includes the infiltration water, harvesting rainwater and construction wastewater.

The open trench drainage system shall be adopted for the foundation pit, and the main building construction for foundation pit excavation shall be taken into account concurrently for the layout of drainage system. Water is mainly pumped and drained by pumps in sections with section construction in the Project. Since the foundation pit shall be excavated to a certain depth for the grouted rubble banket foundation, but the strongly permeable sand and cobble course mostly exists for a majority of foundations of the embankment engineering, there is construction drainage, requiring the layout of electric submersible pumps to pump the accumulated water.

III. Construction of main works

(1) Earthwork excavation

Earthwork excavation mainly includes earth-rock of foundation trench at embankment foundation. Earth excavation is based on mechanical construction and manually assisted, with the 1m^3 loader adopted for construction, the 5t dump truck for transportation and the excavator for foundation cleaning and slope repair. Besides, a certain margin shall be reserved at the design base of levee to be cleaned and excavated manually, avoiding overexcavation and disturbance to substrate soil. Part of excavated materials can be directly used as the backfilled materials of embankment. During excavation, the scope of embankment backfilling shall be properly organized, ensuring the direct utilization of excavated materials and avoiding the secondary excavation and transportation. Open excavation of stones mainly includes the foundation excavation of the gravity retaining wall. Excavation is required in layers from top to bottom. Initially, holes shall be drilled by hand drill, with presplitting around, bench blasting and manual slagging off. Steps shall be 0.5m-1m high,

and slags shall be bulldozed manually and removed by the 0.3m^3 excavator and 5t dump truck to the slag disposal pit.

During excavation, attention shall be paid to observing the slope stability at any time and regularly observing the impact on surrounding roads, municipal facilities and buildings. Any adverse soil layers, such as miscellaneous fill, sludge, humus, sand layer and construction waste, must be thoroughly removed. Those over-excavated shall be rolled densely and backfilled flatly by sand and gravel in layers. For the filling or pouring of the embankment body, the next process is only allowed after the foundation surface and embankment foundation are cleared.

The foundation of the Project is located on the flood plain, most of which will be excavated and constructed underwater when reaching the bottom of foundation. It requires proper drainage during construction. Foundation excavation with large openings is adopted generally during the water-bearing layer construction. Upon on-site observation, foundation excavation and construction will be facilitated after water pumping and drainage of cofferdam.

(2) Earthwork filling

Excavated available materials are preferred for backfilling as the embankment filling materials, and the rest shall be provided by the stockyard. The 1.0m^3 hydraulic backhoe shall be used for excavation and loading, and the 5t dump truck shall be used for transportation to the construction site. The soil material shall meet the design requirements, and the filling soil material shall be paved by bulldozer, and unloaded and leveled synchronously, but cannot be accumulated. The 8t vibrating roller shall be selected as the compacting machine, and rolling is required by back-and-forth overlapping method. Local areas and corners shall be tamped by frog hammer. Manual slope cutting and repair are required after the full section filling of embankment is completed.

The filling soil material shall be paved by bulldozer, and unloaded and leveled synchronously, but cannot be accumulated. The 8t vibrating roller shall be selected as the compacting machine, and rolling is required by back-and-forth overlapping method. Local areas and corners shall be tamped by frog hammer. Manual slope cutting and repair are required after the full section filling of embankment is completed.

For foundation backfilling, the excavated material shall be transported by the 5t dump truck to the backfilling areas, and spread and rolled in layers by the 59~132kW bulldozer and manually assisted.

(3) Stonework construction

Stones shall be purchased from the quarry, and transported by the 5t dump truck to the construction site. The foundation and slope masonry shall be built manually by the bedding method strictly. Masonry shall be built in layers. Attention shall be paid to staggered joints for masonry, and vertical through joints are not allowed. When laying the upper building blocks, large vibration shall be avoided for the lower masonry. If the masonry is restored after interruption, the surface shall be cleaned and wetted. During the masonry capping, bulks of stones with fine quality shall be selected, achieving capping flatness, sturdiness and beauty. The water cement ratio of mortar shall be appropriately reduced during construction in rainy days, and the surface of masonry shall be properly protected. The exposed surface of masonry shall be jointed, and flat joints are required on the surface. Before jointing, the mortar joint shall be chiseled by 2cm approximately in depth, cleaned and flushed. Jointing is required from top to bottom. Mortar shall be mixed by mixer nearby, and mixed and used synchronously.

Dry pitched protection slopes shall be built by vertical laying method. Masonry joints shall be tight and the bottom shall be stably padded and tamped. Being overhead, overlapping and floating are not allowed.

Block stones shall be purchased from the quarry, excavated and loaded by the 1.0m³ loader, and transported by the 5t dump truck to the working areas. Some embankment sections shall be transported by rubber-tyred vehicles and manually riprapped and filled.

(4) Concrete pouring

Aggregates shall be purchased nearby or screened on site, transported to the construction site, mixed into concrete by the 0.4m³ concrete mixer, transported to the working area by the rubber-tyred vehicle and to the bin through chutes, formed by a steel mould, and vibrated and compacted by a 2.2kW immersion vibrator.

IV. Transportation and general layout of construction

(1) Transportation of construction

After the construction for years, the traffic network based on railways, highways and waterways has been formed at present in Hanbin District, Ankang. The Xiangyang-Chongqing Railway, the National Highway G316, the Provincial Highway 310, the Xi'an-Ankang Expressway, and the Shiyan-Tianshui Expressway are adjacent to the urban area. Each engineering area along the banks of reservoir area is connected to the urban area by road. Besides, the golden waterway of the Ankang Reservoir is through the engineering area, and external traffic conditions of the Project are superior. It is planned that on-site and off-site transportation is based on highway and waterway transport.

In order to facilitate the floodwall construction, temporary traffic roads can be built according to local conditions during construction preparation, to meet the transportation demands of small vehicles, which shall be restored in the completion period.

(2) Water supply and power supply

In the Project, the water supplied for construction is mainly used for the production and maintenance of concrete and mortar, the living of construction personnel, and the firefighting during construction. Construction water can be directly pumped from the Ankang River by pumps, and domestic water is provided by the urban (town) water supply pipe network.

Since the construction section is close to the urban area and various towns, the electricity for construction in this section is supplied by the nearby urban (town) power supply system. The 0.4KV dedicated line for construction shall be erected from the urban (town) power supply station to the construction site.

(3) Layout principle for construction

The Project is located near the town, and the general layout is performed for the construction site of the Project based on the topographic and geological conditions and the actual site conditions of the Project.

In the specific layout, reasonable layout and overall arrangements are required based on the existing conditions of construction site, ensuring the normal and orderly proceeding of construction in each construction period. At the same time, the cultivated land shall be occupied as little as possible, and the construction area and surrounding environment shall be effectively protected.

The principles of combining centralization and decentralization and integrating permanent facilities and temporary construction facilities shall be adopted. Permanent management sites and building facilities shall be used to the greatest extent as the temporary construction facilities. Construction shall be mainly arranged along the riverway, and the main production systems and living facilities shall be concentrated around each protection zone.

(4) Layout of construction facilities

The living quarters, finished material storage areas, auxiliary production enterprises, and warehouses of such building materials as cement and steel bars shall be considered in this stage and arranged centrally. The sand and gravel processing system is set near the stockyard, and the concrete mixing plant can be relocated in different parts based on project progress. Refer to Table 3.3-2 for the temporary facilities in each work area of the Project.

Table 3.3-2 List of Temporary Construction Quantities

Name of town	Name of protection zone	Construction road (km)	Warehouse (m^2)	Work shed (m^2)	Temporary area (*mu*)
Zhangtan Town	Zhangtan Town Protection Zone 1	3.0	315	210	78.2

V. Overall construction schedule

The total construction period of the Project is 13 months.

Project preparation period: The preparation period lasts 2 months, and it is arranged from August to September in the first year and mainly used for external transportation, construction power supply and communication systems, land acquisition, and bidding. The preparation period is excluded in the total construction period.

Construction preparation period: The preparation period lasts one month, and it is arranged in October in the first year. Main tasks include the necessary preparations for the construction of main works, including site leveling, on-site transportation, temporary housing, and auxiliary enterprise construction.

Construction period of main works: The construction period arranged for the main works is from November in the first year to June in the next year, with a construction period of 8 months. After construction, the embankment begins to play a role of flood control.

Completion period: It lasts 2 months and arranged from July to August in the next year. Main tasks include completing the site cleaning, restoring roads and cultivated land, and other closure works.

VI. Construction management

The quality management system, i.e. the Employer in charge, the control by the Supervisor, and the integration of guarantee by the Construction Contractor and government supervision, is implemented for the Project. In order to guarantee the project quality, the Employer shall organize experts and technical backbones to establish a dedicated quality management team, strictly controlling the quality. The Construction Contractor and the Supervisor shall be selected through qualification review and bidding, and contracts shall be managed. The Construction Contractor is required to establish a sound quality assurance system, and the Supervisor shall dispatch corresponding supervision agencies to the construction site for the self-inspection and supervision of quality respectively. Comprehensive quality control shall be implemented.

VII. Emergency plan of flood prevention

Ecological agriculture is designed outside the embankment in the Project. The *Urban Flood Prevention and Relief Plan of Ankang* has been issued in Ankang, based on which, the urban flood prevention scheme of Ankang is as follows:

(1) When the flood flow is predicted as 9,600m^3/s at the Ankang Station: The warning water level will be reached in Chengdong New Area and the Dongba Zaoyuan area.

1) Command procedure: The urban flood prevention headquarters of Ankang issues the warning notice, and organizes the preparations for emergency evacuation.

2) Flood prevention scheme: ① The urban flood prevention headquarters of Ankang is on duty; and ② Members of all command posts, staff from various contracting units, public security officers, and traffic police under Order 1 are gathered and await orders.

(2) When the flood flow is predicted as 12,700m^3/s at the Ankang Station: The vegetable fields outside the Dongba floodwall are flooded, and the houses of villagers and residents in low-lying areas are submerged.

1) Command procedure: The urban flood prevention headquarters of Ankang issues the Order 1 and organizes the implementation.

2) Flood prevention scheme: ① organization of the evacuation and resettlement of disaster victims; ② rescue by rescue team; ③ operation of lifesaving vehicles and lifeboats; and ④ initiation of the implementation for local public security control schemes.

(3) When the flood flow is predicted as 17,200m^3/s at the Ankang Station: All merchants and enterprises outside the Xiba, Old Town and Dongba floodwalls are flooded.

1) Command procedure: The urban flood prevention headquarters of Ankang issues the first step of the Order 2 and organizes the implementation.

2) Flood prevention scheme: ① organization of the evacuation and resettlement of disaster victims; ② continuous working of rescue teams, lifesaving vehicles and lifeboats; and ③ closing of part of traffic gates of the urban embankment.

(4) When the flood flow is predicted as 21,700m^3/s at the Ankang Station: All residents, government departments, enterprises and public institutions in two dams in the east and west are submerged.

1) Command procedure: The urban flood prevention headquarters of Ankang issues the second step of the Order 2 and organizes the implementation.

2) Flood prevention scheme: ① organization of the evacuation and resettlement of disaster victims; ② continuous working of rescue teams, lifesaving vehicles and lifeboats; and ③ closing of all traffic gates of the urban embankment.

(5) When the flood flow is predicted as 28,500m^3/s at the Ankang Station: The old town is flooded.

1) Command procedure: The provincial general headquarters of flood prevention and drought relief issues the Order 3, which is organized to be implemented by the Ankang flood prevention and drought relief headquarters and the urban flood prevention headquarters of Ankang.

2) Flood prevention scheme: ① curfew imposing in the whole city; ② evacuation and resettlement of all units, workers and the masses in the old town; and ③ organization of flood relief, disaster relief, rescue and epidemic prevention with every effort.

3.3.2 Construction requirements for low-impact and resilient road engineering

The construction period and construction technology of the low-impact and resilient road engineering are basically the same as those of general construction sites, mainly including site leveling, foundation and subgrade excavation, main road construction, installation works of facilities on roads, and engineering quality acceptance. During the project construction period, there is the main impact of temporary land occupation for construction, such as construction camps, construction roads and mixing plants, as well as the operation of construction personnel on the surrounding personnel and the environment.

Among them, all the land temporarily occupied in this type of project are within the permanent land occupation scope of the Project, without temporary land outside the plant. The land temporarily occupied is mainly used as material storage yards and construction roads. In the Project, 200 and 160 construction personnel during construction and operation respectively and the temporary land occupation of about 120 *mu* are anticipated. Since it is impossible to determine the specific numbers of migrant workers and local construction personnel among the construction personnel in the present feasibility study stage, the setting of construction camp is still uncertain. Construction personnel rent the surrounding residential buildings or they are not stationed at the construction site. The construction camp will be set up as required by project construction in the future.

Besides, the high-fill-depth subgrade excavation and protection engineering shall be focused on in the Project. Construction shall be strictly subject to construction specifications and design, so as to ensure subgrade stability. The base course of subgrade shall be compacted first. Corresponding treatment measures (such as replacement, addition of sand and gravel

base course, gravel pile vibroflotation, blind drain and geogrid) must be taken in case of insufficient base strength or soft soil or expansive soil. Ultra-high fill and surcharge preloading are required for the high fill sections based on the results, reducing the differential settlement of subgrade. For the excavation section to be provided with catchwater, the roadbed excavation shall be conducted after the catchwater construction. Mountains shall be excavated for deep cutting, and corresponding protective measures shall be taken according to different geological conditions. For semi-filled and semi-excavated subgrade, attention shall be paid to the setting of soil steps or the use of appropriate geotechnical materials, and slip prevention is required for the subgrade. Special attention shall be paid to the drainage and protection in the construction period. Timely slope drainage and protection are required during the cutting excavation and the embankment filling. When necessary, temporary drainage and protection facilities shall be added to ensure the overall stability of subgrade in the construction period.

For the evaluation requirements, the Construction Contractor shall be determined for project construction in strict accordance with the engineering bidding process. The Construction Contractor is required to formulate the technical proposal and construction organization design of project construction according to the current situation of the Project, to adopt the project management method for construction, to assign the Project Manager and the Chief Engineer with rich practical experience and professional knowledge, to organize capable and efficient management teams, and to make progresses of the Project in high quality, safely and fast based on management advantages, ensuring the project construction completed within the total construction period as required by the Owner, guaranteeing the engineering construction quality in line with the eligibility criteria of the national construction acceptance specifications, and minimizing the environmental impact in the construction period.

3.3.3 Design and construction requirements for urban ecological restoration engineering

Urban ecological restoration engineering (the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), the Huangyang River Environmental Improvement and Ecological Restoration Project, and the Integrated Waterlogging Prevention System Project of Ecological Park and City), and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering.

Construction of this type of project mainly includes the ecological restoration engineering, the ecological footpath engineering along the Hanjiang River, the park landscape engineering, the square landscape engineering, and the construction of main roads and secondary main roads inside and outside the park. The Project mainly contains landscaping, park roads, service buildings, park corridors, pavilions and towers, landscape walls, parking lots, water supply

and drainage facilities, lighting facilities, electrical facilities and communication facilities.

(1) Design principles and requirements

While adhering to the principles of ecology prioritizing and environment first, landscaping is required according to the current conditions based on the status-quo spatial conditions of the greenbelts along the Hanjiang River, avoiding the destruction of river bank ecology due to excessive construction and even the impact on the flood drainage safety of riverway. The Project will adopt natural restoration as the main approach, supplemented by artificial restoration; work to main ecological security by selecting local species. Collaborative promotion is required in accordance with the laws and regulations. While adhering to the collaborative promotion by multiple departments, coordination is required with laws and regulations, policies and standards on natural resources, environmental protection and water conservancy, linking up the space control requirements for "three lines and one list", "three spaces and three lines", urban blue lines, and river and lake management scope.

(2) Measures required in the design stage and construction stage

From the feasibility study, the ecological restoration of the Hanjiang River and the Huangyang River mainly focuses on prioritizing the background species, improving the biodiversity, and creating a better habitat environment for existing animals based on the current ecological community without the destruction of the existing biological substrate to the greatest extent. For the evaluation requirements, in the design stage, the existing animal and plant types shall be fully considered under the guidance of experts in botany and biology, aiming at improving vegetation coverage, and maintaining and restoring the ecological functions along the Hanjiang River and the Huangyang River. Besides, from the interpreting drawing of the present situation of land use in the project area, there is a large amount of artificial forests distributed in the section from Yangjiawan to Shiti Bridge on the northeast side of the Hanjiang River, for which the footpath is designed in the feasibility study. For evaluation, it is suggested to reasonably consider the footpath material selection, design footpath width and footpath direction in the design stage while fully following the principle that the existing artificial forests are not destroyed to the greatest extent, keeping and improving the existing biodiversity.

In the construction stage, for the evaluation requirements, the construction roads and the land temporarily occupied shall be arranged within the permanent land occupation scope of the Project to the greatest extent. Besides, the habitat environment and habits of surrounding animals shall be fully considered, and the timing sequence and routes of construction shall be reasonably arranged to reduce the disturbance to the existing ecological environment. For the evaluation requirements, the Construction Contractor shall properly make construction arrangements, construction preparations, production preparations, technical preparations, plans for allocation of construction water, electricity and resources, labor arrangement

schedule, and technical and organization measures guaranteeing project quality, work safety, construction period and civilized construction as required by the Owner, ensuring the project construction completed within the total construction period as required by the Owner, guaranteeing the engineering construction quality in line with the eligibility criteria of the national construction acceptance specifications, and minimizing the impact of discharging three wastes during construction on the living environment of surrounding animals, plants and residents.

3.4 Analysis of alternative scheme

3.4.1 Analysis of project-free scheme

Scheme 1: Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project Loaned by Asian Infrastructure Investment Bank

Scheme 2: Action-free and Project-free Scheme

Refer to Table 3.4-1 for the comparison of advantages and disadvantages of the above two schemes.

Table 3.4-1 Scheme Comparison

Category	Scheme 1	Scheme 2
Advantages	1. Project construction conforms to the relevant national policies; 2. The Project enables the improvement of transportation capacity in Chengdong New Area, Ankang, the addition of green public parking lots in Chengdong New Area, Ankang, the addition of new energy streetlight construction, and the reduction of carbon emissions; 3. The Hanjiang River Riverside Ecological Green Corridor Project (Phase I) is constructed in line with the function requirements for city image, cultural display and residential environment improvement and for the daily leisure and fitness activity venues of citizens. It enables the fulfillment of the ecological system service functions, the promotion of human health, and the achievement of coordinated development of environment, economy and society; 4. The Protection Zone 1 Project of Zhangtan Town Section Protection	The current land use status of Scheme 1 shall be maintained, with avoiding all impacts during the construction and operation, especially during the construction, in the Scheme 1.

Category	Scheme 1	Scheme 2
	Engineering has improved the flood control capacity of the Hanjiang River and guaranteed the normal production and living of residents; 5. The Integrated Waterlogging Prevention System Project of Ecological Park and City has improved the urban flood control and drainage capabilities and the ecological afforestation in suburbs, enables the ecopark for daily leisure of residents, enhanced the urban life quality, and improved the living environment; 6. The green and low-carbon city operation system enables the construction of the low-carbon and smart green benchmarking demonstration project; 7. The improvement of tourism infrastructure promotes the development of regional green industries; 8. In the survey, the public express their support for the construction of the Project, and the project construction is consistent with the intentions of the public.	
Disadvantages	1. Dust, noise, wastewater (sewage), solid wastes and other pollutants are generated in the construction period, which will destroy the land vegetation, causing water and soil loss; temporarily increase the traffic pressure and damage the landscape at the construction site; 2. Part of land is permanently occupied for road construction, changing the ways of using such land.	1. Currently, the road construction is incomplete in Chengdong New Area, Ankang, and unable to meet the development needs with inconvenient transportation and travel; 2. The urban drainage system is incomplete, easily causing waterlogging and seriously affecting the production and life of residents; 3. The flood control engineering of riverway is incomplete with hidden dangers of safety and environment; 4. There is a lack of ecoparks for recreation in the city, disabling the improvement of residents' environmental quality;

From Table 3.4-1, after the Scheme 1 is implemented, there may be certain environmental impacts during the project construction and operation, especially during the construction. But they are limited in time or space. They will be eliminated or minimized by taking various measures, without causing significant adverse effects on regional environment, and will disappear as the construction is ended.

Through the implementation of the Scheme 1, the construction of road infrastructure has been improved in Chengdong New Area, Ankang, and the green parking lot engineering has been constructed for new energy vehicle promotion at the same time; the ecological green corridors along the Hanjiang River have been improved, facilitating the improvement of water environment and residents' living environment; water environment treatment has been performed for the Huangyang River, effectively improving its flood control capacity and promoting the sustainable development; the ecopark project has been constructed, adding the urban public places for rest and recreation, providing more choices for culture life of citizens in communities, and having positive effects on their healthy life; and the green and low-carbon urban operation management and data center has been constructed, supporting the urban digital construction. The implementation of the Project can further improve the carbon sequestration capacity of plants in Hanbin District, Ankang. During the implementation of the project, plants are also affected by natural environment and human activities. Therefore, effective management and protection measures are needed to effectively enhance the carbon sequestration capacity of plants and make positive contributions to global climate change. The Project not only meets the relevant national policies, but also conforms to the intentions of the public. Therefore, through the above analysis, the Scheme 1 is reasonable and must be implemented upon evaluation.

3.4.2 Analysis of alternative scheme of engineering design

The construction content is unique in the project construction. Therefore, the best scheme of project implementation is considered in the engineering design scheme.

I. Road engineering scheme comparison

The design scheme comparison of road engineering is analyzed based on the feasibility study report of the Project.

(1) New construction of the Ankang Chengdong City-Industry Integration Demonstration Area - Zhenxing Road

The width of the boundary lines for Zhenxing Road in this project is 26m. The layout of the road cross section is as follows:

Scheme I (for recommendation):

Sidewalk (3m) + Non-motorized vehicle lane (3m) + Side strip (3m) + Motor vehicle lane (8m) + Side strip (3m) + Non-motorized vehicle lane (3m) + Sidewalk (3m) = 26m

Scheme II (for comparison):

Sidewalk (3.5m) + carriageway (19m) + sidewalk (3.5m)=26m.

Comparison conclusion:

After the comparison of two schemes, the plate-shared design of sidewalk and non-motor vehicle lanes is adopted in the Scheme I, and motor vehicles and non-motor vehicles are diverged, guaranteeing the traffic safety to some extent. Besides, lanes are divided reasonably. Therefore, after comprehensive comparison, the recommended scheme is recommended.

(2) New construction of the Ankang Chengdong City-Industry Integration Demonstration Area - Huanta Road

The width of the boundary lines for Huanta Road in this project is 12m. The layout of the road cross section is as follows:

① Scheme I (for recommendation):

3m (sidewalk) + 3m (motor vehicle and non-motor vehicle mixed traffic lane) + 6m (sidewalk) = 12m

② Scheme II (for comparison):

1.5m (sidewalk) + 9m (motor vehicle and non-motor vehicle mixed traffic lane) + 1.5m (sidewalk) = 12m

Comparison conclusion:

The motor vehicle and non-motor vehicle mixed traffic lane is adopted in the recommended scheme. In order to ensure the traffic safety of vehicles, motor vehicles can be separated from non-motor vehicles by markings or isolation railings. However, if motor vehicles are separated from non-motor vehicles by isolation railings, later maintenance and cleaning are required for such isolation railings. Certain potential safety hazards exist for the separation of motor vehicles from non-motor vehicles by markings. Motor vehicle and non-motor vehicle lanes are separated by greenbelts in the comparison scheme, diverging motor vehicles and non-motor vehicles, improving their traffic capacity and guaranteeing the traffic safety of vehicles. Both

the recommended scheme and comparison scheme can meet the traffic requirements of roads. The section form mentioned in the recommended scheme is adopted in the planning based on the overall planning of project area.

(3) New construction of the Ankang Chengdong City-Industry Integration Demonstration Area - Lvyuan Road

The width of the boundary lines for Lvyuan Road in this project is 18m. The layout of the road cross section is as follows:

① Scheme I (for recommendation):

3.0 (sidewalk) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 6.0m (motor vehicle and non-motor vehicle mixed traffic lane) + 3.0 (sidewalk) = 18.0m

② Scheme II (for comparison):

3.0 (sidewalk, and non-motor vehicle lane) + 2.0m (isolation strip) + 4.0m (motor vehicle lane) + 4.0m (motor vehicle lane) + 2.0m (isolation strip) + 3.0 (sidewalk and non-motor vehicle lane)=18.0m

Comparison conclusion:

Motor vehicle and non-motor vehicle lanes are separated by greenbelts in the recommended scheme, diverging motor vehicles and non-motor vehicles, improving their traffic capacity and guaranteeing the traffic safety of vehicles. The motor vehicle and non-motor vehicle mixed traffic lane is adopted in the comparison scheme. In order to ensure the traffic safety of vehicles, motor vehicles can be separated from non-motor vehicles by markings or isolation railings. However, if motor vehicles are separated from non-motor vehicles by isolation railings, later maintenance and cleaning are required for such isolation railings. Certain potential safety hazards exist for the separation of motor vehicles from non-motor vehicles by markings. Both the recommended scheme and comparison scheme can meet the traffic requirements of roads. The section form mentioned in the recommended scheme is adopted in the planning based on the overall planning of project area.

(4) New construction of the Ankang Chengdong City-Industry Integration Demonstration Area - Chunlin Road

The width of the boundary lines for Chunlin Road in this project is 18m. The layout of the road cross section is as follows:

① Scheme I (for recommendation):

3.0 (sidewalk) + 6.0m (carriageway) + 6.0m (carriageway) + 3.0 (sidewalk) = 18.0m

② Scheme II (for comparison):

3.0 (sidewalk, and non-motor vehicle lane) + 2.0m (isolation strip) + 4.0m (motor vehicle lane) + 4.0m (motor vehicle lane) + 2.0m (isolation strip) + 3.0 (sidewalk and non-motor vehicle lane)=18.0m

Comparison conclusion:

Motor vehicle and non-motor vehicle lanes are separated by greenbelts in the recommended scheme, diverging motor vehicles and non-motor vehicles, improving their traffic capacity and guaranteeing the traffic safety of vehicles. The motor vehicle and non-motor vehicle mixed traffic lane is adopted in the comparison scheme. In order to ensure the traffic safety of vehicles, motor vehicles can be separated from non-motor vehicles by markings or isolation railings. However, if motor vehicles are separated from non-motor vehicles by isolation railings, later maintenance and cleaning are required for such isolation railings. Certain potential safety hazards exist for the separation of motor vehicles from non-motor vehicles by markings. Both the recommended scheme and comparison scheme can meet the traffic requirements of roads. The section form mentioned in the recommended scheme is adopted in the planning based on the overall planning of project area.

(5) New construction of the Ankang Chengdong City-Industry Integration Demonstration Area - Yongan Road North Section

The width of the boundary lines for Yongan Road North Section in this project is 26m. The layout of the road cross section is as follows:

① Scheme I (for recommendation):

Sidewalk (3m) + Non-motorized vehicle lane (3m) + Side strip (3m) + Motor vehicle lane (8m) + Side strip (3m) + Non-motorized vehicle lane (3m) + Sidewalk (3m) = 26m

② Scheme II (for comparison):

Sidewalk (3.5m) + carriageway (19m) + sidewalk (3.5m)=26m.

Comparison conclusion:

After the comparison of two schemes, the plate-shared design of sidewalk and non-motor vehicle lanes is adopted in the Scheme I, and motor vehicles and non-motor vehicles are diverged, guaranteeing the traffic safety to some extent. Besides, lanes are divided

reasonably. Therefore, after comprehensive comparison, the Cross Section Scheme I is recommended.

(6) Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)

The width of the boundary lines for the Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) is 40m. The layout of the road cross section is as follows:

① Scheme I (for recommendation):

Sidewalk (6m) + Non-motorized vehicle lane (4m) + Side strip (3m) + Motor vehicle lane (14m) + Side strip (3m) + Non-motorized vehicle lane (4m) + Sidewalk (6m) = 40m

② Scheme II (for comparison):

Sidewalk (3m) + non-motor vehicle lane (3m) + side strip (1.5m) + motor vehicle lane (11.5m) + medial strip (2m) + motor vehicle lane (11.5m) + side strip (1.5m) + non-motor vehicle lane (3m) + sidewalk (3m) =40m.

Comparison conclusion:

Through the comparison of two schemes, the proportion of green area and slow traffic system (pedestrians and non-motor vehicles) in the Scheme I is relatively high, facilitating the setting of road LID with low impact on development facilities. Therefore, the Cross Section Scheme I is recommended after comprehensive comparison.

The gas engineering for this road design is excluded in the scope of road design, and only pipe positions are reserved in this design, which will be designed and implemented by relevant gas units later.

II. Ecological slope protection scheme comparison

Type I: interlocked protective block slope protection

The I-shaped interlocked ecological slope protection bricks shall be pre-fabricated by the I-shaped interlocked slope protection mould, and mainly used in the upper part of gabion box. Its interlocked network structure will effectively prevent the impact of flowing water. Besides, water-based plant seeds can be sown in the gaps of interlocked slope protection bricks. In the later stage, the green plant roots are firmly rooted in and interconnected with the soil of embankment slope.

The interlocked slope protection is in the self-locking structure with reliable stability and deformation adjustment ability. It is a common form of slope protection. Coarse sand and a layer of geotextile are laid under the interlocked blocks successively. The I-shaped interlocked ecological brick slope protection is featured by good scour prevention of slope, simple construction process and relatively low cost. Besides, plants still grow on the bank slope, playing a role in water ecological circulation, and also beautifying the environment and achieving significant ecological benefits.

Type II: gabion slope protection

The gabion mesh is made of mechanically woven double-hinged hexagonal flexible metal meshes made of low-carbon steel wires after surface anti-corrosion treatment. The gabion slope protection refers to the integral surface cover of gabion and stone mat by binding the above metal meshes into the interconnected mesh cages and mats of different structures and sizes, filling appropriate stones, and then binding the cover meshes. The gabion mesh is made of hot-dip aluminum zinc low-carbon steel wire, and the gravel cushion and a layer of geotextile are laid under the gabion. The gabion slope protection is advantageous in softness with rigidity, filtration guiding and scouring prevention, soil and water conservation, ecological restoration, and adaption to deformation and displacement. Disadvantages include relatively high cost and difficult maintenance and management.

Type III: masonry slope protection

The masonry slope protection is also common, and the designed thickness of pitched protection slope is 30-40cm. The plain fill or silty clay subgrade is adopted for the foundation surface. Drain holes are drilled on the slope, with hole diameter of φ80mm and hole distance of 2.5m. Inverted filter materials are used at the orifice and arranged in the quincunx shape. An expansion joint with a width of 20mm is arranged every 10m, and joints are caulked by foam boards. The masonry slope protection is advantageous in good scouring prevention and strong durability, but disadvantageous in very high engineering cost.

Type IV: precast concrete six-block slope protection

For this type, the 80-120mm thick precast concrete six-block structure is adopted, with the concrete coping at the top and the concrete or gabion groove at the slope toe. Drain holes are drilled on the six-block slope, with hole diameter of φ50mm, hole distance of 1m and row spacing of 2m. Inverted filter materials are used at the orifice, and an expansion joint with a width of 2cm is arranged every 10m for the coping, slope protection and banket. Joints are caulked by foam boards.

Type V: ecological bag slope protection

Ecological bags are processed by the two-sided ironed and needled non-woven fabrics made of polypropylene (PP) or polyester fiber (PET) as raw materials. As an important part of flexible ecological slope engineering system with the targeted permeable and non-soil permeable filtration functions, ecological bags will not only prevent the loss of fillers (soil and nutrient mixtures), but also achieve the normal water exchange in the soil. The water required for plant growth is maintained effectively and supplemented promptly, which is very friendly to plants and enables their free growth through the bags. The root system enters the soil of project foundation. If restabilization is enabled between the bag and the main body by countless anchor rods. It will be more firm as the more time has been spent, further achieving the purpose of building stable permanent slope, and greatly reducing the maintenance charge.

Type VI: lattice beam ecological bag slope protection

The slope protection is composed of precast concrete C40 blocks, which are piled up and connected by bolts (up, down, left and right) to form a whole. The single block has the size of 1.08m (length) × 1.08m (width) × 0.3m (height) in the porous structure, and waste rock ballasts or soil of riverway are filled inside the masonry, appropriate for plant growth. The 350g/m^2 geotextile is laid on the soil side of wall for inverse filtering, and placed on the foot groove as a whole. The allowable maximum flow rate of scouring prevention is 5~6m/s for the structure of this type.

Type VII: slope protection of hanging net and borrowed soil spray seeding

The principle of hanging net and borrowed soil spray seeding technology (referred to as hydraulic spray seeding, planting substrate spray seeding, spraying mixed planting, vegetation spray planting, etc. in China) is to mix the vegetation seeds (after accelerating germination), water, fiber covering, adhesives and fertilizer in a certain proportion, and then to spray them onto the exposed slope surface hung with galvanized wire mesh (grid meshes, etc.) through the special spraying and mixing system (dedicated spray seeding machine) to form the uniform substrate covering layer. Excess water in the covering layer seeps into the soil surface, and fibers are bonded through adhesives to form the physical strength. The semi-transparent moisturizing surface is formed by water-retaining agent, greatly reducing the water evaporation and enabling the moisture, nutrients, and shading conditions for seed germination. Since the formed fiber covering has physical strength, water absorption and moisture retention, as well as nutrient provision, there is no loss after wind blowing, rainfall or watering, and it is capable of drought resistance, seed strengthening and seedling protection. After vegetation restoration, developed roots are able to penetrate into the joints and cracks of the rock mass through the substrate, achieving the dual goals of permanent slope stabilization and environmental beautifying.

From the perspective of protecting effect, all the above types of protection masonry types can meet the requirements.

For the Type I bank slope protection by the I-shaped interlocked ecological slope protection bricks, it is advantageous in adaption to slope deformation, better safety and stabilization, strong scouring prevention, and conformance to the requirements of ecological protection. With waterborne operation allowed and convenient and fast construction, it is a slope protection type with relatively high cost performance.

For the Type II bank slope protection by the gabion, it is advantageous in that the gabion is in the flexible protective structure, not only adaptive to the riverbed deformation, but also adaptive to uneven frost heaving of foundations. The particle size is not highly required for the retaining wall filler, with good permeability and ecological effect. Waterborne operation is allowed. It is disadvantageous in slightly high cost and applicable to the river sections with steep bank slope and high ecological requirements.

The Type III masonry slope protection is advantageous in good integrity, strong stormy wave resistance, excellent frost heaving resistance, convenient construction and easy maintenance. It is applicable to the engineering areas with rich stone sources, and disadvantageous in poor permeability and poor ecological effect.

The Type IV precast six-block bank slope protection is advantageous in good scouring prevention and integrity, reduced riverway roughness factor and relatively low cost, but disadvantageous in the failure of rigid structure to adapt to the slope change, impermeability, obvious man-made traces and poor ecological features. It is applicable to the river sections with limited investment.

The Type V ecological bag slope protection is advantageous in good scouring prevention, water permeability and terrain adaptability, simple construction and good ecological effect. It is disadvantageous in more manpower consumed, relatively high cost, slow plant growth, easy aging of slope protection bags, as well as easy bags out based on the water flow scouring due to their excessive holes, resulting in settlement and affecting the bank slope stabilization. Moreover, the plant root system extension will be hindered due to undersized holes, affecting the structural stability of flexible slope and reducing the water permeability.

The Type VI lattice beam ecological bag slope protection is advantageous in good scouring prevention, water permeability and terrain adaptability, simple construction and good ecological effect.

For the Type VII hanging net and borrowed soil spray seeding slope protection, it is advantageous in that developed roots are able to penetrate into the joints and cracks of the

rock mass through the substrate, achieving the dual goals of permanent slope stabilization and environmental beautifying.

All in all, based on the actual situation of the slope in the project area, we have compared all options and decided to adopt the combination of ecological bag slope protection and hanging net alien soil spraying slope protection. The hanging net alien soil spraying slope protection is implemented in the slope area with a larger slope, and the ecological bag slope protection is implemented in the slope area with a smaller slope. The form of hanging net and borrowed soil spray seeding is adopted for the Water Environment Treatment and Ecological Restoration Project of the Huangyang River.

4. Environmental Baseline

4.1 Natural environment

4.1.1 Geographical location

The Project is located in Chengdong New Area, Hanbin District, Ankang City, Shaanxi Province, where Shaanxi Province is located in central China, Ankang City is located in the southeast of Shaanxi Province, upstream of the Hanjiang River, and Hanbin District is located in the central part of Ankang City, with the widest east-west distance of 110km, the longest north-south distance of 310km, a total area of 3,646km^2, extending from E108°30′ to E109°23′ and N32°22′ to N33°17′. It is bordered by Xunyang County of Ankang City to the east, Ziyang County and Hanyin County to the west, Zhen'an County of Shangluo City to the north, Ningshan County of Ankang City to the south, and Pingli County and Langao County of Ankang City to the south. Chengdong New Area is located in the southeast of Hanbin District, east of Ankang city center. The geographical location of the Project is shown in Figure 4.1-1.

Figure 4.1-1 Project Geographical Location Map

4.1.2 Topography and landform

Ankang is divided into two main regions, with the Hanjiang River as the boundary. The northern region is the Qinling Mountains area, while the southern region is the Daba Mountains area.

Hanbin District belongs to the hilly and gully area of Qinling-Bashan Mountain in Southern Shaanxi. The Hanjiang River and Yuehe River pass through the middle part of the area, and it is bounded by Yuehe River. It belongs to the Qinling Mountains area in the north and extends along the remaining Bashan Mountain in the south. There are high peaks over 2000m in both the north and south, forming the geographical feature of high in the north and south, low in the centre. The altitude ranges from 216m to 2141m, with a vertical difference of 1900m.

The Project is located in an area of numerous gullies, with a south-to-north slope. The landform belongs to a shallow hilly region, with the altitude ranging from 200 to 800 meters. It is a typical mountainous agricultural landscape of Southern Shaanxi.

4.1.3 Geological formations and earthquakes

The Project is located at the junction of the southern Qinling Mountains Indosinian fold belt of the Qinling fold system and the eastern Caledonian fold belt of the northern Daba Mountains. The regional geological structure is stable, simple in composition, with relatively hard and intact rocks and shallow overlying strata. After reviewing geological data and referring to corresponding construction projects in neighboring areas, it has been determined that there are no adverse geological engineering effects, such as structural fractures, within the entire site of the Project that would affect the safety of the buildings. The Project is located in a relatively stable area.

According to Appendix A of *Code for Seismic Design of Buildings* (GB50011-2010), the seismic fortification intensity of Ankang City is Grade 7, the design value of basic seismic acceleration is 0.10g, the design earthquake group is the Group I, and the design value of characteristic period is 0.35s.

4.1.4 Climate and meteorology

The Hanbin District of Ankang City is located in the humid monsoon climate zone of the northern subtropical region, with moderate sunlight, abundant rainfall, mild climate, and four distinctive seasons. Due to the influence of the topography, the climate has a distinct vertical zonality, with lower temperatures in the southern and northern mountainous regions and higher temperatures in the central river valleys and hilly areas. The average temperature over the years is 15.5°C, with extreme maximum temperatures reaching 41.7°C and extreme minimum temperatures below -10°C.

The dominant wind direction in this area throughout the year is northeast. The wind frequency is 14 in early spring, 6-9 from midsummer to autumn, and 10 in winter. The average wind speed in spring is 1.4-2.0m/s, while in winter it ranges from 1.0 to 1.4m/s.

The distribution of rainfall within the area is uneven, with significant differences between different areas. The overall trend is an increasing amount of precipitation from north to south, with a gradual increase from east to west in the basins of Hanjiang River and Yuehe River. The relationship between precipitation and time is very close. Precipitation varies greatly from year to year, with an average annual precipitation of 750-1200mm. 60% of the precipitation is concentrated in the months of June to September; the lowest value was 540.3mm in 1966, and the highest value was 1109.2mm in 1983, with a difference of 568.9mm. The frost-free period is 263 days.

4.1.5 River systems

The project site is bordered by the Hanjiang River to the north, the Huangyang River to the west and the Mogou River to the south. Please refer to Figure 4.1-2 for the water system map of the project site.

The Hanjiang River is the largest tributary of the Yangtze River, and crosses the entire area of Ankang City from west to east. It enters the country at the mouth of the Zuoxi River in Shiquan County at a distance of 3km, and leaves the country below the mouth of the Baishi River in Baihe County at a distance of 10km. It flows for a total of 340km within the territory of Ankang City, with a drop of over 290m. The river basin covers an area of 5900km^2, with an average annual runoff of 10.655 billion m^3.

Huangyang River is a primary tributary on the south bank of Hanjiang River. It originates from Longxuya, Fenghuang Mountain, Luohe Town, Pingli County, Ankang City, and flows from south to north into Hanjiang River at Dian'an Tower in Zhangtan Town, Hanbin District, Ankang City. With a total length of 126km, it has a basin area of 964km^2 and an average annual runoff of 396 million m^3. Huangyang River Basin, with the mountain gradually descending from south to north, belongs to plain hilly area and forms Zhangtan basin, Xianhe windward plain and Cailiang hills; the washland has only 1~2m terracette, which is 5~15m above the normal water surface, and its ground width is 100~4000m; the cultivated land area of the basin and plain is more than 15,000 *mu*.

Mogou River is a primary tributary on the east bank of Huangyang River, with a total basin area of 65.3km^2. The main river channel is 25.7km long, with an average gradient of 11.2‰, and flows into Huangyang River at the Huangyang River Bridge.

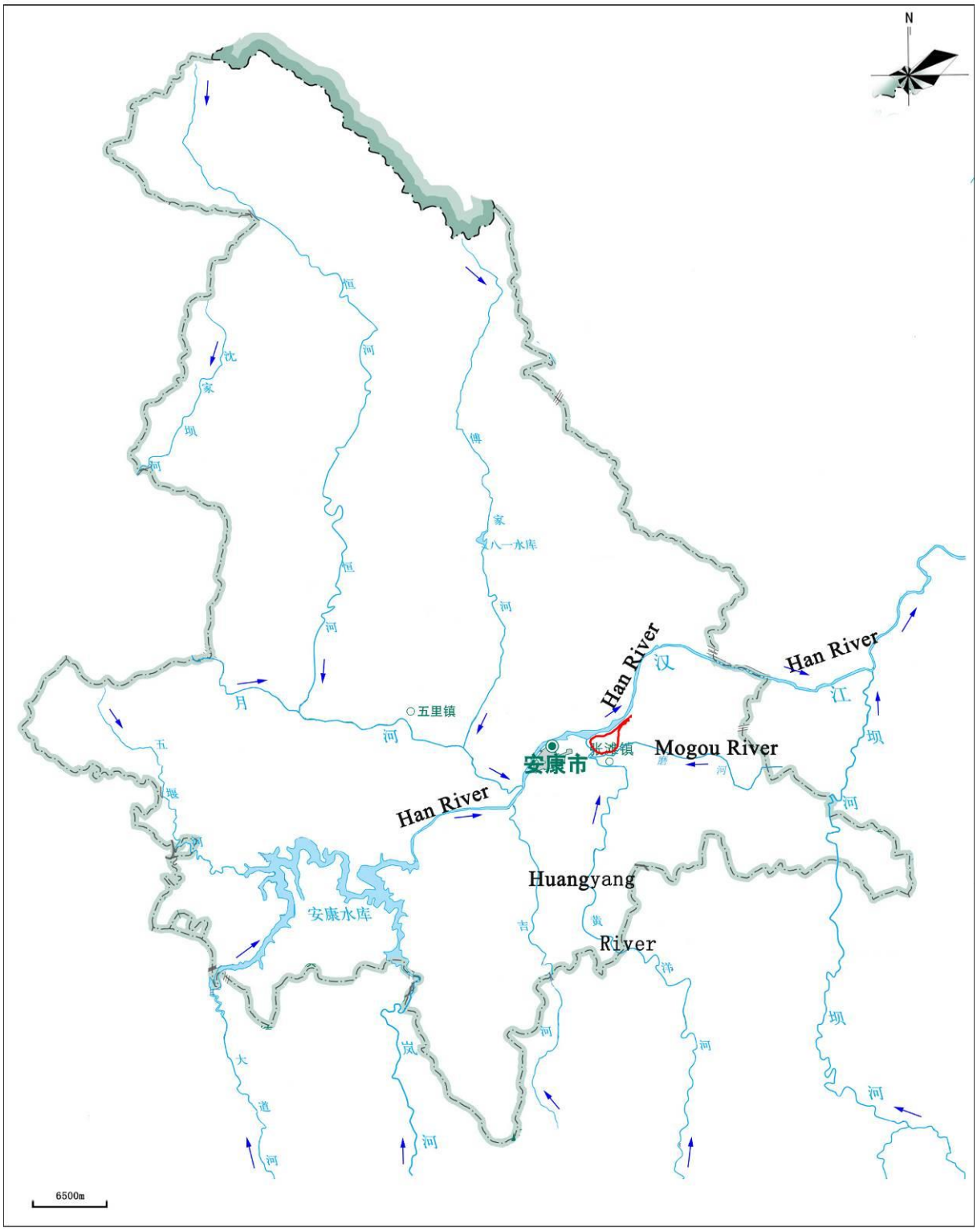


Figure 4.1-2 Water System Map of the Project Site

4.1.6 Hydrogeology

(1) Groundwater occurrence types

Ankang has a subtropical climate with abundant rainfall and excellent groundwater recharge.

The average annual precipitation throughout the area is generally over 700mm, which is the main source of groundwater recharge. There are four main types of groundwater occurrence: loose rock-like pore water, clastic rock-like fissure pore water, karst water and bedrock fissure water.

(2) Groundwater chemistry types

The groundwater quality in Ankang is good, with low mineralization and simple chemistry type. Most of it is of the weakly mineralized bicarbonate type, with mineralization generally ranging from 0.1 to 0.3 g/l. Total hardness is generally between 4 and 16.8 °dH (degrees of German hardness), mostly classified as soft water and slightly hard water; the pH is between 5.5 and 8.3, with the water temperature typically around 12℃, and it is colorless, odorless and tasteless. It is generally applicable to domestic, industrial and agricultural water.

(3) Groundwater recharge, runoff, and discharge conditions

The main aquifer in the Ankang Valley Basin is the Quaternary porous sand and gravel aquifer, while the bedrock at the edge of the basin is poorly permeable schist and phyllite. Therefore, the amount of recharge from the surrounding bedrock to the sand and gravel aquifer in the basin is relatively small. The groundwater in the main aquifer within the basin is mainly dependent on recharge from the upstream Huangyang River in the upper reaches of the Hanjiang River, the buried water of the Yuehe River, and stream and ditch water from recurrent or seasonal surface runoff on both sides.

4.2 Biodiversity baseline

4.2.1 Ecological function zoning

The People's Government of Shaanxi Province approved and issued the *Ecological Function Zoning of Shaanxi Province* in 2004 (SZB [2004] No. 115). Based on this zoning, Shaanxi Province is divided into 4 ecological zones, 10 ecological function zones and 35 residential quarters. The positioning and situation of the ecological function zones in the project area are shown in Table 4.2-1. The ecological function zoning situation of the project site is shown in Figure 4.2-1.

Table 4.2-1 Positioning of Ecological Function Zones

Level I ecological zone	Level II ecological zone	Level III ecological zone	Scope	Characterization of ecological service function importance or ecological sensitivity and ecological protection countermeasures
Deciduous broadleaf and evergreen broadleaf mixed forest ecoregion in the Qinba Mountainous region	Agro-ecological function zones in the hilly basin on both sides of the Hanjiang River	Towns and agricultural areas in Yuehe Basin	Hanyin County, Ankang City, central part of Xunyang County, northern part of Baihe County	Densely populated towns, thriving agriculture and sensitive water environment. Rationalize the layout of towns and enterprises, control pollution, and improve the greening and soil and water conservation in the surrounding mountains and hills, such as the Fenghuang Mountain. Agriculture is mainly focused on cultivation and breeding, with a primary concern for non-point source pollution.

Figure 4.2-1 Map of Ecological Function Zoning of the Project Site

4.2.2 Current status of land resources

4.2.2.1 Current status of land use

According to the *Current Land Use Classification* (GB/T21010-2017), the current status of land use types of the project area are divided into the irrigable land, the nonirrigated farmland, the orchard, arbor forest, shrubland, other forest lands, natural grasslands, other grasslands, industrial land, mining land, urban residential land, rural homestead, educational land grant, railway land, highway land, river surface, pond surface, inland mudflats, hydraulic construction site, vacant land, and bare land, with a total of 21 land categories. The statistical results of land use types and areas are presented in Table 4.2-2, while the current status of land use is shown in Figures 4.2-2 to 4.2-4.

Table 4.2-2 Statistics of Land Use Types in Hanjiang River Evaluation Area, Huangyang River Evaluation Area, and Project Area

Land use type	Hanjiang River evaluation area		Huangyang River evaluation area		Project Area	
	Area (km2)	Proportion (%)	Area (km2)	Proportion (%)	Area (km2)	Proportion (%)
Irrigable land	0.4985	5.35	1.4326	17.47	1.2680	8.44
Nonirrigated farmland	1.1627	12.49	0.5641	6.88	3.3206	22.09
Orchard	1067	1.15	0.2573	3.14	0.3189	2.12
Arbor forest	2.7448	29.48	0.8932	10.89	4.0021	26.62
Shrub	0.4448	4.78	0.4908	5.98	0.9387	6.25
Other forest lands	0.4548	4.88	0.2327	2.84	0.8184	5.44
Natural grasslands	0.0153	0.16	0.1583	1.93	0.1116	0.74
Other grasslands	0.1183	1.27	0.0866	1.06	0.0879	0.58
Industrial land	0.2160	2.32	0.1725	2.10	0.1954	1.30
Mining land	0.0832	0.89	0.1910	2.33	0.1747	1.16
Urban residential land	0.1942	2.09	1.5162	18.49	1.2579	8.37
Rural homestead	0.3786	4.07	0.2167	2.64	0.9976	6.64
Educational land grant	0.0286	0.31	0.0365	0.45	0.0365	0.24
Railway land	0.1025	1.10	0.0000	0.00	0.0000	0.00

Highway land	0.2419	2.60	0.1163	1.42	0.2076	1.38
River surface	1.8188	19.53	0.6972	8.50	0.0477	0.32
Pond surface	0.0118	0.13	0.0137	0.17	0.0358	0.24
Inland mudflats	0.2297	2.47	0.5413	6.60	0.0679	0.45
Hydraulic construction site	0.0000	0.00	0.1844	2.25	0.0805	0.54
Vacant land	0.0659	0.71	0.1899	2.32	0.5522	3.67
Bare land	0.3936	4.23	0.2094	2.55	0.5116	3.40
Total	9.3109	100.00	8.2007	100.00	15.0317	100.00

From the statistics table of land use types, it can be seen that:

The area of the arbor forest in the Hanjiang River evaluation area is the largest, accounting for 29.48% of the total area of the evaluation area; followed by the river surface, it accounts for 19.53% of the total area of the evaluation area; the nonirrigated farmland, irrigable land, other forest lands, and shrubland account for 12.49%, 5.35%, 4.88%, and 4.78%, respectively.

The area of the urban residential land in the Huangyang River evaluation area is the largest, accounting for 18.49% of the total area of the evaluation area; followed by the irrigable land, it accounts for 17.47% of the total area of the evaluation area; the arbor forest, river surface, nonirrigated farmland, and inland mudflats account for 10.89%, 8.50%, 6.88%, and 6.60%, respectively.

The area of arbor forest in the project area is the largest, accounting for 26.62% of the total area of the evaluation area; followed by the nonirrigated farmland, it accounts for 22.09% of the total area of the evaluation area; the irrigable land, urban residential land, rural homestead, and shrubland account for 8.44%, 8.37%, 6.64%, and 6.25%, respectively.

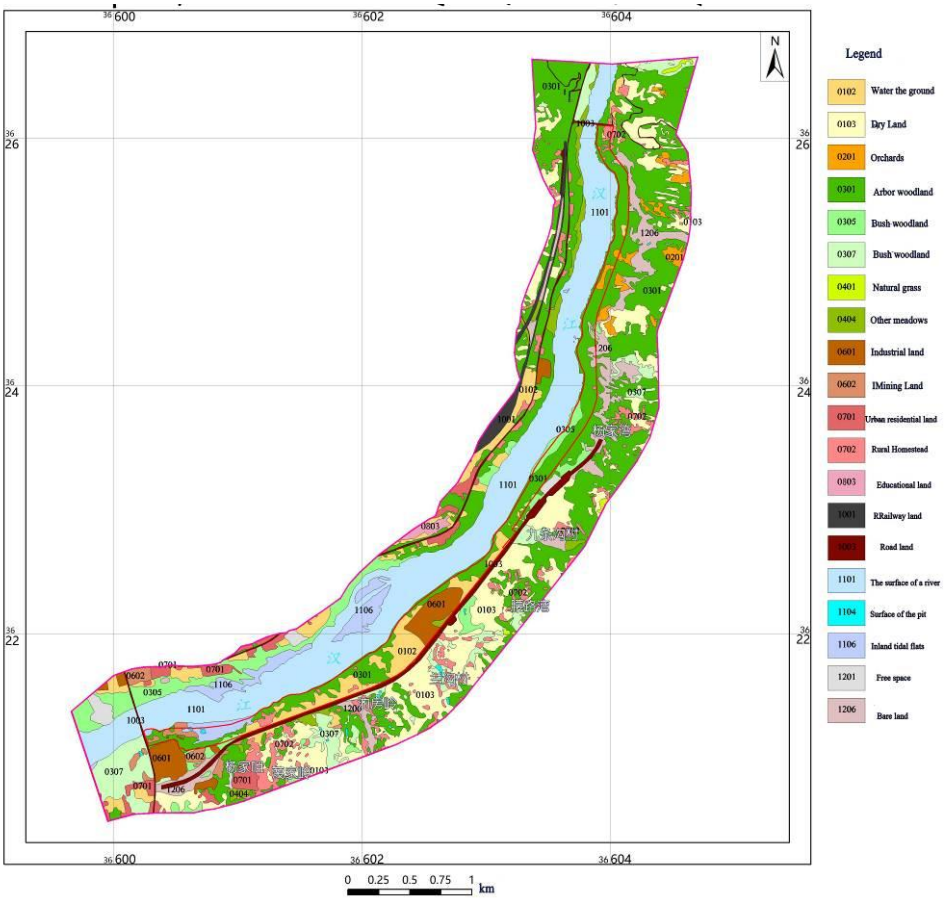


Figure 4.2-2 Map of Current Land Use in the Hanjiang River Evaluation Area

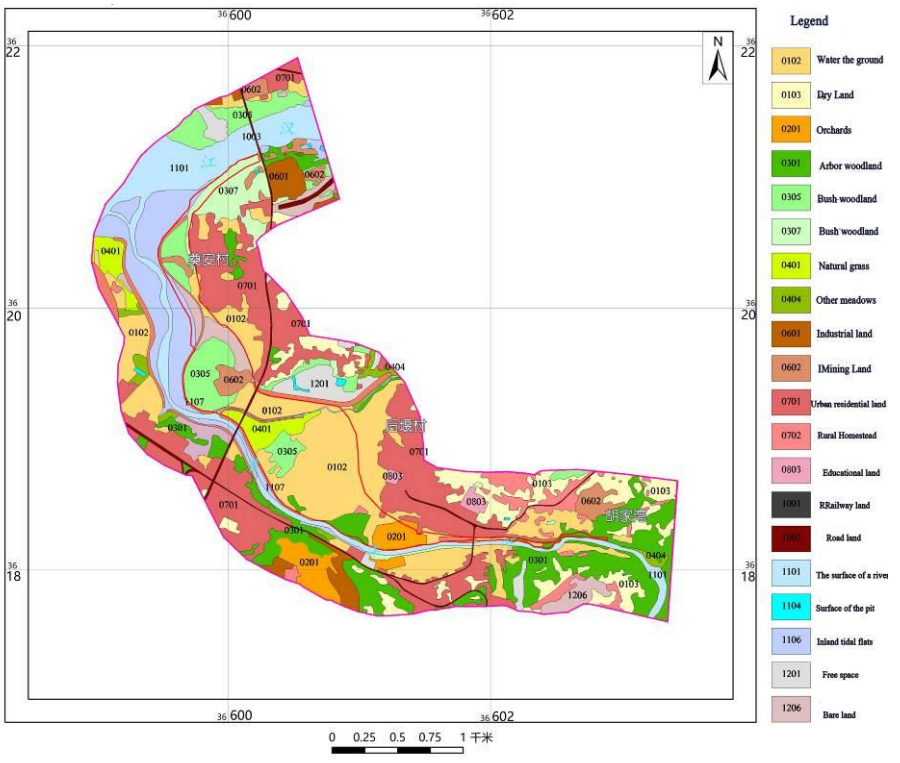


Figure 4.2-3 Map of Current Land Use in the Huangyang River Evaluation Area

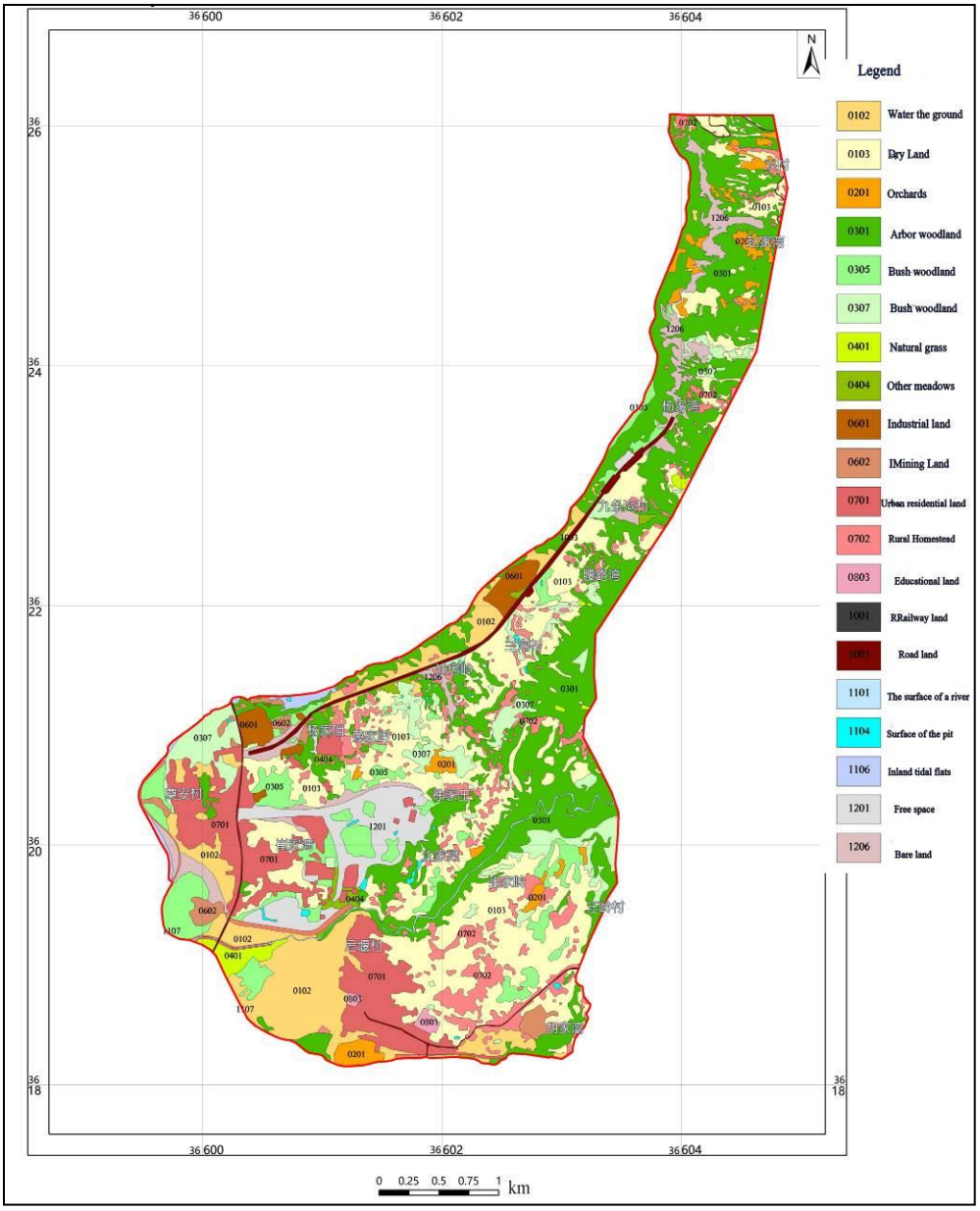


Figure 4.2-4 Map of Current Land Use in the Project Area

4.2.2.2 Soil erosion

According to the *Notice of the General Office of the Ministry of Water Resources on the Issuance of the Results of the Review and Delineation of State-Level Key Prevention Areas and Key Control Areas for Soil and Water Loss in the National Soil and Water Conservation Planning* (SLBBGTBSB [2013] No. 188), this area belongs to Ithe Shaanxi Key Control Area for Soil and Water Loss, which is I-6 the key control areas in the low hills and ridges around the Hanjiang River. The relationship between the location of the project site and the key area for the prevention and control of soil and water loss in Shaanxi Province is shown in Figure 4.2-5.

The classification of soil erosion intensity in the evaluation area is based on the regional soil erosion modulus. It is achieved through a comprehensive analysis using indirect indicators such as land use type, vegetation coverage, and ground slope, following the classification and grading system of soil erosion types and intensity in the *Technical Regulations for National Soil Erosion Remote Sensing Survey*. The soil erosion types in the evaluation area are divided into two categories: slight hydraulic erosion and mild hydraulic erosion. The statistical results of soil erosion types are shown in Table 4.2-3, and the current status of soil erosion is shown in Figures 4.2-6 to 4.2-7.

Table 4.2-3 Statistics of Soil Erosion Types in Hanjiang River Evaluation Area and Huangyang River Evaluation Area

Soil erosion types	Hanjiang River evaluation area		Huangyang River evaluation area	
	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)
Slight hydraulic erosion	1.6612	17.84	1.9967	24.35
Mild hydraulic erosion	4.5739	49.12	3.0594	37.31
Construction land	0.9007	9.67	2.3174	28.26
Road	0.3445	3.70	0.1163	1.42
Water body	1.8306	19.66	0.7109	8.67
Total	9.3109	100.00	8.2007	100.00

As shown in Table 4.2-3, the soil erosion intensity of Hanjiang River evaluation area is dominated by mild hydraulic erosion, with an area of 4.5739km^2, accounting for 49.12% of the appraisal scope; the area of water body is 1.8306km^2, accounting for 19.66% of the appraisal scope; the area of slight hydraulic erosion is 1.6612km^2, accounting for 17.84% of the appraisal scope; the area of construction land is 0.9007km^2, accounting for 9.67% of the appraisal scope; the road area is 0.3445km^2, accounting for 28.26% of the appraisal scope.

The soil erosion intensity of Huangyang River evaluation area is dominated by mild hydraulic erosion, with an area of 3.0594km^2, accounting for 37.31% of the appraisal scope; the area of construction land is 2.3174km^2, accounting for 28.26% of the appraisal scope; the area of slight hydraulic erosion is 1.9967km^2, accounting for 24.35% of the appraisal scope; the area of water body is 0.7109km^2, accounting for 8.67% of the appraisal scope; the area of roads is 0.1163km^2 , accounting for 1.42% of the appraisal scope.

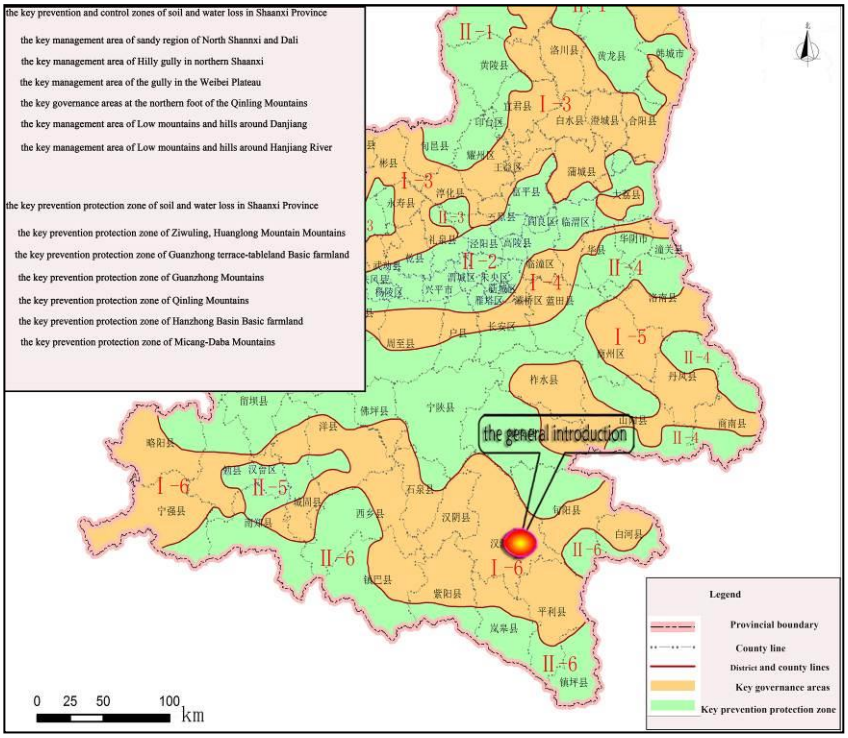


Figure 4.2-5 Relationship Diagram between the Project Site and the Key Area for the Prevention and Control of Soil and Water Loss in Shaanxi Province

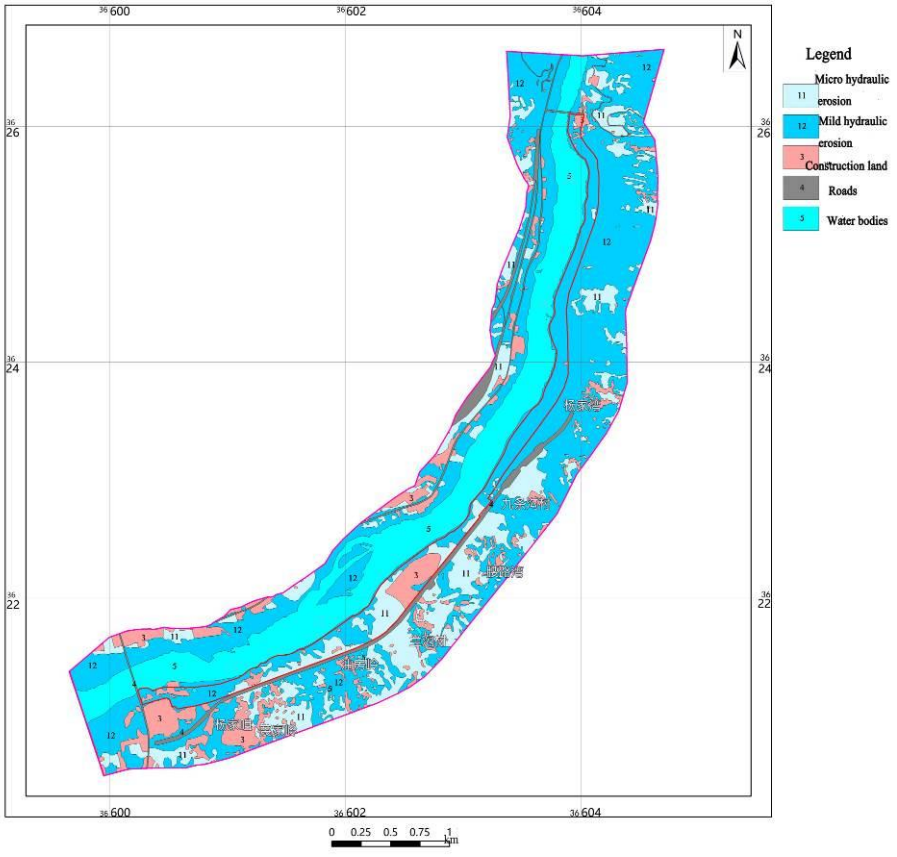


Figure 4.2-6 Soil Erosion Map of Hanjiang River Evaluation Area

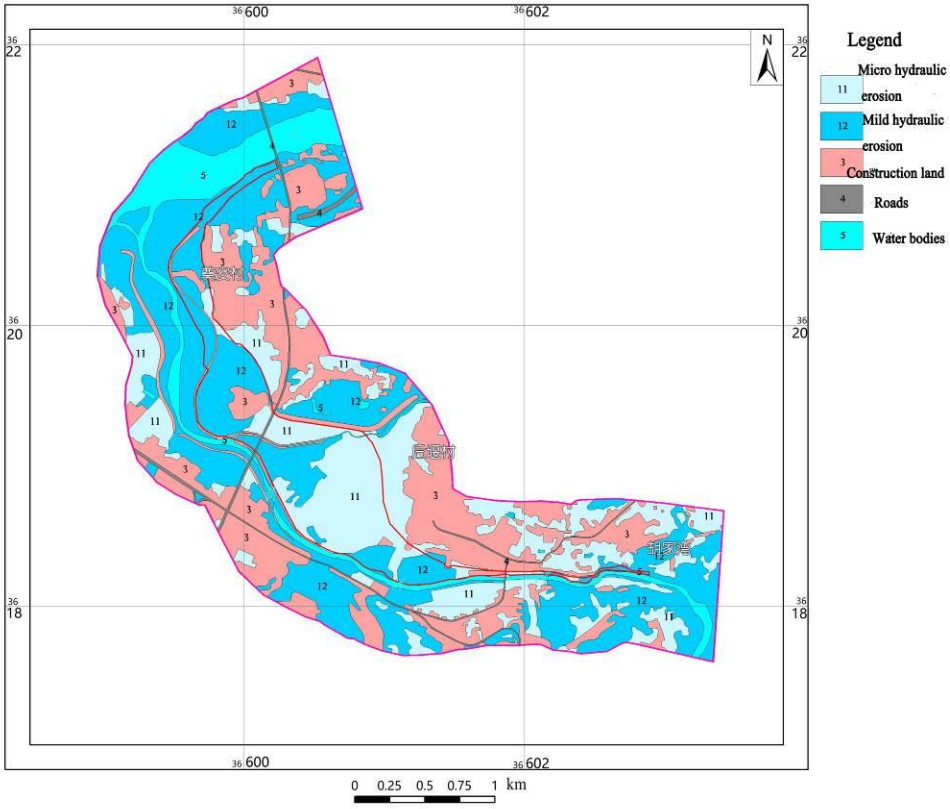


Figure 4.2-7 Soil Erosion Map of Huangyang River Evaluation Area

4.2.3 Current status of plant resources

4.2.3.1 Vegetation status survey

There are more than 2,000 economically valuable plant resources in Hanbin District, including more than 400 varieties of high-quality Chinese herbal medicines and about 30,000 tons of wild medicinal materials. It is therefore known as the "gene pool of natural biological resources", the "cradle of Chinese herbal medicine" and the "home of lacquer tree, gastrodia elata (rhizoma gastrodiae), jelly ear (auricularia auricula-judae) and Chinese galls (rhus chinensis)". The vegetation within the area is dominated by arable crops and arbor forest.

To objectively understand and comprehensively reflect the existing vegetation in the evaluation area of the Project, this ecological evaluation has conducted a field survey of the plants in the evaluation area by using quadrat and line transect sampling methods.

(1) Key protected plants

The Project adopts the line transect method combined with sample plot survey method to systematically investigate the vegetation of the evaluation area. A total of 319 species, 84 families and 238 genera of higher plants were surveyed. The dominant families are Rosaceae,

Asteraceae, Gramineae, Cruciferae, and Leguminosae. Among them, there is one species of national second-class protected wild plant in China, which is the wild soybean (Glycine soja).

Figure 4.2-8 Pictures of Wild Soybeans

Wild soybean (***Glycine soja*** Sieb. et Zucc.) is an annual twining herb of Glycine L. (Glycine Willd.) in the legume family (Leguminosae) and can grow to a height of 1-4m. The stems and branchlets are slender, and the entire plant is sparsely covered with long, brown, and stiff hairs. The leaf consists of three leaflets, which can grow up to 14cm long. The stipules are ovate-lanceolate, acute, and covered with yellowish soft hairs. The terminal leaflets are ovoid or ovate-lanceolate, measuring 3.5 to 6cm in length and 1.5 to 2.5cm in width. They have a sharp to obtuse-rounded apex and a nearly circular base. The leaves are smooth-edged and covered with silky rough hairs on both sides. The lateral leaves are obliquely ovate-lanceolate. The racemose inflorescence is usually short, occasionally reaching up to 13cm in length; the flowers are small, about 5mm long. The pedicels are densely covered with yellow, long, and stiff hairs. The bracts are lanceolate. The calyx is campanulate and densely hirsute, with 5 lobes that are triangular-lanceolate and have sharp apex. The corolla is pale reddish-purple or white; the standard petal is nearly circular, with a slightly concave apex; there is a short petiole at the base; the wings (or alae) are obliquely obovate with conspicuous ears, and the keel petal is smaller than the standard petals and wings, densely covered with long hairs; the stamen is short and bent to one side. The pod is oblong and slightly curved, with slightly flattened sides, measuring 17-23mm in length and 4-5mm in width. It is densely covered with long, stiff hairs, and the seeds are slightly shriveled and easily cracked when dry. There are 2-3 elliptical, slightly flattened seeds, measuring 2.5-4mm in length and 1.8-2.5mm in width,

ranging in color from brown to black. The flowering period is from July to August, and the fruiting period is from August to October.

It is spread throughout the country except Xinjiang, Qinghai and Hainan. Born in the sunny undergrowth or reed beds along the moist fields, gardens, ditches, riverbanks, lakesides, marshes, meadows, coasts, and islands at an altitude of 150~2650m, it is rarely found in the understory of sparse forests along riverbanks.

Table 4.2-4 Survey and Statistics Form of Protected Wild Plants

S/N	Species name (Chinese name)	Latin name	Protection level	Endangered category	Endemic species (Yes/No)	Extremely small population of wild plants (Yes/No)	Distribution area	Source	Occupancy of the Project (Yes/No)
1	Wild soybean	Glycine soja	National second-class protected wild plant	Least concern (LC)	Yes	No	It is spread throughout the country except Xinjiang, Qinghai and Hainan.	Field survey and data acquisition	Yes

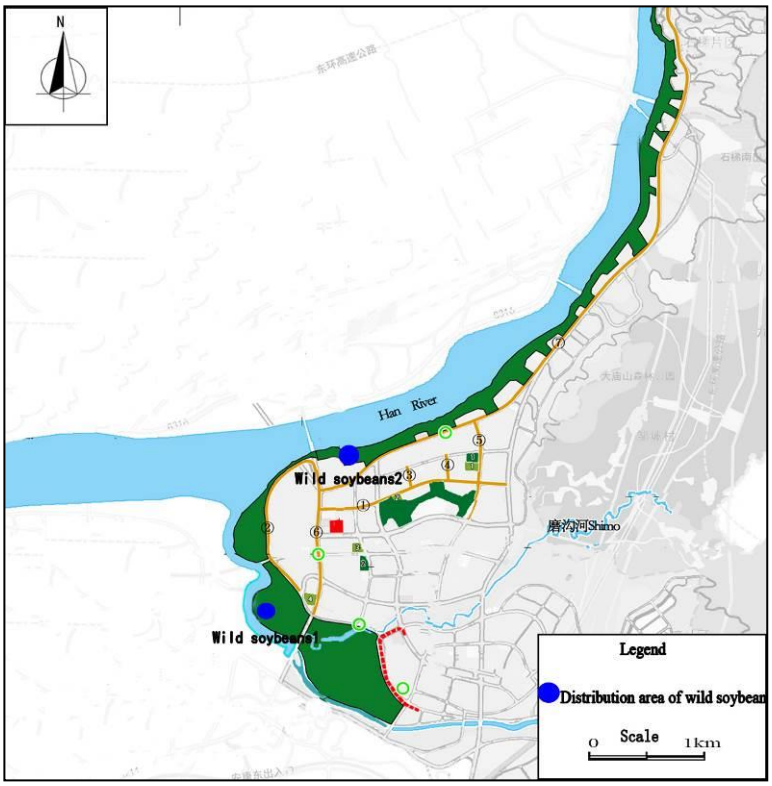


Figure 4.2-9 Distribution Map of Wild Soybeans during the Quadrat Sampling Survey

(2) Setting of quadrat and line transect

The current status of vegetation in the project area was surveyed, and the whole survey area was divided into forest ecosystems, farmland ecosystems, and riparian wetland ecosystems. Based on the current status of the survey area and the convenience analysis, the survey area is divided into three areas, namely: Area No. 1 (Huangyang River Water Environment Improvement and Ecological Park Project), Area No. 2 (Chengdong Sports Park in Ankang, Community Park, and Parking Lot, etc.) and Area No. 3 (Hanjiang River Riverside Ecological Green Corridor Project (Phase I).

1) Line transect setting

Combined with the actual topographical characteristics of the survey area of the Project, this survey is based on a systematic line transect survey of three areas. The range of line transect lengths involved in the three crossing points (calculated based on the longest side) is as follows:

Area No. 1: This area is a typical farmland ecosystem interspersed with plantation forests. It is mainly composed of herbaceous plants, followed by trees, and very few shrubs. The total length of the line transect is approximately 4km, with elevations ranging from 243 to 255m, and coordinates ranging from N32.6814, E109.0825 to N32.7048, E109.0687.

Area No. 2: This area is also a typical farmland ecosystem interspersed with plantation forests. It is mainly composed of herbaceous plants, followed by trees, and very few shrubs. The total length of the line transect is approximately 4.5km, with elevations ranging from 245 to 326m, and coordinates ranging from N32.6956, E109.0737 to N32.7056, E109.0879.

Area No. 3: This area is dominated by farmland ecosystem and deciduous broad-leaf forests. The total length of the line transect is approximately 7km, with elevations ranging from 269 to 243m, and coordinates ranging from N32.7509, E109.1140 to N32.7053, E109.0748.

2) Quadrat setting

According to the characteristics of the line transect, the sample plots were set based on the random sampling method. Quadrat sampling was surveyed for trees, shrubs and herbaceous plants distributed among them. See Figure 4.2-10 for the distribution of the sample points.

Area No. 1: This area is a typical farmland ecosystem interspersed with plantation forests. It is mainly composed of herbaceous plants, followed by trees, and very few shrubs. This area is

divided into 4 plots for trees, 1 plot for shrubs, and 18 plots for herbaceous plants. Photographs of the quadrats in Area No. 1 are shown in Table 4.2-5.

Table 4.2-5 Photographs of the Quadrats in Area No. 1

Area No. 2: This area is also a typical farmland ecosystem interspersed with plantation forests. It is mainly composed of herbaceous plants, followed by trees, and very few shrubs. The survey area was discrete in blocks, so each block was designated as a large sample plot. A total of seven large sample plots were established. Photographs of selected quadrats in Area No. 2 are shown in Table 4.2-6.




Table 4.2-6 Photographs of Quadrats in Area No. 2

Area No. 3: This area is dominated by farmland ecosystem and deciduous broad-leaf forests. A total of 16 large sample plots were randomly sampled in this area which was divided into 16 plots for trees, 16 plot for shrubs, and 16 plots for herbaceous plants. Photographs of the quadrats in Area No. 3 are shown in Table 4.2-7.

Table 4.2-7 Photographs of the Quadrats in Area No. 3

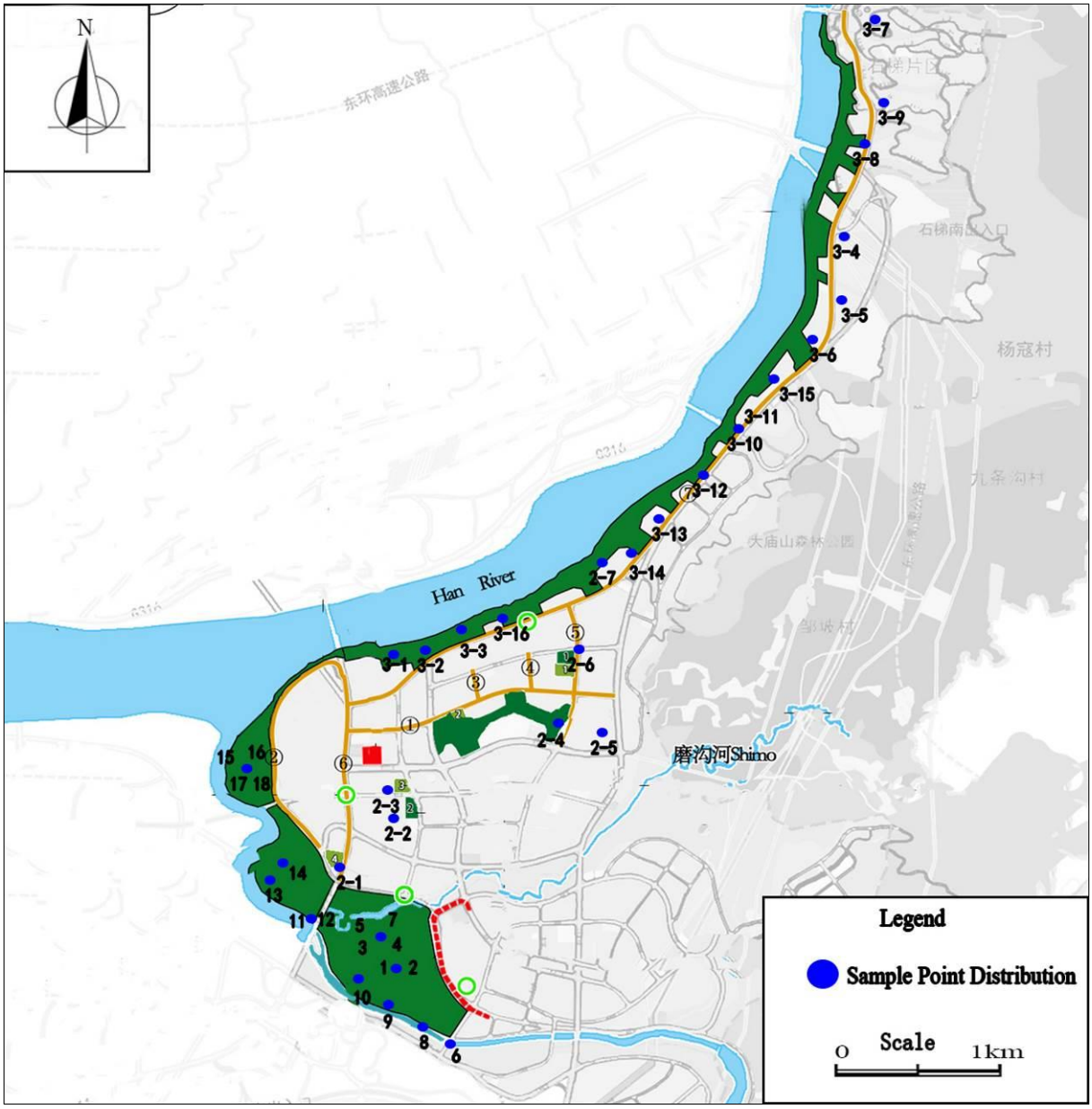


Figure 4.2-10 Distribution Map of the Sample Points

(3) Results of the plant diversity survey

The Project adopts the line transect method combined with sample plot survey method to systematically investigate the vegetation of the evaluation area. A total of 319 species, 84 families and 238 genera of higher plants were surveyed. Among the families with more than three species include Gramineae, Rosaceae, Asteraceae, Leguminosae, Cruciferae, Labiatae, Buttercups, Liliaceae, Polygonaceae, Cyperaceae, Euphorbiaceae, Rhamnaceae, Amaranthaceae, Rubiaceae, Solanaceae, Umbelliferae, Caryophyllaceae, Scrophulariaceae, Boraginaceae, Juglandaceae, Moraceae, and Salicaceae. The statistical results of quadrat are shown in Exhibit 1 - Exhibit 2.

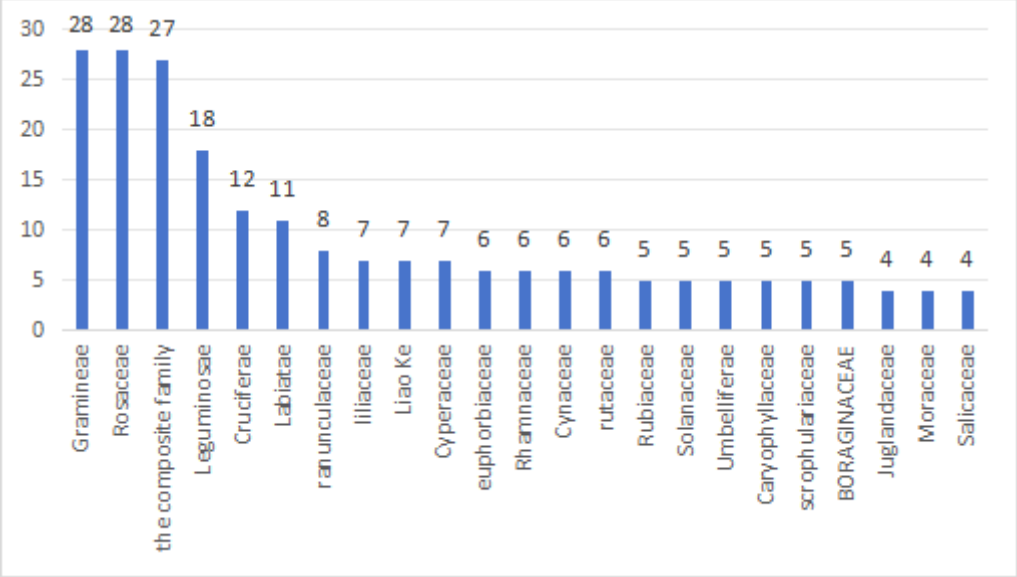


Figure 4.2-11 Statistical Results of the Species Counts for Family Category

1) Vegetation status and land use in Area No. 1

The vegetation type in the Area No. 1 is relatively homogeneous and is dominated by beach vegetation and farmland ecosystem. The beach vegetation is mainly composed of herbaceous plants; the farmland ecosystem is primarily focused on cultivated crops and vegetables, followed by cultivated trees for landscaping; the rest of the area is covered by farmland weeds. There are various woody plants such as metasequoia glyptostroboides, ginkgo, weeping willow, red leaf plum, photinia serrulata, citrus, loquat, plum and walnut. Shrubs are very rare, with occasional rubus corchorifolius. Herbaceous plants include oilseed rapes, leeks, Chinese cabbages, radish, wheat, water celery, Vicia sativa, wild oats and Juncus roemerianus. In total, there are 178 species, 57 families, and 145 genera. Among them, there is one species of national second-class protected wild plant in China, which is the wild soybean (Glycine soja). Exotic invasive plants include Avena fatua, conyza canadensis, Veronica persica, Aster subulatus, Lactuca serriola, Daucus carota, Pharbitis purpurea and

Oxalis corniculata. Exotic invasive plants have encroached upon the living environment and resources of native species, thereby reducing the biodiversity of the ecosystem.

2) Vegetation status and land use in Area No. 2

Land use type: farmland; vegetation type: artificial vegetation

This area is a typical farmland ecosystem and the construction area is plate-like, so the line transect method combined with large sample plot survey method was used for the survey. A total of 139 species, 52 families and 120 genera of higher plants were surveyed in this area. It is composed of crops, vegetables and economic forests such as loquat, citrus, lagerstroemia indica and gardenia communities.

3) Vegetation status and land use in Area No. 3

Land use type: planted woodland and farmland; vegetation type: deciduous broad-leaf forest and artificial vegetation.

This area mainly consists of plant communities composed of deciduous broad-leaved trees that shed their leaves in winter. For example, platycladus orientalis forest, bamboo forests, Rhus javanica L., Platycarya strobilacea, Ulmus pumila, Robinia pseudoacacia, weeping willow, and walnut.

4.2.3.2 Vegetation coverage

The vegetation coverage of the evaluation area is categorized into four classes based on the percentage of vegetation covering the ground surface, i.e., high vegetation coverage, medium-high vegetation coverage, medium vegetation coverage and low coverage. According to the remote sensing interpretation results of the Project: the statistical results of vegetation coverage are shown in Table 4.2-7, and the current status of vegetation coverage is shown in Figures 4.2-12 to 4.2-14.

Table 4.2-7 Statistics of Vegetation Coverage in Hanjiang River Evaluation Area, Huangyang River Evaluation Area, and Project Area

Vegetation coverage	Evaluation scope of the Hanjiang River		Evaluation scope of the Huangyang River		Project Area	
	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)
Cultivated vegetation	1.6612	17.84	1.9967	24.35	4.5886	30.53
High vegetation coverage	3.3064	35.51	1.3831	16.87	5.1394	34.19

Medium-high vegetation coverage	0.4448	4.78	0.4908	5.98	0.9387	6.25
Medium vegetation coverage	0.3632	3.90	0.7862	9.59	0.2674	1.78
Low vegetation coverage	0.4595	4.94	0.3993	4.87	1.0638	7.08
Construction land	0.9007	9.67	2.3174	28.26	2.7426	18.25
Road	0.3445	3.70	0.1163	1.42	0.2076	1.38
Water body	1.8306	19.66	0.7109	8.67	0.0836	0.56
Total	9.3109	100.00	8.2007	100.00	15.0317	100.00

As shown in Table 4.2-7, the area of high vegetation coverage in the Hanjiang River evaluation area is the largest, accounting for 35.51% of the total area of evaluation area. The other seven types, in descending order, are water body, cultivated vegetation, construction land, low vegetation coverage, medium-high vegetation coverage, medium vegetation coverage, and roads, accounting for 19.66%, 17.84%, 9.67%, 4.94%, 4.78%, 3.90%, and 3.70% of the total area of the evaluation area, respectively.

The area of construction land within the Huangyang River evaluation area is the largest, accounting for 28.26% of the total area of the evaluation area. The other seven types, in descending order, are cultivated vegetation, high vegetation coverage, medium vegetation coverage, water body, medium-high vegetation coverage, low vegetation coverage, and roads, accounting for 24.35%, 16.87%, 9.59%, 8.67%, 5.98%, 4.87% and 1.42% of the total area of the evaluation area, respectively.

The area of high vegetation coverage in the project area is the largest, accounting for 34.19% of the total area of evaluation area. The other seven types, in descending order, are cultivated vegetation, construction land, low vegetation coverage, medium-high vegetation coverage, medium vegetation coverage, roads and water body, accounting for 30.53%, 18.25%, 7.08%, 6.25%、1.78%, 1.38% and 0.56% of the total area of the evaluation area, respectively.

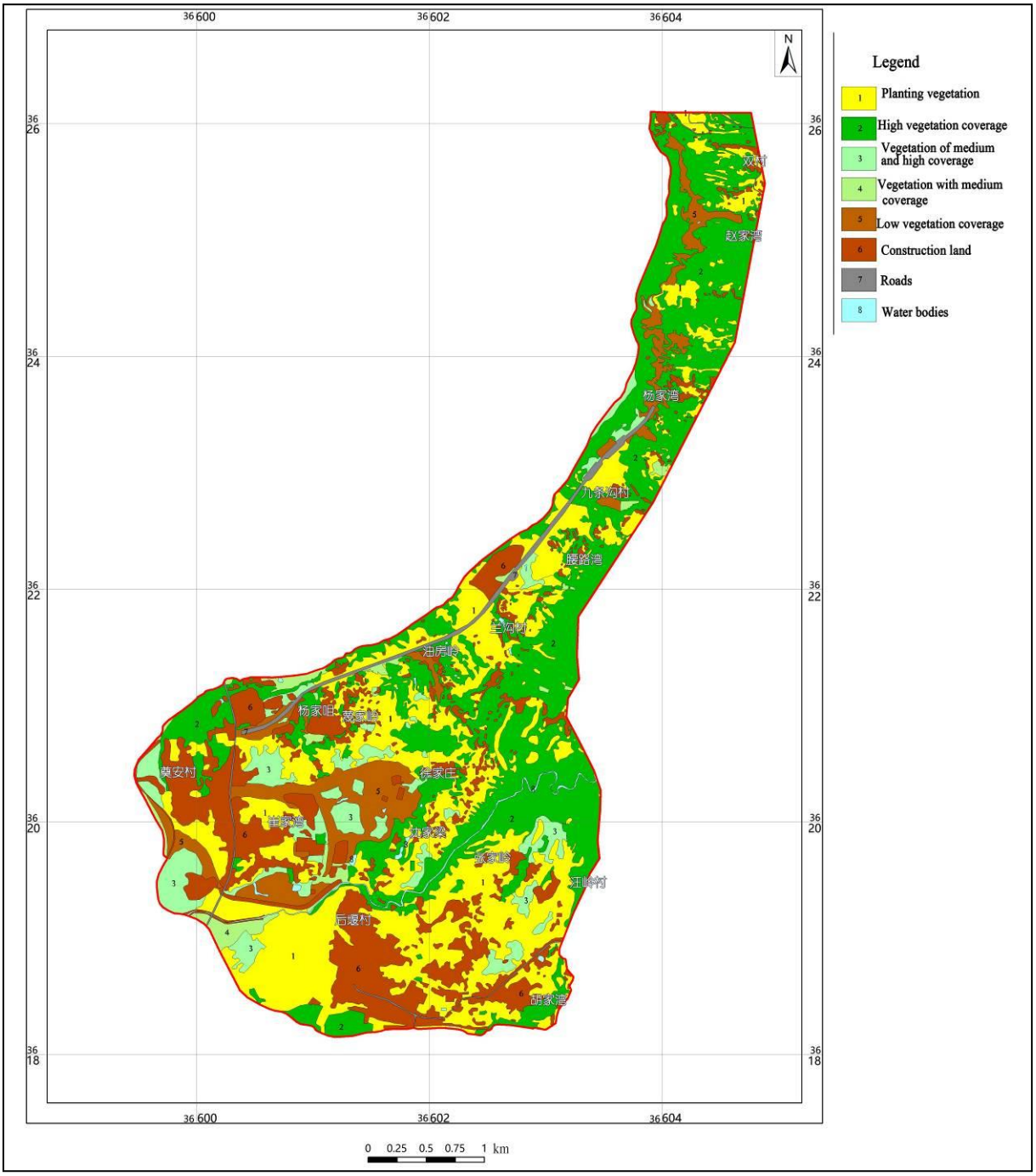


Figure 4.2-12 Distribution Map of Vegetation Coverage in the Project Area

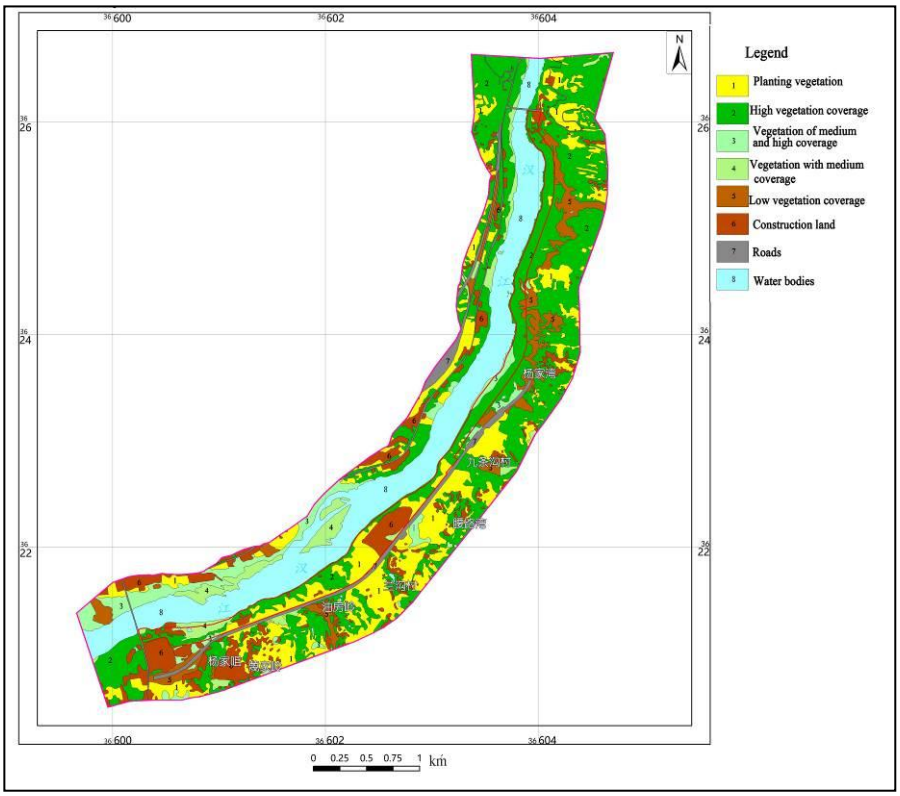


Figure 4.2-13 Distribution Map of Vegetation Coverage in the Hanjiang River Evaluation Area

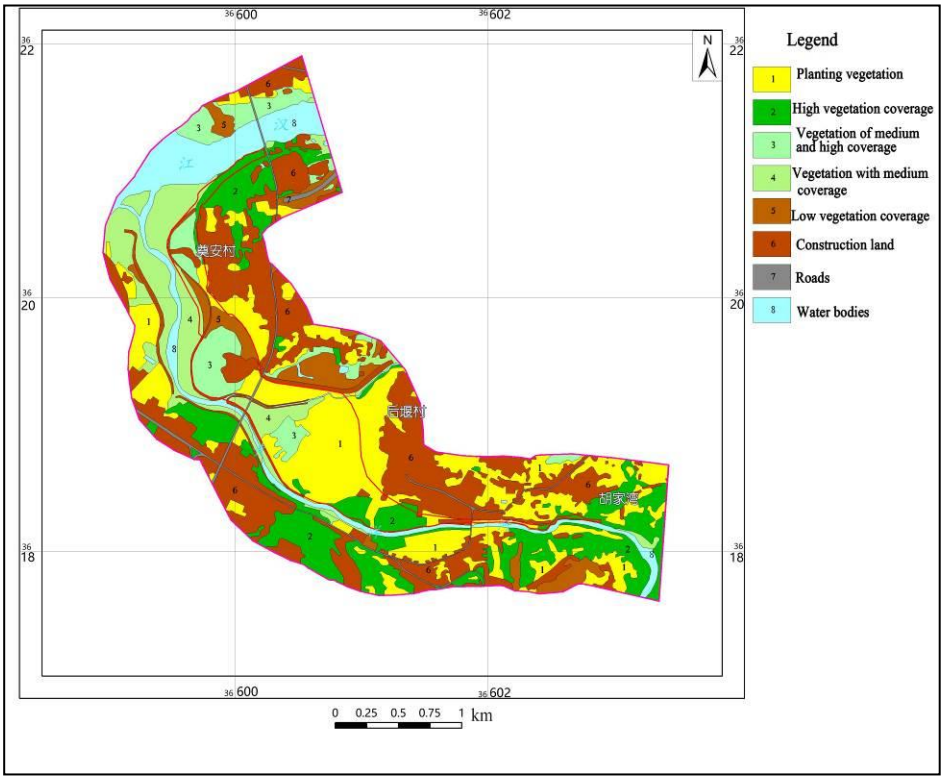


Figure 4.2-14 Distribution Map of Vegetation Coverage in the Huangyang River Evaluation Area

4.2.3.3 Vegetation types

The statistical results of vegetation type of the Project are shown in Table 4.2-8 and the vegetation type maps are shown in Figures 4.2-15 to 4.2-17.

Table 4.2-8 Statistics of Vegetation Type in Hanjiang River Evaluation Area, Huangyang River Evaluation Area, and Project Area

Vegetation types	Evaluation scope of the Hanjiang River		Evaluation scope of the Huangyang River		Project Area	
	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)
Cultivated vegetation	1.6612	17.84	1.9967	24.35	4.58.86	30.53
Arbor forest	3.3064	35.51	1.3831	16.87	5.1394	34.19
Shrubland	0.4448	4.78	0.4908	5.98	0.9387	6.25
Tussock	0.3632	3.90	0.7862	9.59	0.2674	1.78
Sparsely vegetated land	0.0659	0.71	0.1899	2.32	0.5522	3.67
Unvegetated land	0.3936	4.23	0.2094	2.55	0.5116	3.40
Construction land	0.9007	9.67	2.3174	28.26	2.7426	18.25
Road	0.3445	3.70	0.1163	1.42	0.2076	1.38
Water body	1.8306	19.66	0.7109	8.67	0.0836	0.56
Total	9.3109	100.00	8.2007	100.00	15.0317	100.00

From the above table, it can be seen that: the area of arbor forest within the evaluation area of Hanjiang River is the largest, accounting for 35.51% of the evaluation area range. The other eight types, in descending order, are water body, cultivated vegetation, construction land, shrubland, unvegetated land, tussock, roads, and sparsely vegetated land, accounting for 19.66%, 17.84%, 9.67%, 4.78%, 4.23%, 3.90%, 3.70%, and 0.71% of the total area of the evaluation area, respectively.

The area of construction land within the evaluation scope of Huangyang River is the largest, accounting for 28.26% of the evaluation area range. The other eight types, in descending order, are cultivated vegetation, arbor forest, tussock, water body, shrubland, unvegetated land, sparsely vegetated land and roads, accounting for 24.35%, 16.87%, 9.59%, 8.67%, 5.98%, 2.55%, 2.32% and 1.42% of the total area of the evaluation area, respectively.

The area of arbor forest in the project area is the largest, accounting for 34.19% of the evaluation area range. The other eight types, in descending order, are cultivated vegetation, construction land, shrubland, sparsely vegetated land, unvegetated land, tussock, roads and water body, accounting for 30.53%, 18.25%, 6.25%, 3.67%, 3.40%, 1.78%, 1.38% and 0.56% of the total area of the evaluation area, respectively.

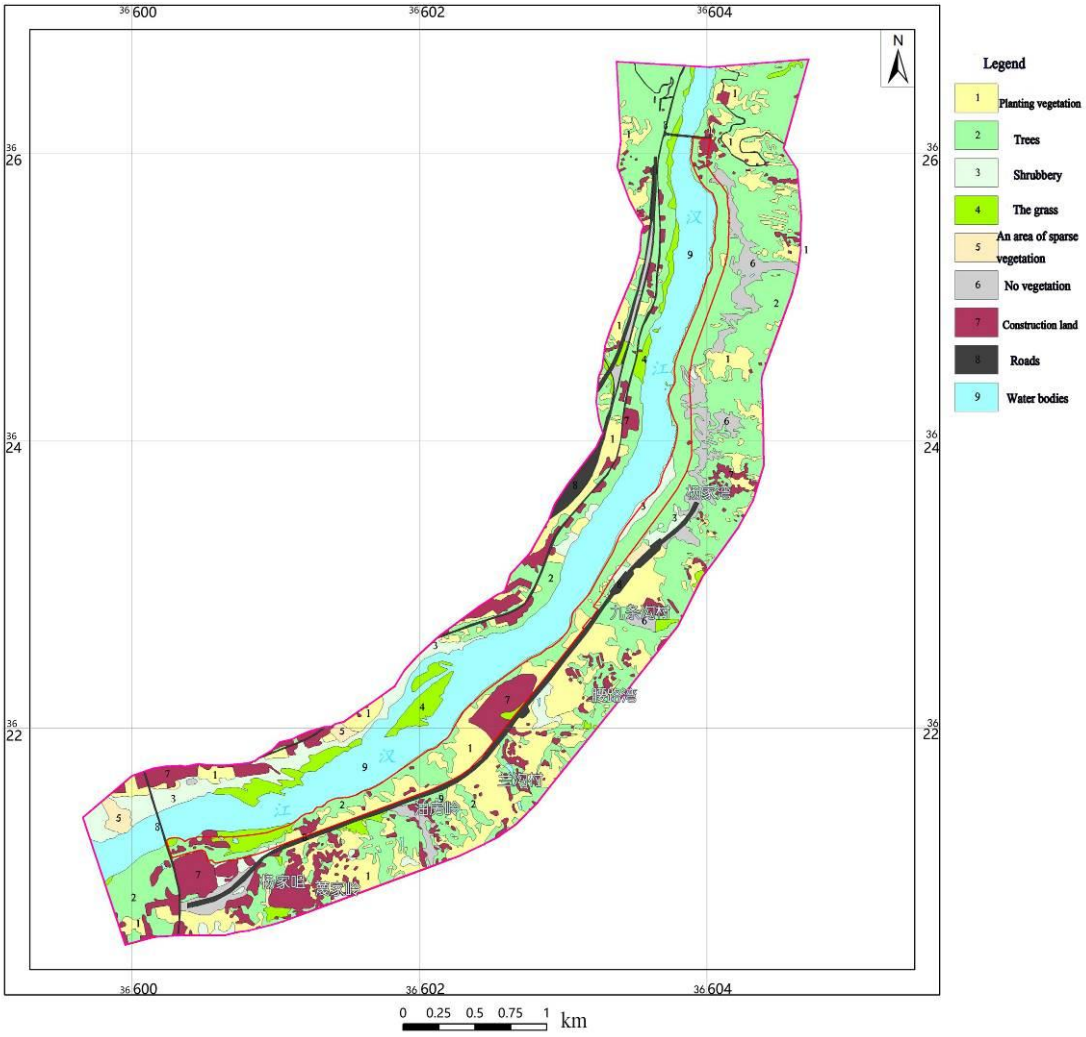


Figure 4.2-15 Distribution Map of Vegetation Types in the Hanjiang River

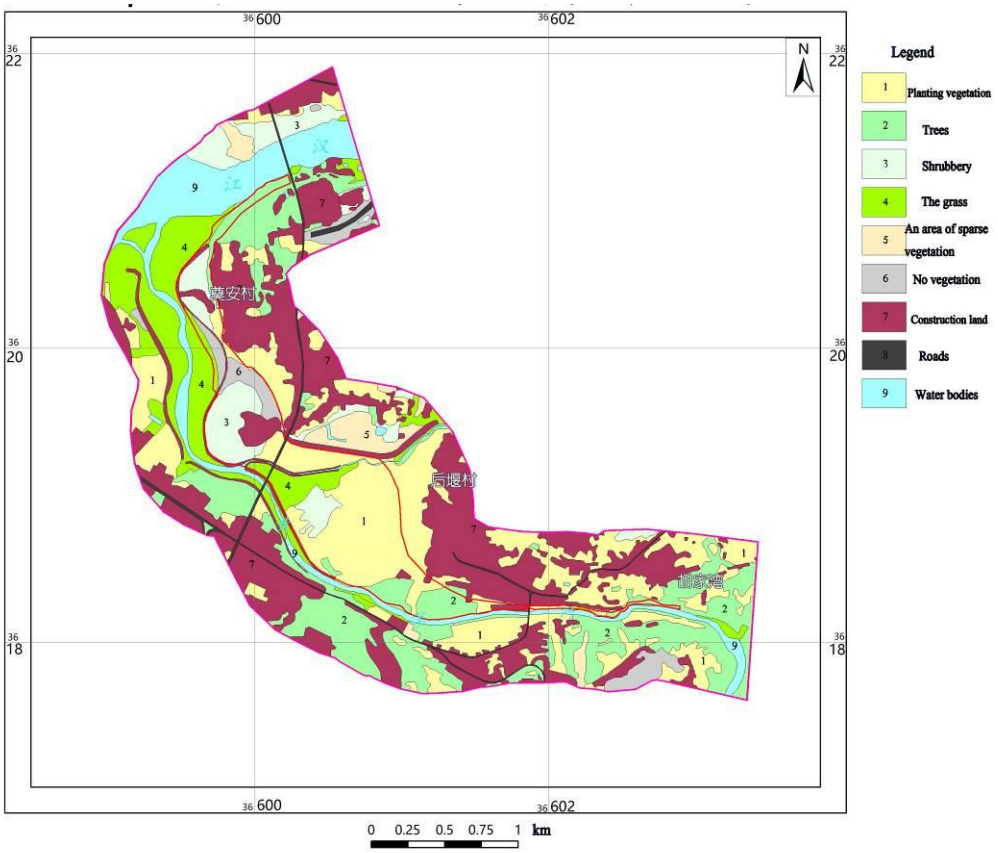


Figure 4.2-16 Distribution Map of Vegetation Types in the Huangyang River

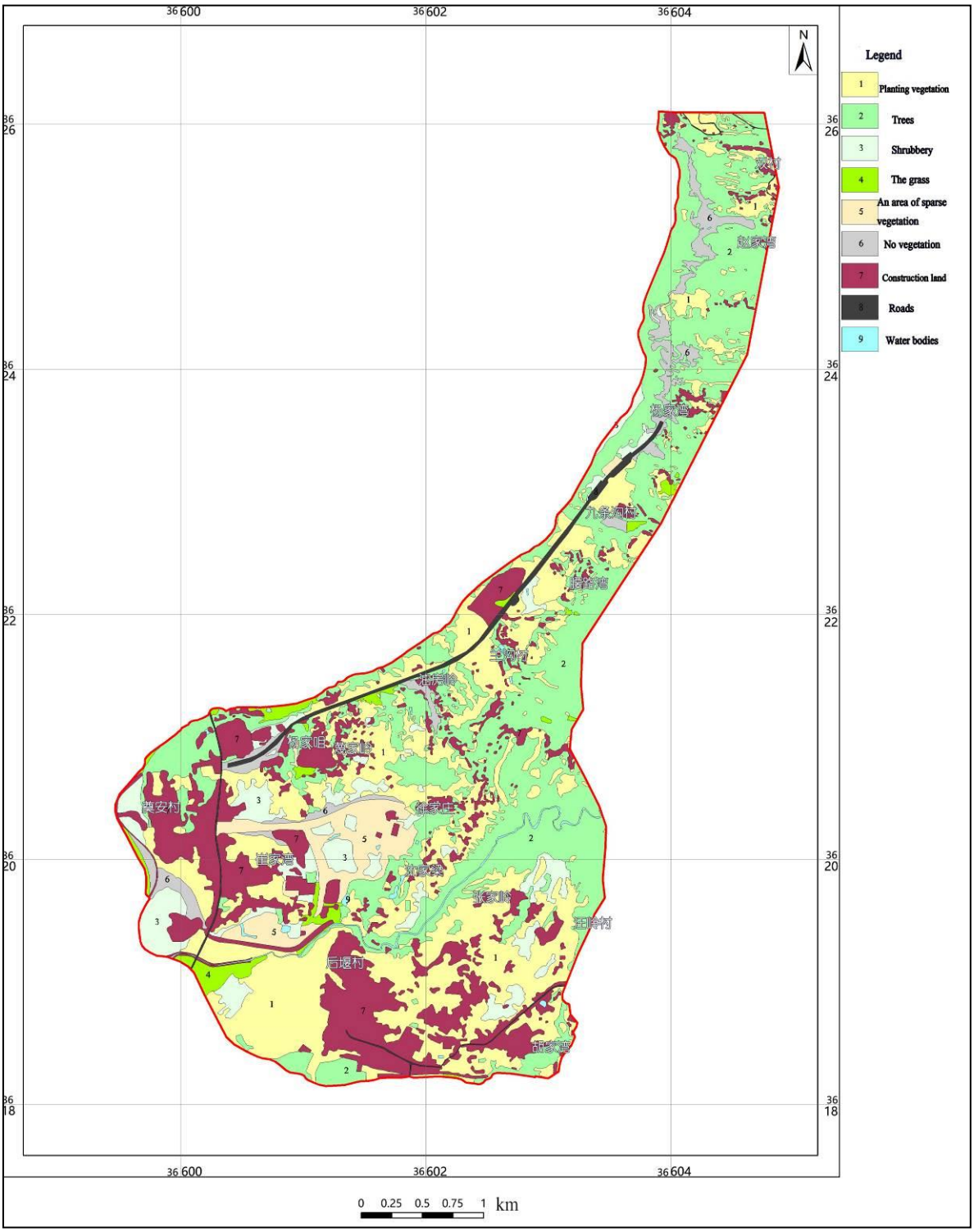


Figure 4.2-17 Distribution Map of Vegetation Types in the Project Area

4.2.4 Animal resources

4.2.4.1 Animal survey methods

To objectively understand and comprehensively reflect the existing animal in the evaluation area, this ecological evaluation adopts three methods including access to relevant information, interview survey and field survey to investigate the animals in the evaluation area.

(1) Access to relevant information

According to *Land and Resources of Ankang City*: Ankang City is home to 430 known species of wildlife, ranking first in Shaanxi. Among them, there are 296 species of birds, accounting for 77.49% of the total bird species in Shaanxi and 24.96% of the total bird species in China; there are 98 species of beasts, accounting for 69.5% of the 141 species in Shaanxi and 23.3% of the total species of beasts in China; there are also 36 species of amphibians and reptiles, accounting for 87.8% of total species in Shaanxi and 7.1% of the total species in China.

(2) Interview survey

Through communication with local farmers with field experience and local village committees, it has been determined that there are animals such as grass carp, Rana chensinensis, egrets, sparrows, magpies, barn swallows, mus musculus, Mustela sibirica, hedgehogs, and Lepus capensis lmnaeus within the ecological evaluation scope of the construction project.

(3) Field survey

According to the *Technical Guidelines for Environmental Impact Assessment - Ecological Impact* (HJ19-2022), this field survey included point count method, line transect method, quadrat sampling method and direct counting method.

1) Point count method

The point count method is mainly used for bird and fish surveys.

Point count method for birds: A certain number of sampling points are evenly set up within the survey sample area, and each sampling point is used as the center point to count the species and quantities of birds within a certain radius area, so as to estimate the composition and habitat condition of birds within the survey area. The radius of the sampling point in the riverside survey area should be within 200m, and the radius of the sampling point in the residential and farmland area should be 50m. The specific range can be determined based on the habitat types on site.

Point count method for fish: According to the water system of the project area, no less than five sampling points were set up at appropriate locations along the river, and fishing gears such as cast nets, fish cages, hand nets, and electric fishing were used to collect specimens of wild fish. The basic catches was counted, and individual identification was conducted. At the same time, the survey was centered on the project area and extended upstream and downstream by 2km.

The necessary procedures, such as obtaining fishing permits, should be completed with the relevant authorities before the fish survey is carried out. Fish should be sampled in sufficient quantities but as few as possible. Except for necessary specimens, the remaining individuals should be released. During the field surveys and collection of fish, video recording and photographing should be conducted as supplementary means for analyzing the survey results.

2) Line transect method

The line transect method is used for most mammals and birds in open habitats.

Set up the survey line transects in different habitats within the survey area as relatively independent territories to carry out field surveys. The survey line transects should be randomly distributed but their feasibility should be taken into consideration. When encountering animals or their traces, record information such as the name of the animal, type of animal trace, quantity, geographical location, and interfering factors The recommended length for the line transect is 2km. The width of the line transect on one side depends on the habitat type and the subject of the survey. In general, for amphibians and reptiles, it is 2~5m, for birds, it is 100~500m, and for mammals, it is 200~1000m.

3) Quadrat sampling method

The quadrat sampling method is used for reptiles and amphibians. The survey season is mainly focused on the summer.

Several quadrats are randomly distributed within the survey area. At least four people simultaneously walk towards the center of each quadrat from the four sides, carefully searching and recording the names and quantities of the animals found. By counting the number of animals in each quadrat, an estimate of the total number of animals in the entire survey area is made. The size and shape of the quadrat are determined based on the range of activities, ecological habits, and habitat types of wild animals.

4) Direct counting method

The direct counting method is used for mammals and birds that reproduce or inhabit in clusters. The survey season is focused on the spring and winter.

First, determine the time, location, and scope of the animal population by interview survey, accessing historical data and other sources. Then, mark these details on a map. During the investigation of animal population, record information such as the location of the animal population, the species of animals and their quantities.

4.2.4.2 Animal survey results

(1) Current status of fish resources

Due to the fishing ban in the Yangtze River, this survey mainly focused on gathering information about fish species. In the project area, we randomly set up eight observation points. The river water was found to be clear and no trash or other floating materials were seen. In the project area, there are a total of 33 species of fish belonging to 3 orders and 6 families. Among them, there are 20 species from the Cyprinidae, accounting for 60.6%; 7 species from the Bagridae, accounting for 21.2%; 2 species from the Cobitidae, accounting for 6.06%; 2 species from the Siluridae, each accounting for 6.06%; and 1 specie from the Serranidae and 1 specie from Synbranchidae, each accounting for 6.06%. Please refer to Table 4.2-9.

Table 4.2-9 Fish Resources in the Survey Area

S/N	Order	Family	Species
1	Cypriniformes	Cobitidae	Cobitis sinensis
2			Loach
3		Cyprinidae	Grass carp
4			Rhynchocypris lagowskii
5			Elopichthys bambusa
6			Xenocypris davidi
7			Distoechodon tumirostris
8			Hypophthalmichthys nobilis
9			Hypophthalmichthys moritrix
10			Pseudolaubuca sinensis
11			Hemiculter bleekeri
12			Hemiculter leucisculus
13			Megalobrama terminalis
14			Erythroculter mongolicus
15			Parabramis pekinensis
16			Pseudorasbora parva
17			Gnathopogon argentatus
18			Gnathopogon wolterstorffi

S/N	Order	Family	Species
19			Saurogobio dabryi
20			Saurogobio dumerili
21			Carp
22			Crucian carp
23		Siluridae	Catfish
24			Silurus meridionalis Chen
25		Bagridae	Pelteobagrus fulvidraco
26			Pelteobagrus vachelli
27			Pseudobagrus nitidus
28			Leiocassis crassilabris
29			Wallago attu
30			Pseudobagrus tenuis
31			Mystus macropterus
32	Synbranchiformes	Synbranchidae	Monopterus albus
33	Perciformes	Serranidae	Siniperca scherzeri

(2) Current status of amphibian resources

Since the project area is mainly dominated by farmland ecosystems (85% of the survey area), amphibians are distributed only along the river, the banks of the Huangyang River, and near the water network within the farmland. A total of five species of amphibians belonging to one order and three families were found in this survey area. Specific species are listed in Table 4.2-10. A total of five species of amphibians belonging to one order and three families were counted in this survey area.

Table 4.2-10 Amphibian Resources in the Survey Area

S/N	Order	Family	Species
1	Anura	Bufonidae	Bufo gargarizans (with ecological, scientific, social values)
2		Dicroglossidae	Fejervarya multistriat
3			Rana quadranus
4		Ranidae	Pelophylax nigromaculata
5			Rana chensinensis

(3) Current status of reptile resources

The project area is located near the main urban area of Ankang. Due to frequent human activities, there are 11 species of reptiles belonging to 3 orders and 6 families in the project area. Please refer to Table 4.2-11 for specific species.

Table 4.2-11 Reptile Resources in the Survey Area

S/N	Order	Family	Species
1	Testudines	Emydidae	Turtle
2		Trionychidae	Chinese soft-shell turtle
3	Squamata	Agamidae	Japalura flaviceps
4		Scincidae	Eumeces capito
5		Lacertidae	Sphenomorphus indicus
6		Megapodiidae	Dinodon rufozonatum
7			Elaphe carinata
8			Elaphe taeniura
9			Rhabdophis tigrinus
10			Entechinus major
11			Zaocys dhumnades

(4) Current status of birds resources

Birds were one of the focuses of this survey. A total of 36 bird survey sites were set up along 3 line transects. A total of 79 species in 14 orders and 33 families were recorded in this survey. Rare species are mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo and falco tinnunculus,

and they are all national second-class protected animals. Specific species are listed in Table 4.2-12.

Table 4.2-12 Bird Resources in the Survey Area

S/N	Order	Family	Species	IUCN	National class
1	Pelecaniformes	Ardeidae	Botaurus stellaris	LC	
2			Heron	LC	
3			Egretta alba	LC	
4			Egretta intermedia	LC	
5			Aigrette	LC	
6	Accipitriformes	Accipitridae	Sparrow hawk	LC	National second-class protected
7			Accipiter soloensis	LC	National second-class protected
8			Buteo buteo	LC	National second-class protected

S/N	Order	Family	Species	IUCN	National class
9	Falconiformes	Falconidae	Falco tinnunculus	LC	National second-class protected
10			Peregrine falcon	LC	
11	Galliformes	Phasianidae	Phasianus colchicus	LC	
12	Anseriformes	Anatidae	Mandarin ducks	LC	National second-class protected
13			Anas platyrhynchos	LC	
14			Anas poecilorhyncha	LC	
15			Anas crecca	LC	
16	Gruiformes	Rallidae	Gallinula chloropus	LC	
17			Fulica atra	LC	
18	Charadriiformes	Recurvirostridae	Himantopus himantopus	LC	
19		Charadriidae	Charadrius dubius	LC	
20			Vanellus cinereus	LC	
21		Scolopacidae	Tringa ochropus	LC	
22			Calidris temminckii	LC	
23	Columbiformes	Columbidae	Streptopelia orientalis	LC	
24			Streptopelia decaocto	LC	
25			Spilopelia chinensis	LC	
26	Cuculiformes	Cuculidae	Cuculus canorus	LC	
27			Cuculus poliocephalus	LC	
28			Eudynamys scolopacea	LC	
29	Podicipediformes	Podicedidae	Little grebes	LC	
30			Podiceps cristatus	LC	
31	Coraciiformes	Alcedinidae	Ceryle lugubris	LC	
32			Alcedo atthis	LC	
33	Bucerotiformes	Upupidae	Upupa epops	LC	
34	Piciformes	Picidae	Picus canus	LC	
35			Dendrocopos major	LC	
36	Passeriformes	Hirundinidae	Barn swallow	LC	
28			Hirundo daurica	LC	
39		Motacillidae	Motacilla alba	LC	
40			Motacilla cinerea	LC	
41			Motacilla flava	LC	
42			Motacilla citreola	LC	
43		Campephagidae	Pericrocotus	LC	

S/N	Order	Family	Species	IUCN	National class
			ethologus		
44		Pycnonotidae	Spizixos semitorques	LC	
45			Pycnonotus xanthorrhous	LC	
46			Pycnonotus sinensis	LC	
47			Hypsipetes mcclellandii	LC	
48		Laniidae	Lanius schach	LC	
49		Corvidae	Cyanopica cyana	LC	
50			Urocissa erythrorhyncha	LC	
51			Picapica	LC	
52			Corvus torquatus	VU	
53		Muscicapidae	Tarsiger cyanurus	LC	
54			Phoenicurus ochruros	LC	
55			Phoenicurus auroreus	LC	
56			Rhyacornis fuliginosus	LC	
57			Enicurus scouleri	LC	
58			Enicurus leschenaulti	LC	
59		Leiothrichidae	Garrulax pectoralis	LC	
60			Garrulax sannio	LC	
61			Garrulax elliotii	LC	
62		Sylviidae	Pteruthius xanthochlorus	LC	
63		Sylviidae	Paradoxornis webbianus	LC	
64		Cettiidae	Cettia fortipes	LC	
65		Phylloscopidae	Phylloscopus inornatus	LC	
66			Phylloscopus proregulus	LC	
67			Phylloscopus trochiloides	LC	
68		Paridae	Parus major	LC	
69			Parus monticolus	LC	
70			Parus venustulus	LC	
71		Aegithalidae	Aegithalos concinnus	LC	
72		Sittidae	Sittaeuropaea	LC	
73		Zosteropidae	Zosteropsjaponica	LC	
74			Yuhina diademata	LC	

S/N	Order	Family	Species	IUCN	National class
75		Fringillidae	Sparrow	LC	
76			Passer rutilans	LC	
77		Emberizidae	Emberiza cioides	LC	
78			Emberiza elegans	LC	
79			Emberiza pusilla	LC	

Note: IUCN is the abbreviation for the International Union for Conservation of Nature. Produced by the Species Survival Commission (SSC) in collaboration with several species assessment organizations, it assesses the risk of extinction for thousands of species each year, assigning species to nine different conservation levels: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not evaluated (NE). In this survey, only the Corvus torquatus is classified as a vulnerable species.

(5) Current status of beasts resources

There are 43 species of beasts in 6 orders and 14 families in the survey area. Of these, the Eulipotyphla and Rodentia are predominant. Rare species are the yellow-throated marten and Felis bengalensis, which are national second-class protected animal. Specific species are listed in Table 4.2-13.

Table 4.2-13 Beasts Resources in the Survey Area

S/N	Order	Family	**Species**	Degree of protection
1	Eulipotyphla	Erinaceidae	Mesechinus hughi	
2		Talpidae	Talpalongirostris	
3			Scapanulus oweni	
4			Uropsilus gracilis	
5			Uropsilus soricipes	
6			Scaptochirus moschata	
7		Soricidae	Sorex cylindricauda	
8			Sorex bedfordiae	
9			Blarinella quadraticauda	
10			Anourosorex squamipes	
11			Soriculus salenskii	
12	Chiroptera	Rhinolophidae	Rhinolophus ferrumequinum	
13			Rhinolophus sinicus	
14		Vespertilionidae	Nyctalus plancyi	
15			Pipistrellus abramus	
16			Murina leucogaster	
17			Eptesicus fuscus	
18	Carnivora	Mustelidae	Yellow-throated marten	National second-class protected

S/N	Order	Family	**Species**	Degree of protection
19			Mustela sibirica	
20			Mustela kathiah	
21		Felidae	Felis bengalensis	National second-class protected
22	Artiodactyla	Suidae	Sus scrofa	
23		Sciuridae	Sciurotamias davidianus	
24			Tamias sibiricus	
25		Cricetidae	Tscherskia triton	
26			Cansumys canus	
27			Microtus oeconomus	
28			Microtus fortis	
29	Rodentia	Muridae	Vernaya fulva	
30			Mus musculus	
31			Micromys minutus	
32			Apodemus draco	
33			Apodemus peninsulae	
34			Apodemus agrarius	
35			Rattus flavipectus	
36			Rattus norvegicus	
37			Rattus fulvescens	
38			Niviventer confucianus	
39			Niviventer andersoni	
40			Rattus edwardsi	
41		Spalacidae	Myospalax rufecens	
42	Lagomorpha	Ochotonidae	Ochotona thibetana	
43		Leporidae	Lepus capensis lmnaeus	

4.2.4.3 Key protected animals

According to the *List of National Key Protected Wild Animals (2021)*, the *List of Local Key Protected Animals of Shaanxi Province* and the *List of Terrestrial Wildlife with Important Ecological, Scientific and Social Values,* during the line transect survey for animals, the following species were found: mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten and Felis bengalensis, which are all national second-class protected wild animals. Additionally, the Elaphe carinata and Corvus torquatus are two "three-have" (with ecological, scientific and social values) protected animals, in which the Elaphe carinata is also a locally protected animal in Shaanxi Province.

Among them, mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten, Felis bengalensis, and Elaphe carinata are listed as the species of Least concern (LC) in 2021 on the International Union for Conservation of Nature Red List of Threatened Species, and the Corvus torquatus is classified as the species of Vulnerable (VU).

The Corvus torquatus is a member of the order Passeriformes in the family Corvidaea. It is commonly found in the forests and shrubs of low hills, foothills, and plains. It forages in the fields in the early morning and flies back to nearby villages or trees on the edge of the forest to roost in the evening. It mainly feeds on small animals such as locusts, mole crickets, beetles, caterpillars, snails, frogs, lizards, as well as crops, plant seeds, garbage, and carrion. During the line transect survey for animals, investigators found Corvus torquatus in the farmland near the village, but no Corvus torquatus nests were found at the proposed project site. Therefore, the implementation of the Project has no impact on it.

Mandarin ducks are migratory birds, so in local surveys, they are considered as passing birds. Four species of hawks and falcons, including the sparrow hawks, Accipiter soloensis, Buteo buteo and falco tinnunculus, primarily feed on field mice. The yellow-throated marten and the Felis bengalensis, two species of beasts, mainly inhabit the farmland ecosystem. In local surveys, the habitats of sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten and Felis bengalensis are located far away from the project area.

According to the *Law of the People's Republic of China on the Protection of Wildlife* (implemented on May 1, 2023), the State requires that the wildlife under key national protection and terrestrial animals protected by the state that have important ecological, scientific or social value should be protected in accordance with the following.

(1) It is prohibited to hunt, or to engage in other activities obstructing the lives and breeding of wildlife, in nature preserves or within areas forbidding hunting (fishing) or during periods when hunting (fishing) is prohibited, except as otherwise provided by laws and regulations;

(2) The hunting or killing of wildlife under national key protection is prohibited;

(3) It is prohibited to consume wildlife under key national protection and terrestrial animals protected by the state that have important ecological, scientific or social value, and other terrestrial wildlife.

4.2.5 Current status of riparian zone ecological environment

(1) There is no canalization, nor does the agricultural cultivation occupy the riparian zone

In the riparian zone of Huangyang River and Hanjiang River, there is no canalization, nor does the agricultural cultivation occupy ecological space of the riparian zone. Only two rivers, the Huangyang River and the Hanjiang River, have the farmland-type riparian zones. Monitoring data from the Laojunguan section, the nationally assessed section in the mains tream of the Hanjiang River, and the section where the Huangyang River, a tributary of the Hanjiang River,

flows into the Hanjiang River over the past five years show that both the Hanjiang River and the Huangyang River meet the Class II water quality standards in the *Environmental Quality Standards for Surface Water* (GB3838-2002). The data are relatively stable and there has been no deterioration in the water quality of the rivers.

Farmland-type riparian zone of the Mogou River (a tributary of the Huangyang River)

Farmland-type riparian zone of the Huangyang River

Farmland-type riparian zone of the Hanjiang River

(2) Other types of riparian zones

The riparian zones of the Huangyang and Hanjiang rivers also include embankment-type and village-type riparian zones.

1) Embankment type: It allows for vegetation restoration and interception of surface runoff from the upstream land area in the buffer zone while preserving the embankment.

2) Village type: It is capable of runoff interception and vegetation restoration.

(3) Agricultural non-point source pollution

Based on the on-site investigation, there are some cultivated lands within the riparian zones of the Huangyang River and the Hanjiang River. The rapeseed and corn are the main crops grown on the cultivated lands. During the planting period, moderate fertilization is carried out based on the growth and development of the seedlings and different growth stages, and spraying pesticides effectively prevents damage to the rapeseed caused by pests.

Agricultural pollution is caused by the contamination of surface waters with pollutants carried

by rainfall runoff. For example, fertilizers and pesticides enter water bodies with surface runoff, which affect water quality.

Protective measures: Farmers should apply fertilizers and pesticides scientifically, using farmyard manure, new types of organic fertilizers and biopesticides, or high-efficiency, low-toxicity and low-residue pesticides. It is important to actively promote technologies such as organic fertilization, the return of crop straw to the soil, slow and controlled release fertilizers, formula fertilization, and green integrated pest control and prevention techniques, in order to reduce environmental pollution caused by overuse of fertilizers and misuse of pesticides.

(4) Current state of the slope of the Huangyang River and Hanjiang River

According to slope level, the topography of the riparian zone was categorized into plains (0°~0.5°, <1%), gentle slopes (0.5°~2°, 1%~3.5%), gradual slopes (2°~5°, 3.5%~9%), slopes (5°~15°, 9%~30%) and steep slopes (>15°, >30%).

Using DEM elevation data combined with on-site surveys, the topographic slopes within a 500m range on both sides of the Hanjiang River and Huangyang River were determined. See Figures 4.2-18 to 4.2-19.

As shown in Figure 4.2-8, the project area: the right bank of the Hanjiang River is dominated by slopes to the south and steep slopes to the north.

As can be seen from Figure 4.2-9, in the vicinity of the Huangyang River Water Environment Improvement and Ecological Park Project, plains and gradual slopes dominate, slopes are followed and a small number of gentle slopes and steep slopes exist.

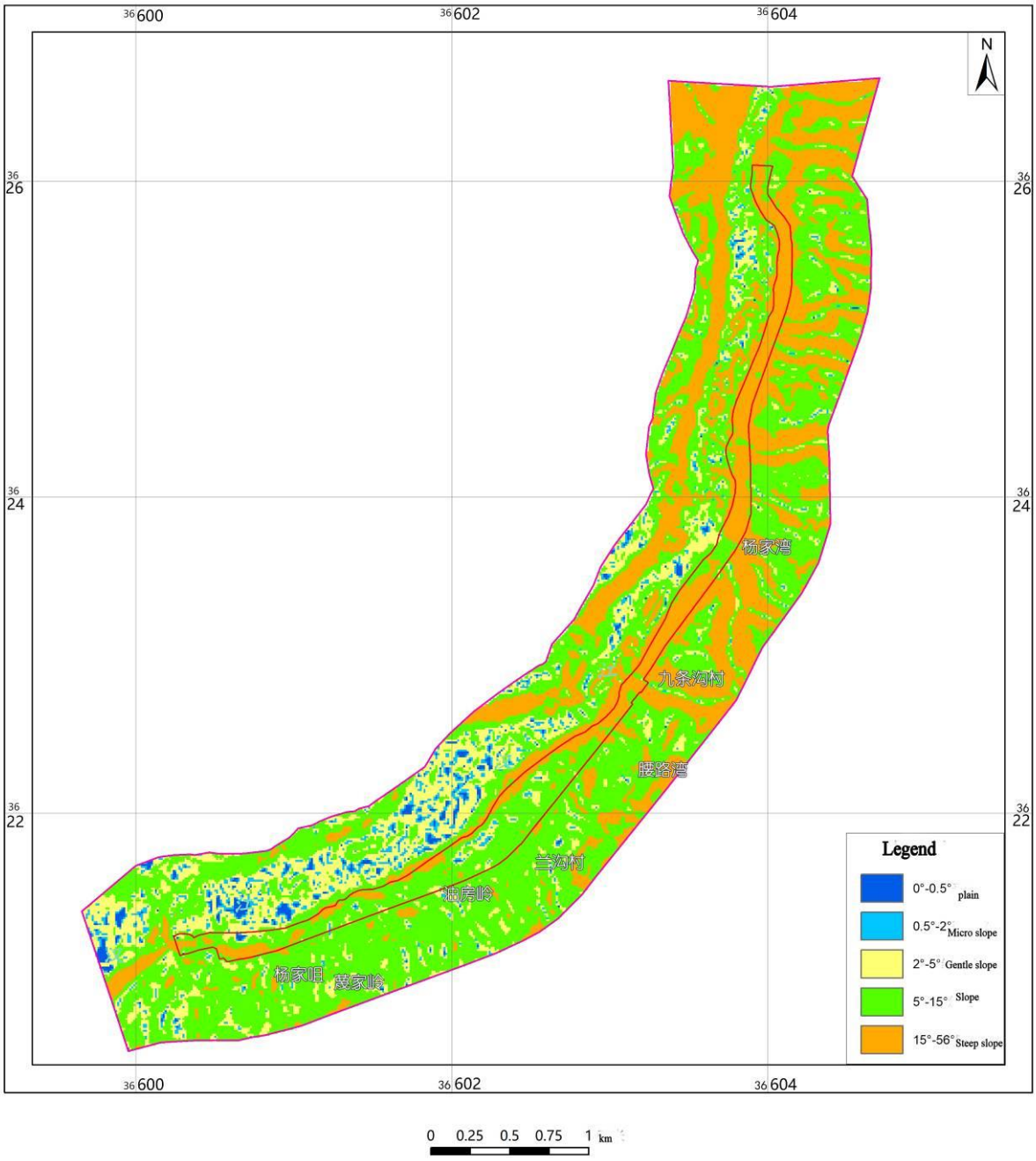


Figure 4.2-18 Current State Map of the Slope of the Hanjiang River Evaluation Area

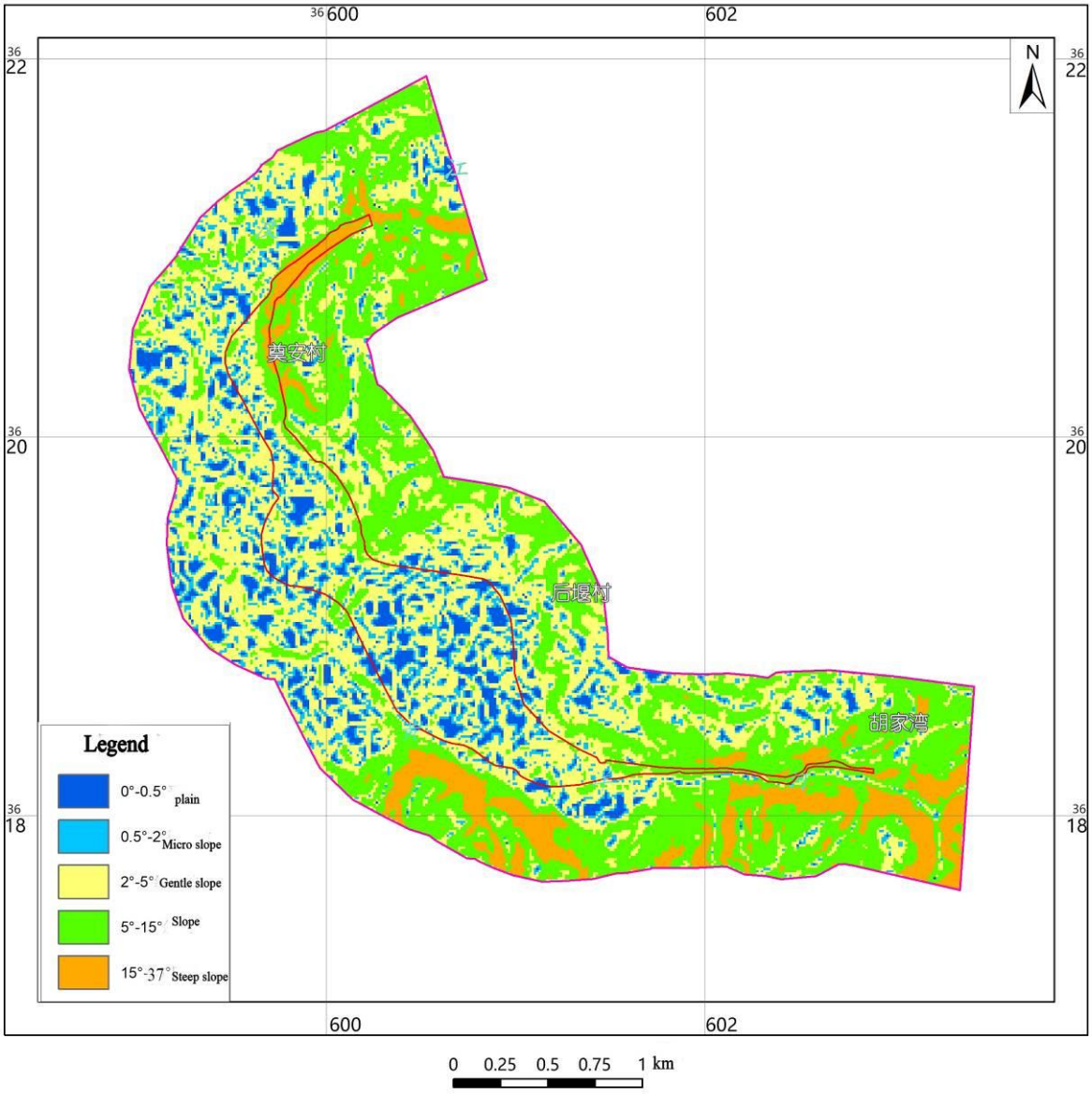


Figure 4.2-19 Current State Map of the Slope of the Huangyang River Evaluation Area

4.3 Environmental quality baseline

The Project quotes the monitoring data of surface water, groundwater, acoustic environment and ambient air from August 18, 2022 to August 24, 2022 by Shaanxi Hengxin Testing Co., Ltd.

4.3.1 Surface water

4.3.1.1 Environmental quality of surface water of Hanjiang River and Huangyang River in the past five years

(1) Hanjiang River

This evaluation collected the historical monitoring data of the Laojunguan section, the nationally assessed section in the main stream of the Hanjiang River (see Figure 4.3-1 for the monitoring section) in the past years. The monitoring unit is Ankang Environmental Monitoring Station. The Laojunguan section in the main stream of the Hanjiang River is located at the beginning of the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), and is assessed in accordance with the Class II water quality goal. The monitoring results of the Laojunguan section in the main stream of the Hanjiang River are shown in Table 4.3-1.

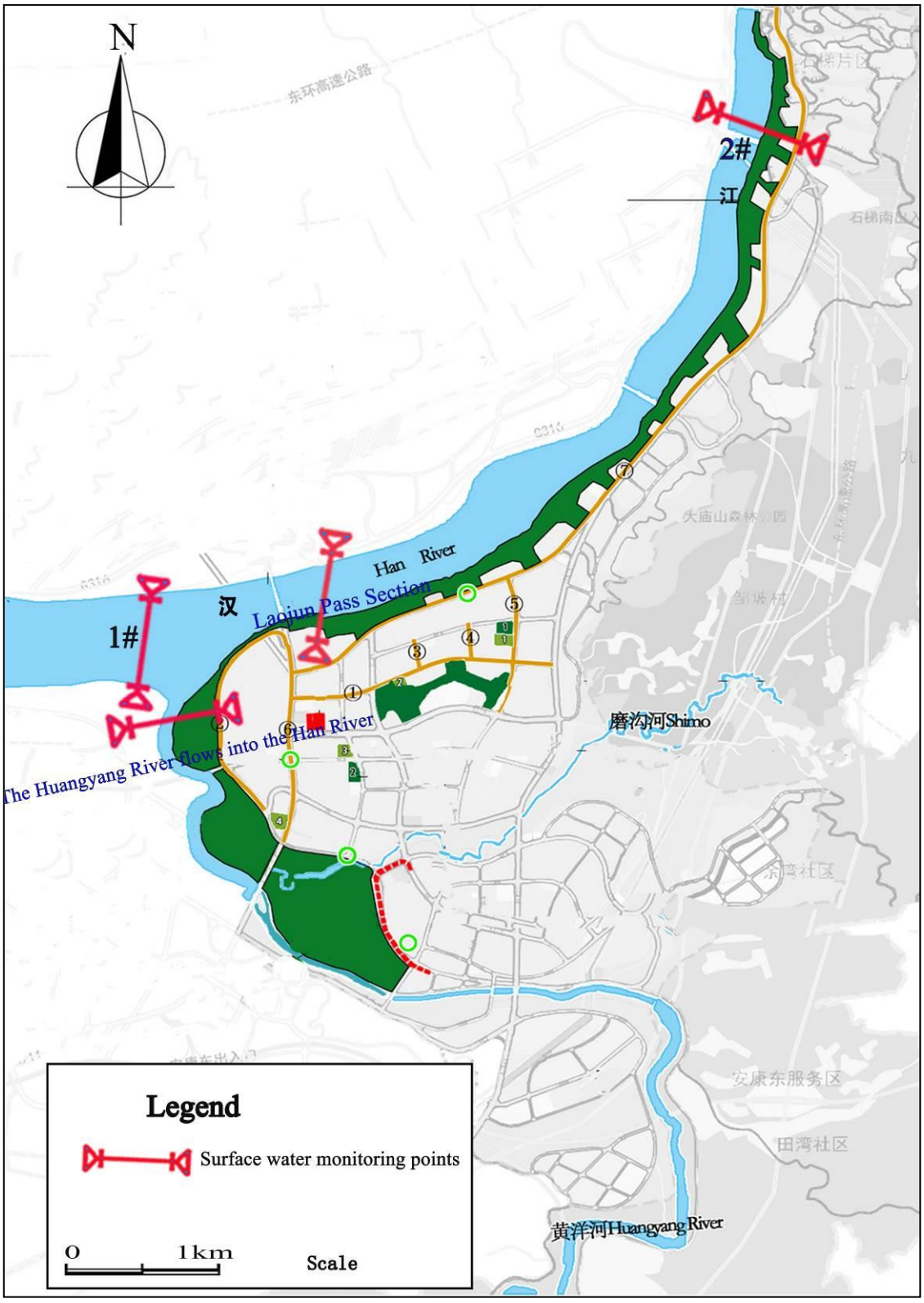


Figure 4.3-1 Map of Surface Water Monitoring Sections

Table 4.3-1 Average Values of Routine Monitoring Results from 2017 to 2020 at Laojunguan Section in the Main Stream of the Hanjiang River Unit (mg/L)

Monitoring section	**Monitoring time**	pH	Dissolved oxygen	**Permanganate index**	BOD5	Ammonia	Petroleum	Plumbum	Chemical oxygen demand	Total Phosphorus	Fluoride	Selenium
Laojunguan (Hanjiang River)	2017	7.74	8.41	2.5	1.8	0.13	0.005	0.001	12.0	0.05	0.17	0.0005
	2018	7.80	8.80	2.3	1.4	0.14	0.005	0.001	11.0	0.03	0.15	0.0002
	2019	7.79	8.26	2.1	1.8	0.202	0.005	0.001	11.2	0.054	0.16	0.0002
	2020	8.00	9.13	1.6	1.6	0.105	0.005	0.001	11.1	0.031	0.16	0.0002
Class II water standards		6~9	≥6	≤4	≤3	≤0.5	≤0.05	≤0.01	≤15	≤0.1	≤1.0	≤0.01
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard
Monitoring section	**Monitoring time**	Arsenic	Cadmium	Hexavalent chromium	Cyanide	**Anionic surfactant**	Volatile penol	Mercury	Sulphide	Copper	Zinc	
Laojunguan (Hanjiang River)	2017	0.0007	0.00005	0.002	0.002	0.113	0.0002	0.00002	0.0025	0.0005	0.025	
	2018	0.0007	0.00005	0.002	0.002	0.04	0.0002	0.00002	0.002	0.0005	0.025	
	2019	0.0007	0.00005	0.002	0.002	0.02	0.0002	0.00002	0.002	0.0005	0.024	
	2020	0.0006	0.00005	0.002	0.002	0.02	0.0002	0.00002	0.002	0.0005	0.025	
Class II water standards		≤0.05	≤0.005	≤0.05	≤0.05	≤0.2	≤0.002	$\leq 5\times10^{-5}$	≤0.1	≤1.0	≤1.0	
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	

The five-year variation trend of monitoring factors such as chemical oxygen demand (COD), five-day biochemical oxygen demand (BOD_5), ammonia nitrogen, total phosphorus (P), etc. is shown in Figure 4.3-2. Analysis of the monitoring results of the past four years reveals that ammonia nitrogen and total phosphorus show an overall trend of first increasing and then decreasing, COD shows a downward trend, and the overall change of the five-day BOD is not significant. In the monitoring results, the monitoring results of the Laojunguan section in the main stream of the Hanjiang River met the Class II water quality standard in *Environmental Quality Standards for Surface Water (GB3838-2002)*.

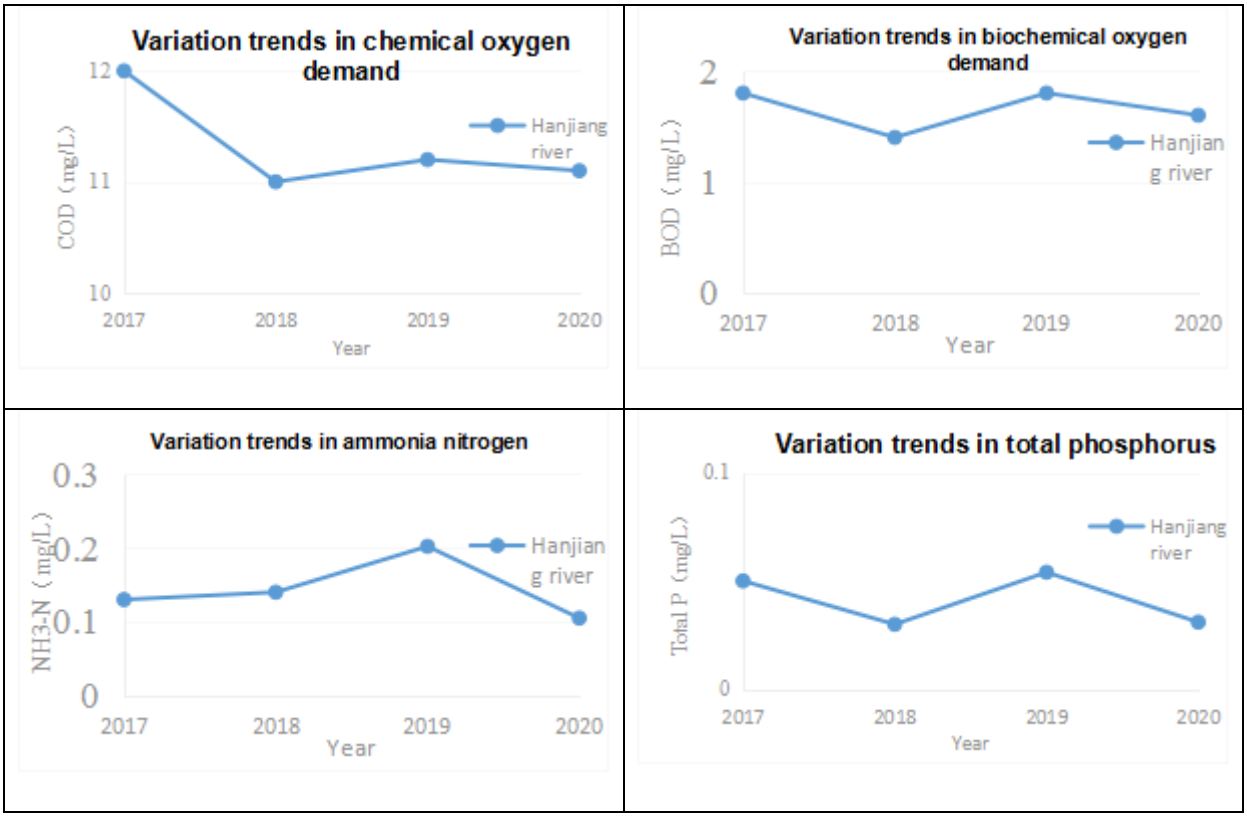


Figure 4.3-2 Trend Chart of Environmental Quality Changes of Main Evaluation Factors of the Laojunguan Section in the Main Stream of the Hanjiang River

(2) Huangyang River

This evaluation collected the routine monitoring data at the section where the Huangyang River flows into the Hanjiang River (see Figure 4.3-1 for the monitoring section). The monitoring unit is Ankang Environmental Monitoring Station. The section where the Huangyang River flows into the Hanjiang River is located within the project area and is assessed according to the Class II water quality goal. The monitoring results of the environmental quality status at the monitoring section are shown in Table 4.3-2.

The five-year variation trend of monitoring factors such as chemical oxygen demand (COD), five-day biochemical oxygen demand (BOD_5), ammonia nitrogen, total phosphorus (P), etc. is shown in Figure 4.3-2. Analysis of the monitoring results of the past five years reveals that the COD and five-day BOD show an overall trend of first increasing and then decreasing, and the overall change of ammonia nitrogen and total phosphorus is not significant. In the monitoring results, the monitoring results of the section where the Huangyang River, a tributary of the

Hanjiang River, flows into the Hanjiang River met the Class II water quality standard in *Environmental Quality Standards for Surface Water* (GB3838-2002).

Table 4.3-2 Average Values of Routine Monitoring Results from 2017 to 2022 at the Section Where the Huangyang River Flows into the Hanjiang River Unit (mg/L)

Monitoring section	**Monitoring time**	**pH (dimensionless)**	Dissolved oxygen	**Permanganate index**	**Biochemical oxygen demand**	Ammonia	Petroleum	Plumbum	**Chemical oxygen demand**	Total Phosphorus	**Fluoride**	**Selenium**
Huangyang River into the Hanjiang River	2018	8.06	8.30	1.52	1.40	0.178	0.01ND	0.01ND	8.5	0.043	0.162	0.0004ND
	2019	7.76	8.32	1.69	1.49	0.103	0.01ND	0.01ND	9.6	0.028	0.165	0.0004ND
	2020	7.75	9.04	1.23	1.11	0.189	0.01ND	0.01ND	10.3	0.036	0.198	0.0004ND
	2021	7.69	10.08	1.7	1.5	0.14	0.01ND	0.002ND	10.28	0.04	0.21	0.0003
	2022	8.0	9.3	1.5	1.3	0.20	0.01ND	0.00009ND	9.50	0.04	0.21	0.0004ND
Class II water standards		6~9	≥6	≤4	≤3	≤0.5	≤0.05	≤0.01	≤15	≤0.1	≤1.0	≤0.01
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard
Monitoring section	**Monitoring time**	Arsenic	Cadmium	Hexavalent chromium	Cyanide	**Anionic surfactant**	Volatile penol	Mercury	Sulphide	Copper	Zinc	
Huangyang River into the Hanjiang River	2018	0.0003ND	0.001ND	0.004ND	0.004ND	0.0770	0.0003ND	0.000004ND	0.005ND	0.001ND	0.005ND	
	2019	0.0003ND	0.001ND	0.004ND	0.004ND	0.05ND	0.0003ND	0.000004ND	0.005ND	0.001ND	0.005ND	
	2020	0.001	0.001ND	0.004ND	0.004ND	0.05ND	0.0003ND	0.000004ND	0.005ND	0.001ND	0.005ND	
	2021	0.0006	0.0001ND	0.004ND	0.004ND	0.05ND	0.0003ND	0.00004ND	0.005ND	0.001ND	0.05ND	
	2022	0.0006	0.0001ND	0.004ND	0.004ND	0.05ND	0.0003ND	0.00004ND	0.005ND	0.001ND	0.0037	
Class II water standards		≤0.05	≤0.005	≤0.05	≤0.05	≤0.2	≤0.002	$\leq 5\times10^{-5}$	≤0.1	≤1.0	≤1.0	
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	
Note: "ND" was not detected.												

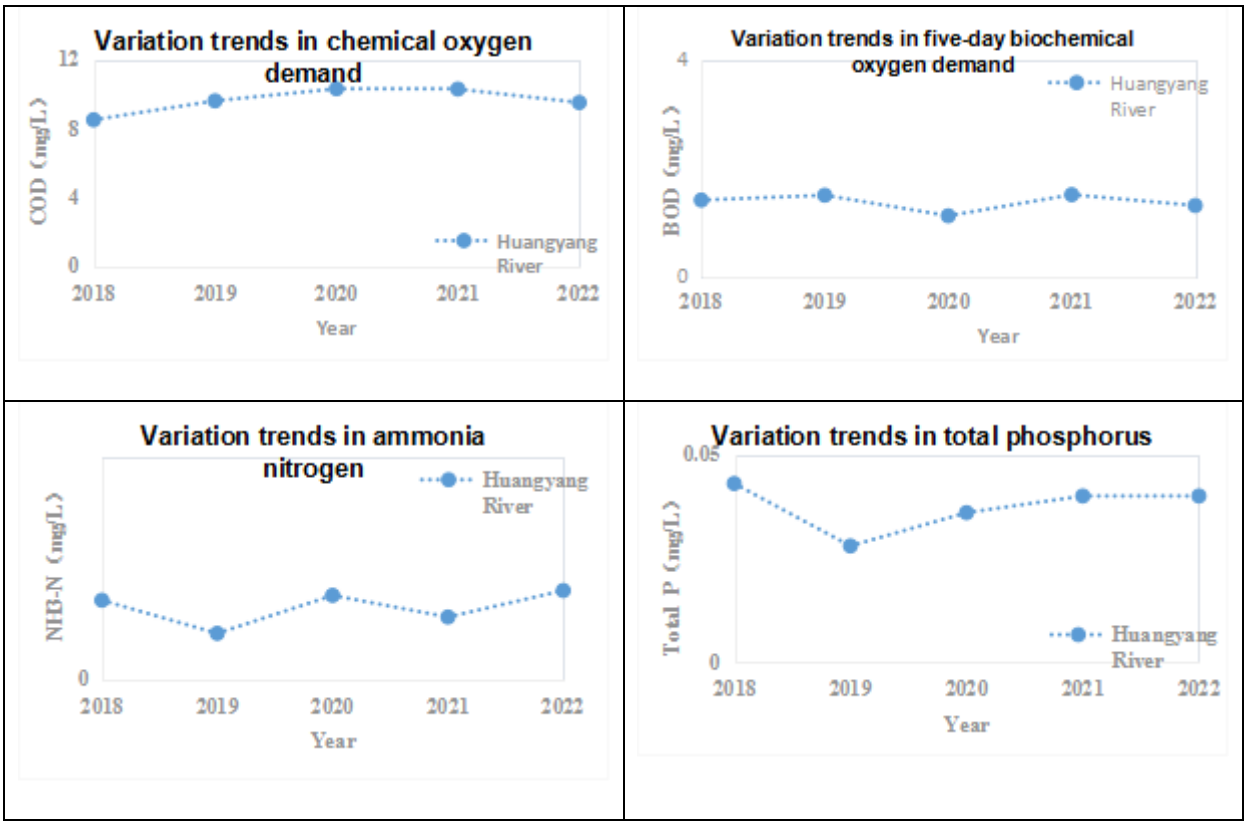


Figure 4.3-3 Trend Chart of Environmental Quality Changes of Main Evaluation Factors of the Section Where the Huangyang River, a Tributary of the Hanjiang River, Flows into the Hanjiang River

4.3.1.2 Additional monitoring

(1) Monitoring section

The selection of this monitoring section is shown in Table 4.3-3 and the map of monitoring point location for surface water is shown in 4.3-1.

Table 4.3-3 List of Monitoring Point Location for Surface Water

Name and location of the section	Water functional area	Note	Monitoring time
500m at the upstream of the Project (1# section of Hanjiang River)	Class III	Upstream control section	2022.8.18-8.20
2000m at the downstream of the Project (2# section of Hanjiang River)	Class II	Downstream normal section	

(2) Monitoring items and analysis methods

Monitoring items: water temperature, pH, dissolved oxygen, permanganate index, COD, BOD_5, ammonia nitrogen, copper, zinc, fluoride, selenium, arsenic, mercury, cadmium, chromium (hexavalent), lead, cyanide, volatile phenols, petroleum products, anionic surfactants, sulfide, and fecal coliform.

The monitoring and analysis methods are shown in Table 4.3-4.

Table 4.3-4 Monitoring and Analysis Methods for Surface Water Status

Monitoring item	Analysis Methodology	Detection limit
Water temperature	*Water quality-Determination of water temperature-Thermometer or reversing thermometer method* (GB/T13195-1991)	/
pH	*Water quality-Determination of pH-Electrode method* (HJ1147-2020)	/
Dissolved oxygen	*Water quality-Determination of dissolved oxygen-Electrochemical probe method* (HJ506-2009)	/
Permanganate index	*Water quality-Determination ofpermanganate index* (GB/T11892-1989)	0.5mg/L
Chemical oxygen demand	*Water quality-Determination of the chemical oxygen demand-Dichromatemethod* (HJ828-2017)	4mg/L
Five-day biochemical oxygen demand	*Water quality-Determination of biochemical oxygen demand after 5 days (BOD_5) for dilution and seeding method* (HJ505-2009)	0.5mg/L
Ammonia nitrogen (N)	*Water quality-Determination of ammonia nitrogen-Nessler's reagent spectrophotometry* (HJ535-2009)	0.025mg/L
Total Phosphorus	*Water quality-Determination of total phosphorus-Ammonium molybdate spectrophotometric method* (GB/T11893-1989)	0.01mg/L
Copper	*Water quality-Determination of copper, zinc, lead and cadmium-Atomic absorption spectrometry* (GB7475-1987)	0.05mg/L
Zinc		0.05mg/L
Fluoride	*Water quality-Determination of fluoride-Ion selective electrode method* (GB/T7484-1987)	0.05mg/L
Selenium	*Water Quality—Determination of Mercury, Arsenic, Selenium, Bismuth and Antimony-Atomic Fluorescence Spectrometry* (HJ694-2014)	4×10^{-4}mg/L
Arsenic		3×10^{-4}mg/L
Mercury		2×10^{-5}mg/L
Cadmium	*Water quality-Determination of 65 elements-Inductively coupled plasma-mass spectrometry* (HJ700-2014)	5×10^{-5}mg/L
Chromium (hexavalent)	*Water quality-Determination of chromium (VI)-1,5 Diphenylcarbohydrazide spectrophotometric method* (GB/T7467-1987)	0.004mg/L
Plumbum	*Water quality-Determination of 65 elements-Inductively coupled plasma-mass spectrometry* (HJ700-2014)	9×10^{-5}mg/L
Cyanide	*Water quality-Determination of cyanide-Volumetric and spectrophotometry method (HJ484-2009)* (Isonicotinic acid-pyrazolone spectrophotometry method)	0.004mg/L
Volatile penol	*Water quality-Determination of volatile phenolic compounds-4-AAP spectrophotometric method (HJ503-2009) (Extraction spectrophotometry)*	0.0003mg/L
Petroleum	*Water quality-Determination of petroleum-Ultraviolet spectrophotometric method (HJ 970-2018)*	0.01mg/L
Anionic surfactant	*Water quality-Determination of anionic surfactants-Methylene blue spectrophotometric method* (GB/T7494-1987)	0.05mg/L

Monitoring item	Analysis Methodology	Detection limit
Sulphide	*Water quality-Determination of sulfide-Methylene blue spectrophotometric method* (HJ1226-2021) (Acidification-distillation-absorption method)	0.003mg/L
Fecal coliform	*Water quality-Determination of fecal coliform-Manifold zymotechnics* (HJ347.2-2018)	20MPN/L

(3) Evaluation results

The results of this current status monitoring are shown in Tables 4.3-5 to 4.3-6.

According to the monitoring results, the monitoring factors of 1# section met the Class III water quality standard in *Environmental Quality Standards for Surface Water* (GB3838-2002); the monitoring factors of 2# section met the Class II water quality standard in *Environmental Quality Standards for Surface Water* (GB3838-2002).

Table 4.3-5 Statistics of Monitoring Results of Surface Water Environmental Quality Status (1# Section) Unit: (mg/L)

Monitoring section		Monitoring factor											
		pH	**Dissolved oxygen**	**Permanganate index**	**Chemical oxygen demand**	**BOD_5**	**Ammonia**	**Total Phosphorus**	**Copper**	**Zinc**	**Fluoride**	**Selenium**	**Arsenic**
1# section	August 18, 2022	7.4	6.6	2.2	12	1.8	0.219	0.07	0.05ND	0.05ND	0.64	4×10^{-4}ND	1.9×10^{-3}
	August 19, 2022	7.3	6.4	2.1	11	2.6	0.207	0.06	0.05ND	0.05ND	0.66	4×10^{-4}ND	2.0×10^{-3}
	August 20, 2022	7.2	6.5	2.1	12	2.4	0.210	0.08	0.05ND	0.05ND	0.45	4×10^{-4}ND	1.9×10^{-3}
Class III water quality standards		6~9	≥5	≤6	≤20	≤4	≤1.0	≤0.2	≤1.0	≤1.0	≤1.0	≤0.01	≤0.05
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard
Over-standard rate (%)		0	0	0	0	0	0	0	0	0	0	0	0
Maximum over-standard multiple		0	0	0	0	0	0	0	0	0	0	0	0
Monitoring section		Monitoring factor											
		Mercury	Cadmium	Hexavalent chromium	Plumbum	Cyanide	Volatile penol	Petroleum	**Anionic surfactant**	Sulphide	**Fecal coliform (MPN/L)**	Water temperature (℃)	
1# section	August 18, 2022	2×10^{-5}ND	5×10^{-5}ND	0.004ND	1.27×10^{-3}	0.004ND	0.0003ND	0.01ND	0.05ND	0.003ND	4.6×10^{2}	26.9	
	August 19, 2022	2×10^{-5}ND	5×10^{-5}ND	0.004ND	1.23×10^{-3}	0.004ND	0.0003ND	0.01ND	0.05ND	0.003ND	4.6×10^{2}	28.0	
	August 20, 2022	2×10^{-5}ND	5×10^{-5}ND	0.004ND	1.19×10^{-3}	0.004ND	0.0003ND	0.01ND	0.05ND	0.003ND	4.6×10^{2}	27.6	
Class III water quality standards		≤0.0001	≤0.005	≤0.05	≤0.05	≤0.2	≤0.005	≤0.05	≤0.2	≤0.2	≤10000	/	
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	/	
Over-standard rate (%)		0	0	0	0	0	0	0	0	0	0	0	
Maximum over-standard multiple		0	0	0	0	0	0	0	0	0	0	0	

Table 4.3-6 Statistics of Monitoring Results of Surface Water Environmental Quality Status (2# Section) **Unit: (mg/L)**

Monitoring section		Monitoring factor										
		pH	**Dissolved oxygen**	**Permanganate index**	**Chemical oxygen demand**	**BOD_5**	**Ammonia**	**Copper**	**Zinc**	**Fluoride**	**Selenium**	**Arsenic**
2# section	August 18, 2022	7.4	6.5	2.0	10	2.7	0.451	0.05ND	0.05ND	0.79	4×10^{-4}ND	3.0×10^{-3}
	August 19, 2022	7.4	6.5	2.2	9	2.0	0.438	0.05ND	0.05ND	0.82	4×10^{-4}ND	3.0×10^{-3}
	August 20, 2022	7.4	6.6	2.1	10	2.2	0.432	0.05ND	0.05ND	0.63	4×10^{-4}ND	3.0×10^{-3}
Class II water quality standards		6~9	≥6	≤4	≤15	≤3	≤0.5	≤1.0	≤1.0	≤1.0	≤0.01	≤0.05
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard
Over-standard rate (%)		0	0	0	0	0	0	0	0	0	0	0
Maximum over-standard multiple		0	0	0	0	0	0	0	0	0	0	0

Monitoring section		Monitoring factor										
		Mercury	**Cadmium**	**Hexavalent chromium**	**Plumbum**	**Cyanide**	**Volatile penol**	**Petroleum**	**Anionic surfactant**	**Sulphide**	**Fecal coliform (MPN/L)**	**Water temperature (℃)**
2# section	August 18, 2022	2×10^{-5}ND	5×10^{-5}ND	0.004ND	8.4×10^{-4}	0.004ND	0.0003ND	0.01ND	0.05ND	0.003ND	7.9×10^{2}	27.9
	August 19, 2022	2×10^{-5}ND	5×10^{-5}ND	0.004ND	8.9×10^{-4}	0.004ND	0.0003ND	0.01ND	0.05ND	0.003ND	7.9×10^{2}	27.9
	August 20, 2022	2×10^{-5}ND	5×10^{-5}ND	0.004ND	8.9×10^{-4}	0.004ND	0.0003ND	0.01ND	0.05ND	0.003ND	7.9×10^{2}	28.0
Class II water quality standards		≤5×10^{-5}	≤0.005	≤0.05	≤0.01	≤0.05	≤0.002	≤0.05	≤0.2	≤0.1	≤2000	/
Attainment of standards		Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	Reach the standard	/
Over-standard rate (%)		0	0	0	0	0	0	0	0	0	0	0
Maximum over-standard multiple		0	0	0	0	0	0	0	0	0	0	0

4.3.2 Groundwater

(1) Monitoring point location and monitoring factors

There are five groundwater quality monitoring point locations for this groundwater monitoring, and the layout of each monitoring point location and monitoring factor is shown in Table 4.3-7. See Figure 4.3-4 for a map of monitoring point location.

Table 4.3-7 List of Monitoring Point Location for Groundwater

S/N	Point location	Water level elevation (m)	Well depth (m)	Burial depth (m)	Coordinate	Monitoring factor
1#	Youfangling Village	277.16	4	5.14	N39°2′35″, E110°40′16″	Eight ions: K^+, Na^+, Ca^{2+}, Mg^{2+}, CO_3^{2-}, HCO_3^-, Cl^-, SO_4^{2-}; Basic factors: pH, total hardness, total dissolved solids, iron, manganese, copper, zinc, aluminum, volatile phenols, oxygen demand, anionic surfactant, ammonia nitrogen, sulfide, total coliform group, nitrate, total bacterial count, nitrite and petroleums
2#	Dian'an Village	281.77	4	2.33	N39°1′53″, E110°42′17″	
3#	Xujiazhuang Village	311.52	10	5.08	N38°59′28″, E110°42′17″	
4#	Houyan Village	221.26	20	12.14	N39°2′35″, E110°40′16″	
5#	Jiutiaogou Village	282.97	5	3.33	N39°1′53″, E110°42′17″	

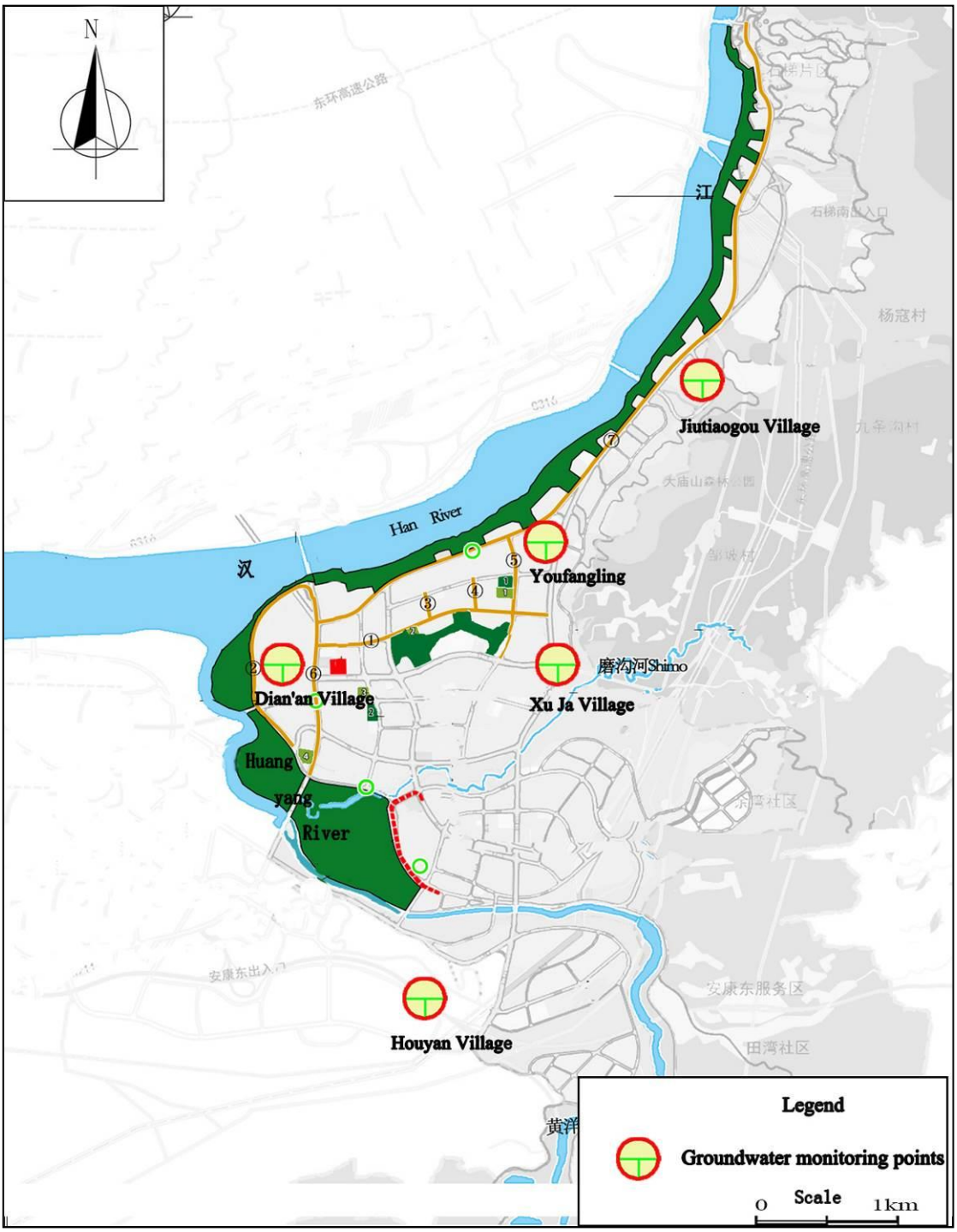


Figure 4.3-4 Map of Environmental Monitoring Point Location for Groundwater

(2) Monitoring time, frequency and method

Monitor for 1 day and sample once.

The monitoring and analysis methods are shown in Table 4.3-8.

Table 4.3-8 Monitoring and Analysis Methods for the Groundwater Status

Monitoring item	Analysis Methodology	Detection limit
K^+	*Water quality-Determination of potassium and sodium-Flame atomic absorption spectrophotometric method* (GB/T11904-1989)	0.05mg/L
Na^+		0.01mg/L
Ca^{2+}	*Water quality-Determination of calcium and magnesium-Atomic absorption spectrophotometric method* (GB/T11905-1989)	0.02mg/L
Mg^{2+}		0.002mg/L
CO_3^{2-}	*Methods for analysis of groundwater quality -Part 49: Determination of carbonate, bicarbonate ions, hydroxy-Titration* (DZ/T0064.49-2021)	2mg/L
HCO_3^-		2mg/L
Cl^-	*Water quality—Determination of chloride-Silver nitrate titration method (GB/T11896-1989)*	3mg/L
SO_4^{2-}	Methods for analysis of groundwater quality-Part 64: Determination of sulfate-EDTA disodium-barium titrimetric method (DZ/T0064.64-2021)	3mg/L
pH	*Water quality-Determination of pH-Electrode method* (HJ1147-2020)	/
Ammonia	Water quality-Determination of ammonia nitrogen-Nessler's reagent spectrophotometry (HJ 535-2009)	0.025mg/L
Nitrates.	Water quality-Determination of nitrate-nitrogen-Ultraviolet spectrophotometry (HJ/T346-2007)	0.08mg/L
Nitrite	Water quality-Determination of nitrogen (nitrite)-Spectrophotometric method	0.003mg/L
Volatile phenolics	*Water quality-Determination of volatile phenolic compounds-4-AAP spectrophotometric method (HJ503-2009) (Extraction spectrophotometry)*	0.0003mg/L
Total hardness	Water quality-Determination of the sum of calcium and magnesium-EDTA titrimetric method (GB/T 7477-1987)	5mg/L
Iron	Water quality-Determination of 65 elements-Inductively coupled plasma-mass spectrometry (HJ700-2014)	8.2×10^{-4}mg/L
Manganese		1.2×10^{-4}mg/L
Copper		8×10^{-5}mg/L
Zinc		6.7×10^{-4}mg/L
Aluminium		1.15×10^{-3}mg/L
Anionic surfactant	*Water quality-Determination of anionic surfactants-Methylene blue spectrophotometric method* (GB/T7494-1987)	0.05mg/L
Petroleum	Water quality-Determination of petroleum-Ultraviolet spectrophotometric method (HJ970-2018)	0.01mg/L
Total soluble solids	*Standard examination methods for drinking water-Organoleptic and physical parameters* (GB/T5750.4-2006) (8.1 Weighing method)	/
Oxygen consumption	*Standard examination methods for drinking water-Aggregate organic parameters* (GB/T5750.7-2006) (1.1 Acidic potassium permanganate titration method)	0.05mg/L

Monitoring item	Analysis Methodology	Detection limit
Total coliform group	*Standard examination methods for drinking water-Microbiological parameters* (GB/T5750.12-2006) (2.1 Multi-tube fermentation method)	/
Total number of colonies	*Standard examination methods for drinking water-Microbiological parameters* (GB/T5750.12-2006) (1.1 Petri dish counting method)	/
Sulphide	*Water quality-Determination of sulfide-Methylene blue spectrophotometric method* (HJ1226-2021) (acidification-distillation-absorption method)	0.003mg/L

(3) Monitoring and evaluation results

The monitoring results of the groundwater environmental quality status at each monitoring point location are shown in Table 4.3-9.

Table 4.3-9 Monitoring Results of Groundwater Environmental Quality Status Unit (mg/L, pH, dimensionless)

Monitoring indicators	1# Youfangling Village	2# Dian'an Village	3# Xujiazhuang Village	4# Houyan Village	5# Jiutiaogou Village	Quality standard
K^+	0.89	1.29	0.87	2.80	0.73	/
Na^+	13.6	26.5	67.8	50.4	14.4	≤200
Ca^{2+}	58.4	84.3	143	88.2	57.7	/
Mg^{2+}	13.8	20.6	28.5	23.3	14.4	/
CO_3^{2-}	2ND	2ND	2ND	2ND	2ND	/
HCO_3^{2-}	169	269	325	254	138	/
Cl^-	21.3	26.2	97.2	39.0	19.2	≤250
SO_4^{2-}	43	57	147	126	105	≤250
pH	7.2	7.1	7.4	7.2	7.1	6.5~8.5
Ammonia	0.113	0.066	0.076	0.269	0.054	≤0.50
Nitrates.	6.3	5.7	5.7	6.3	6.1	≤20
Nitrite	0.003ND	0.003ND	0.003ND	0.003ND	0.003ND	≤1
Volatile penol	0.0003ND	0.0003ND	0.0003ND	0.0003ND	0.0003ND	≤0.002
Total hardness	214	301	351	322	211	≤450
Iron	1.32×10^{-3}	2.09×10^{-3}	2.72×10^{-3}	2.43×10^{-3}	2.56×10^{-3}	≤0.3
Manganese	1.2×10^{-4}ND	1.2×10^{-4}ND	1.2×10^{-4}ND	1.2×10^{-4}ND	1.2×10^{-4}ND	≤0.1
Copper	1.0×10^{-4}	3.08×10^{-3}	4.8×10^{-4}	5.2×10^{-4}	1.2×10^{-4}	≤1
Zinc	6.7×10^{-4}ND	2.33×10^{-3}	3.10×10^{-3}	1.1×10^{-3}	6.7×10^{-4}ND	≤1
Aluminium	1.15×10^{-3}ND	1.15×10^{-3}ND	1.15×10^{-3}ND	1.15×10^{-3}ND	1.15×10^{-3}ND	≤0.2
Anionic surfactant	0.05ND	0.05ND	0.05ND	0.05ND	0.05ND	≤0.3
Petroleum	0.01ND	0.01ND	0.01ND	0.01ND	0.01ND	≤0.5
Total soluble solids	242	352	635	468	318	≤1000
Oxygen consumption	1.08	0.96	1.11	1.18	1.13	≤3.0

Monitoring indicators	1# Youfangling Village	2# Dian'an Village	3# Xujiazhuang Village	4# Houyan Village	5# Jiutiaogou Village	Quality standard
Total coliform group MPN/100mL	Not detected	Not detected	Not detected	Not detected	Not detected	≤3.0
Total number of colonies CFU/mL	35	75	55	70	75	≤100
Sulphide	0.003ND	0.003ND	0.003ND	0.003ND	0.003ND	≤0.02

According to the monitoring results, all the monitoring factors of the monitoring point locations of the Project met the requirements of Class III standard in *Standard for Groundwater Quality* (GB/T 14848-2017).

4.3.3 Acoustic environment

(1) Monitoring point location

A total of seven monitoring point locations were deployed for this acoustic environment monitoring. The monitoring point locations are shown in Table 4.3-10. See Figure 4.3-5 for a map of monitoring point locations.

Table 4.3-10 List of Monitoring Point Location for the Acoustic Environment Status

S/N	Position	Note
1#	Shuangjing Village	Near S207 Yinchuan-Rongjiang Highway
2#	Dian'an Village	
3#	Cuijiawan Village	
4#	Houyan Village	
5#	Jiutiaogou Village	
6#	Langou Village	
7#	Xujiazhuang Village	

(2) Monitoring method and monitoring time

The monitoring method is in accordance with the relevant provisions in the *Environmental Quality Standard for Noise* (GB3096-2008).

The current status monitoring involves continuous monitoring for two consecutive days, once during the day and once during the night.

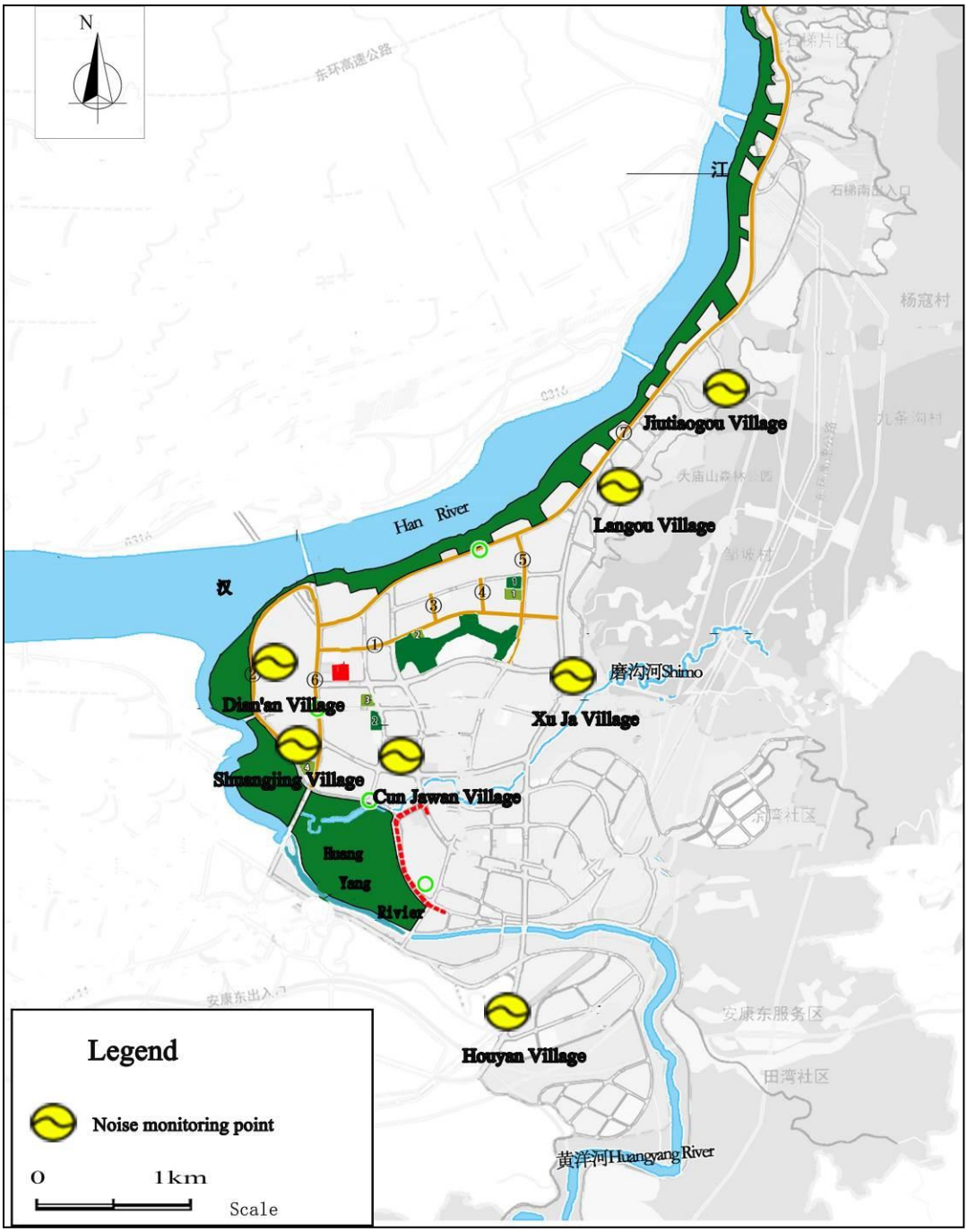


Figure 4.3-5 Map of Quality Monitoring Point Location for Acoustic Environment

(3) Monitoring results and analysis

The results of this monitoring are shown in Table 4.3-11.

Table 4.3-11 Statistics of Monitoring Results of Acoustic Environment Quality
Unit: dB(A)

Point location		August 19, 2022		August 20, 2022		Executive standard	
		Daytime	Night	Daytime	Night	Daytime	Night
1#	Shuangjing Village	68	53	67	53	70	55
2#	Dian'an Village	55	46	56	46	60	50
3#	Cuijiawan Village	57	45	57	46	60	50
4#	Houyan Village	55	46	56	46	60	50
5#	Jiutiaogou Village	57	46	57	46	60	50
6#	Langou Village	54	44	55	44	60	50
7#	Xujiazhuang Village	56	46	55	47	60	50

According to Table 4.3-10, during the monitoring period, the daytime and nighttime acoustic environment quality of each point location can meet the standard limits of the corresponding category of the *Environmental Quality Standard for Noise* (GB3096-2008). Through on-site interviews, villagers have not made any noise complaints. The public is supportive of the construction of the Project, and the local acoustic environment quality meets the domestic standard requirements.

4.3.4 Air quality

4.3.4.1 Determination of standard area at the project site

According to the Shaanxi ambient air quality condition from January to December 2022 released by the Office of the Shaanxi Provincial Environmental Protection Department in the *Environmental Protection Express* on January 18, 2023, the number of good air quality days in Hanbin District in 2022 was 340, with an attainment rate of 93.2%. The local area is classified as a standard area with compliant atmospheric environmental quality. Concentrations, criteria, and compliance determination results for each evaluation factor are shown in Table 4.3-12.

Table 4.3-12 Statistics of Air Quality Status Evaluation in Hanbin District

Pollutant	Annual evaluation index	Current status concentration (μg/m^3)	Standard values for Category II (μg/m^3)	Standard accounting rate (%)	Attainment of standards
PM_{10}	Annual average	55	70	78.57	Reach the standard
$PM_{2.5}$	Annual average	32	35	91.43	Reach the standard
SO_2	Annual average	11	60	18.33	Reach the standard
NO_2	Annual average	19	40	47.50	Reach the

Pollutant	Annual evaluation index	Current status concentration (μg/m^3)	Standard values for Category II (μg/m^3)	Standard accounting rate (%)	Attainment of standards
					standard
CO	24-hour average 95th percentile	1100	4000	27.50	Reach the standard
O_3	Average 90th percentile among 8-hour maximum daytime hours	127	160	79.38	Reach the standard

4.3.4.2 Additional monitoring of ambient air quality status

(1) Monitoring point location and monitoring items

According to the relevant requirements of *Technical guidelines for environmental impact assessment-Atmospheric environment* (HJ2.2-2018), combined with the wind frequency characteristics of the area, the geographic location of the project area, the surrounding natural environment and the distribution of sensitive protection targets, a total of four monitoring point locations have been deployed for this monitoring. See Table 4.3-13 for monitoring point locations and monitoring items. See Figure 4.3-6 for a map of monitoring point location.

Table 4.3-13 List of Monitoring Point Locations and Factors for Ambient Air

S/N	Position	Monitoring factor	Monitoring time
1	Jiutiaogou Village	TSP	2022.8.18~2022.8.24
2	Dian'an Village		
3	Youfangling		
4	Baimiao Dam		

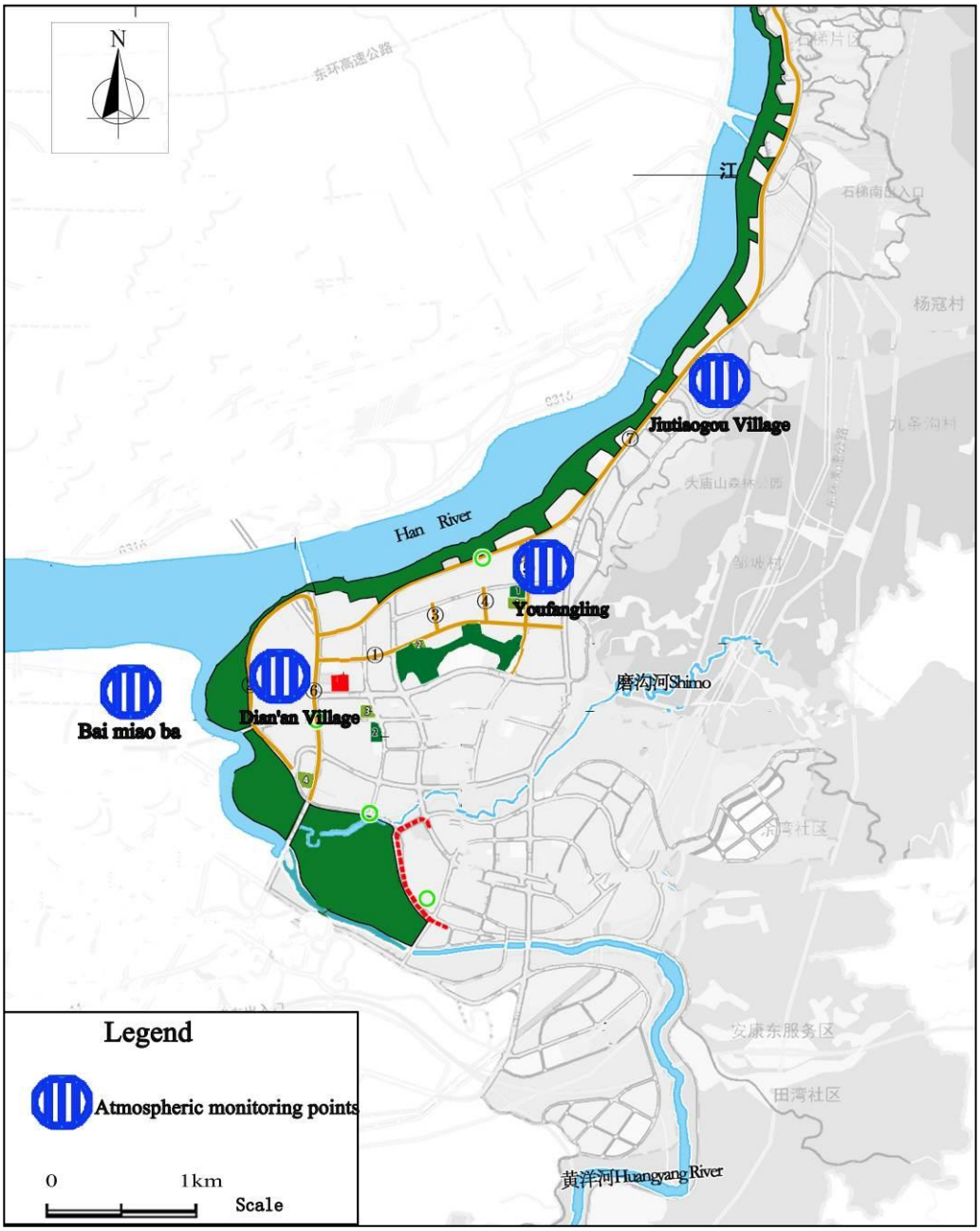


Figure 4.3-6 Map of Monitoring Point Locations for Atmospheric Environment

(2) Monitoring time and frequency

The ambient air monitoring period was from August 18, 2022 to August 24, 2022, with a continuous monitoring period of 7 days. TSP: 24-hour monitoring average value. The monitoring simultaneously records wind direction, wind speed, barometric pressure, air temperature and other conventional meteorological elements.

(3) Monitoring methods

The monitoring time and technical methods meet the requirements of the *Technical Specification for Environmental Monitoring* (Atmospheric Section) and the *Technical*

guidelines for environmental impact assessment-Atmospheric environment (HJ2.2-2018). See Table 4.3-14 for specific analysis methods.

Table 4.3-14 Monitoring Items and Analysis Methods

S/N	Monitoring item	Analysis methods and sources	Detection limit
1	Total suspended particulate (TSP)	*Ambient air-Determination of total suspended particulates-Gravimetric method* (GB/T 15432-1995) and its amendment	1μg/m^3

(4) Monitoring results and evaluation

The results of the current status monitoring and evaluation are shown in Table 4.3-15.

Table 4.3-15 Monitoring Results Statistics of Current Status

Point location	TSP		
	Concentration range (μg/m^3)	Standard value (μg/m^3)	Maximum standard accounting rate (%)
1# Jiutiaogou Village	55~81	300	27.00
2# Dian'an Village	58~82	300	27.33
3# Youfangling	57~79	300	26.33
4# Baimiao Dam	57~82	300	27.33

According to the monitoring results, it can be seen that the monitoring concentration of TSP in the project area met the requirements of the Level II standard given in the *Ambient Air Quality Standard* (GB 3095-2012).

4.4 Socioeconomic overview

4.4.1 Administrative divisions and population distribution

The Hanbin District of Ankang City covers an area of about 3,640km^2. It is divided into 24 towns and 4 subdistrict offices. As of the end of 2021, the total registered population in Hanbin District is 1.0261 million, with 540,000 males and 486,100 females. In terms of geographical distribution, there are 489,800 urban residents and 536,300 rural residents.

In addition to the Han ethnic group, there are 23 ethnic minorities distributed throughout Hanbin District, with a total population of over 17,000 permanent residents. According to the survey, there are no ethnic minorities distributed in and around the project site.

4.4.2 Regional economic overview

In 2021, Shaanxi Province achieved a regional gross domestic product (GDP) of RMB 2.980098 trillion, ranking 14th among the 31 provinces, autonomous regions, and

municipalities directly under the central government in China. The per capita GDP reached RMB 75,390.17, ranking 12th in China. Per capita disposable income was RMB 28,568, of which the per capita disposable income of urban residents was RMB 40,713, ranking 18th in China; the per capita disposable income of rural residents was RMB 14,745, ranking 27th in China.

In 2021, the gross domestic product (GDP) of Ankang City was RMB 120.949 billion, of which the GDP of the Hanbin District was RMB 40.727 billion, with an increase of 7.8% compared to the previous year. In 2021, the added value of the primary industry in Hanbin District was RMB 4.205 billion, the added value of the secondary industry was RMB 14.063 billion, and the added value of the tertiary industry was RMB 22.459 billion. The proportion of the three industries in the GDP was 10.3:34.5:55.1.

4.4.3 Regional transportation overview

Situated at the geometric center of the three major economic regions of Chengdu-Chongqing, Jianghan, and Guanzhong, the Hanbin District of Ankang City enjoys a superior transportation location. It serves as an important transportation hub connecting the northwest, southwest, and central China. National and provincial highways such as 316, 210, and 207 pass through the Hanbin District; the Baotou-Maoming Expressway intersects with Xi'an-Ankang Expressway, Shaanxi-Sichuan, and Shiyan-Tianshui Expressway within the territory. Cement roads are available for 100% of the towns and 90% of the administrative villages in the jurisdiction of Hanbin District.

In recent years, the rapid growth of private cars in the central urban area of Ankang city has highlighted the contradiction between the allocation of road space resources and the lack of public parking resources. At the same time, the number of dedicated parking spaces and charging infrastructure for new energy vehicles in the area cannot meet the needs of urban development. Due to heavy rainfall in the summer, some sections of the roads encountered short circuits and malfunctioning traffic lights, leading to frequent disruptions in normal operations. As a result, the municipal government has intensified maintenance work on the urban transportation facilities. It is necessary to establish a green and low-carbon transportation system that combines public transportation with non-motorized modes of travel as soon as possible.

4.5 Environmental protection objectives

4.5.1 Environmentally sensitive areas

(1) Nature reserves

There are no environmentally sensitive targets such as nature reserves, forest parks and scenic spots within the project construction site and its affected area.

(2) the red line of ecological protection

Shaanxi Hanjiang River Wetland, on August 6, 2008, was listed in the *List of Important Wetlands of Shaanxi Province* by the People's Government of Shaanxi Province. The scope ranges from Tianba, Tuguanpu Town, Mianxian County, Hanzhong City to Chengguan Town, Baihe County, Ankang City, including artificial wetlands within 1km of the Hanjiang River channel, riverbanks, floodplains and both sides of the river. The Shaanxi Hanzhong Crested Ibis National Nature Reserve and the Shaanxi Hanjiang River Wetland Nature Reserve are included. In terms of administrative divisions, it includes Hanzhong City and Ankang City.

Hanjiang Wetland in Shaanxi Province is an important wetland, which is located in the red line of ecological protection. Hanjiang River Riverside Ecological Green Corridor Project (Phase I) is adjacent to the Shaanxi Hanjiang Wetland, but not within the scope of the Han River Wetland, See Figure 4.5-1 for a location relationship diagram.

On January 25, 2021, the People's Government of Shaanxi Province issued the document *Reply on the Adjustment of the Scope and Functional Zoning of Shaanxi Hanjiang River Wetland Provincial Nature Reserve* (SZH [2020] No. 168), which determines the scope of the Shaanxi Hanjiang River Wetland Provincial Nature Reserve: starting from the Wuhou Town, Mianxian County, Hanzhong City, Shaanxi Province in the west to the Chazhen Town, Xixiang County, Hanzhong City in the east, with the geographic coordinates ranging from E106°36'21.92" to E108°07'15.25" and N33°0'30.27" to N33°17'18.92", covering a total area of 14,351.37 hectares. Shaanxi Hanjiang River Wetland Provincial Nature Reserve is located within a distance of about 137km from the project site. See Figure 4.5-2 for a location relationship diagram.

There is no ecological red line around the Huang Yang River water environment treatment and ecological restoration project, only basic farmland. The relationship between the project and the permanent basic farmland is shown in figure 4.5-3. Permanent basic farmland reserves have been avoided in the design of the project.

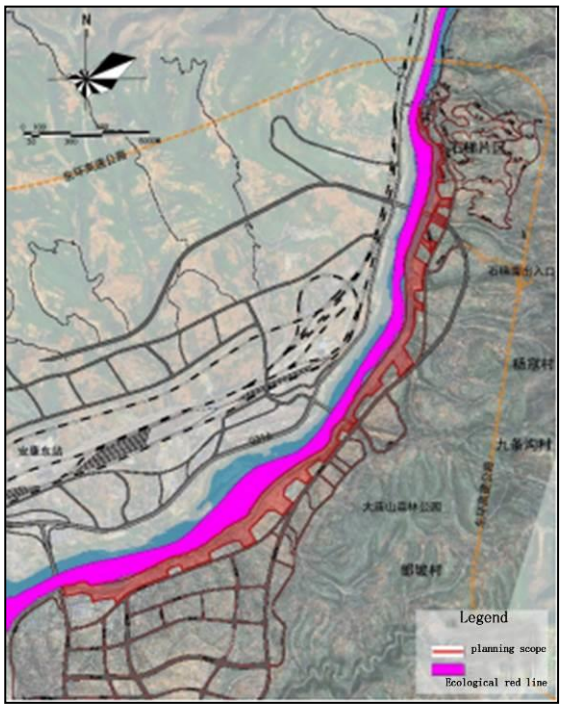


Figure 4.5- 1 Location Relationship between the Project Site and Shaanxi Hanjiang wetland

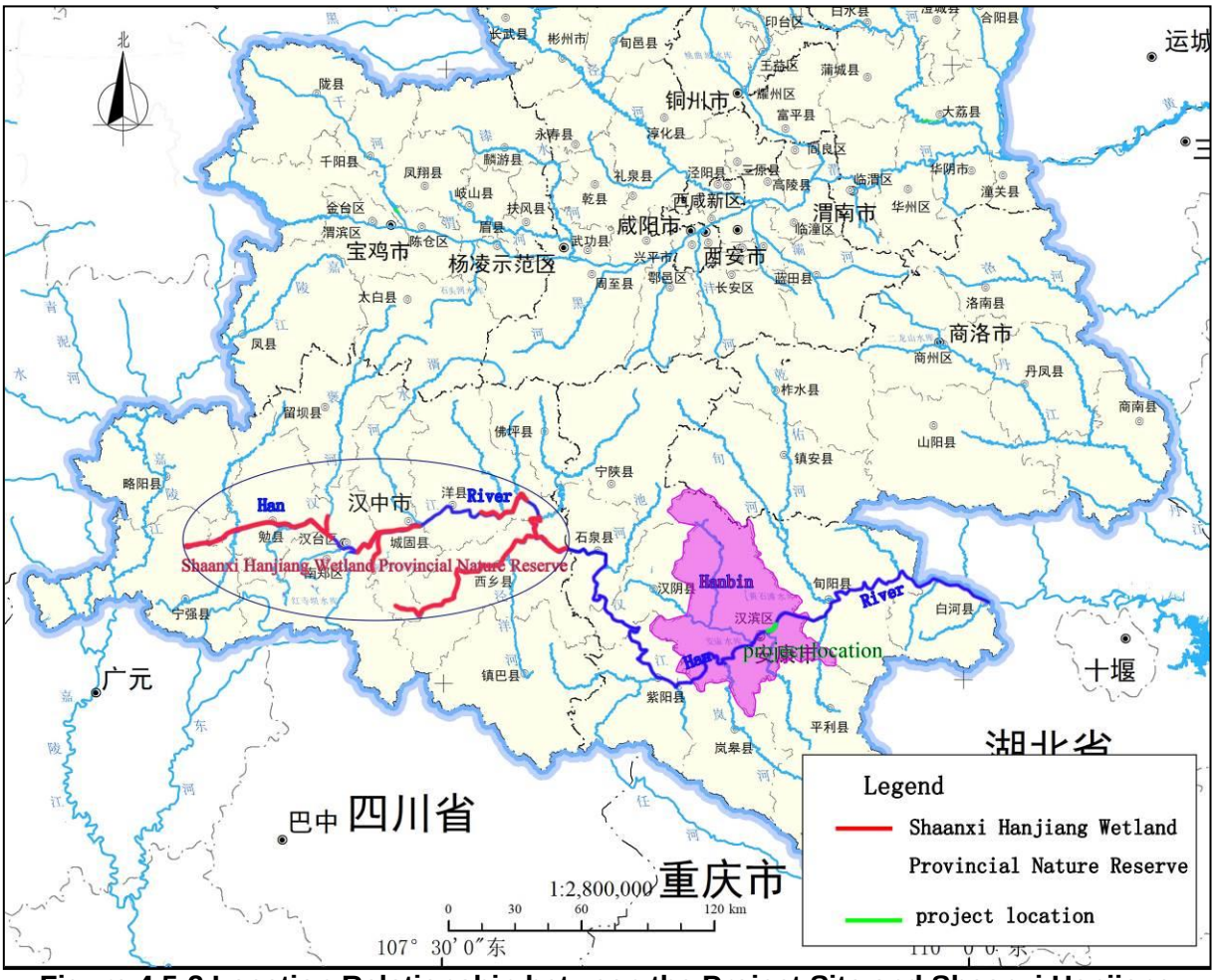


Figure 4.5-2 Location Relationship between the Project Site and Shaanxi Hanjiang River Wetland Provincial Nature Reserve

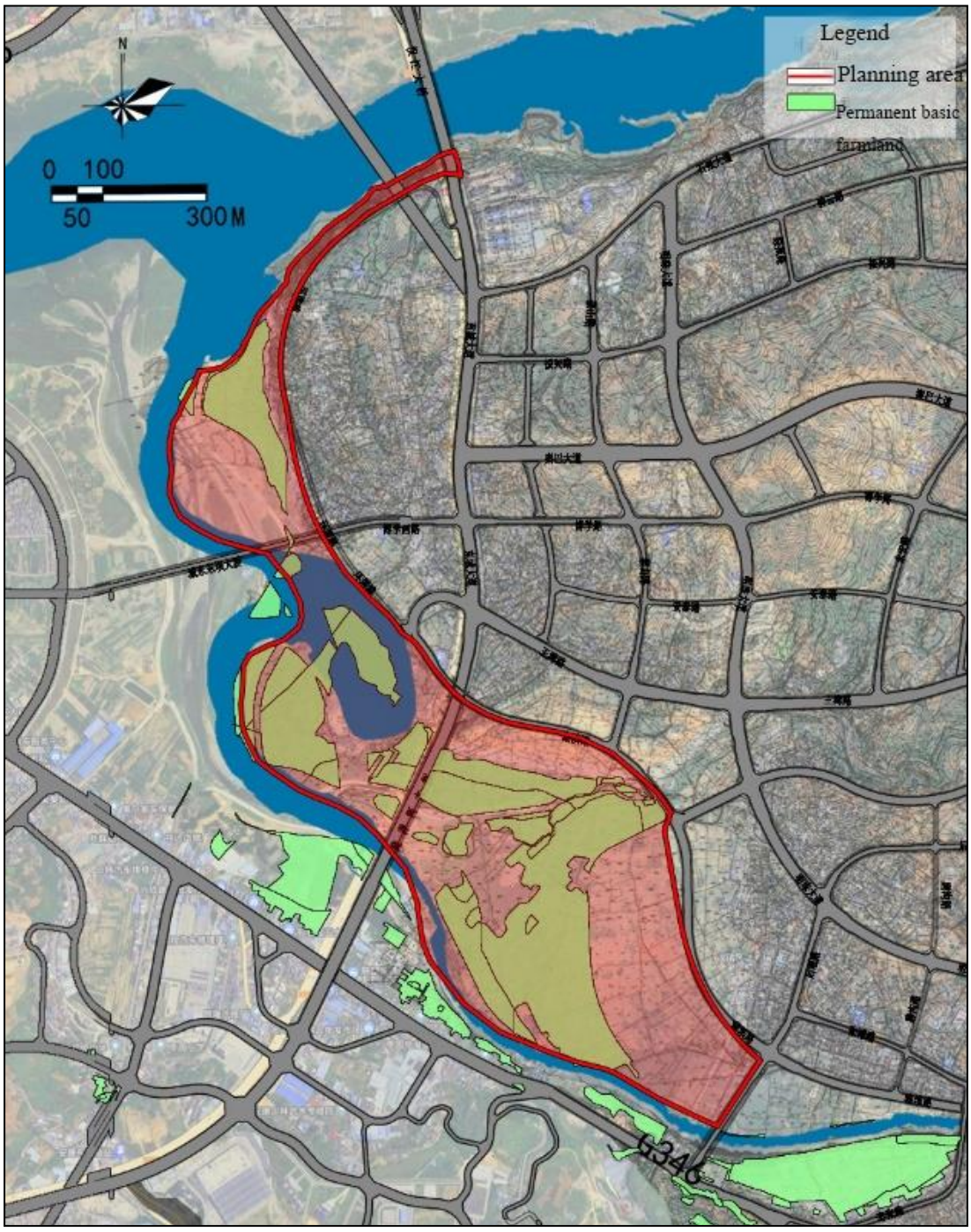


Figure 4.5-3 location of the Huang Yang River water environmental remediation and ecological restoration project and the permanent basic farmland

(3) Does the project site have habitats for protected wildlife?

According to the line transect survey for animals, the Corvus torquatus is a member of the order Passeriformes in the family Corvidaea. It is commonly found in the forests and shrubs of low hills, foothills, and plains. It forages in the fields in the early morning and flies back to nearby villages or trees on the edge of the forest to roost in the evening. It mainly feeds on small animals such as locusts, mole crickets, beetles, caterpillars, snails, frogs, lizards, as

well as crops, plant seeds, garbage, and carrion. During the line transect survey for animals, investigators found Corvus torquatus in the farmland near the village, but no Corvus torquatus nests were found at the proposed project site. Therefore, the implementation of the Project has no impact on it.

Mandarin ducks are migratory birds, so in local surveys, they are considered as passing birds. Four species of hawks and falcons, including the sparrow hawks, Accipiter soloensis, Buteo buteo and falco tinnunculus, primarily feed on field mice, and they are concentrated in farmland more than 10km away from the project area. The yellow-throated marten mainly inhabits all types of forested zones, and its nests are mostly built in tree holes or stone caves; the Felis bengalensis mainly inhabits the forested zones in mountains and near the bushwood in the countryside. Therefore, the habitats of the seven protected species are distant from the project area and will not be affected by the implementation of the Project.

(4) Water sources

According to the on-site investigation, there are two drinking water sources in Wangwan Water Plant, namely Drinking Water Source 1# and Drinking Water Source 2#, located at Huangyang River Water Environment Improvement and Ecological Restoration Project where the Project is located, and the geographic location is shown in Figure 4.5-3.

The water intake from the Drinking Water Source 1# of Wangwan Water Plant is located at E109.0718° and N32.6906° in the south of Zhangtan Town and the east of Huangyang River. Currently, the official delineation of the drinking water source protection area has not yet been established,access to surface wate.By comparing the location of the water intake with that of the project, the water intake is located in the eco-agriculture leisure area of the HHuangyang River Water Environment Improvement and Ecological Restoration Project which mainly focuses on restoration and conservation. Therefore, this area is basically not involved in the activity scope of the construction process, so the project has little impact on the water intake.

The water intake from the Drinking Water Source 2# of Wangwan Water Plant is located at E109.0773° and N32.6833° in the south of Zhangtan Town and the west of Huangyang River. Currently, the official delineation of the drinking water source protection area has not yet been established，access to surface water.By comparing the location of water intake with that of this project, the location of water intake is not within the scope of the project construction, so the construction of this project has little impact on the water source.

On August 8, 2023, the project team investigated the drinking water situation of the residents around the two water sources: Wangwan Water Plant mainly supplies drinking water to the residents of four villages, including Dian'an Village, Shuangjing Village, Wangwan Village, Lishi Village and Houyan Village. All residents have expressed support for the construction of the Project.

According to the *Overall Plan for Chengdong New Area of Ankang City (2018-2035)*, a new water plant will be built in Chengdong New Area, of which the recent water supply capacity is planned to be 10,000m^3/d, and the long-term water supply capacity is planned to be 18,000m^3/d. The water source is surface water. After the construction of the planned water plant is completed, Chengdong New Area will be supplied with water from this plant.

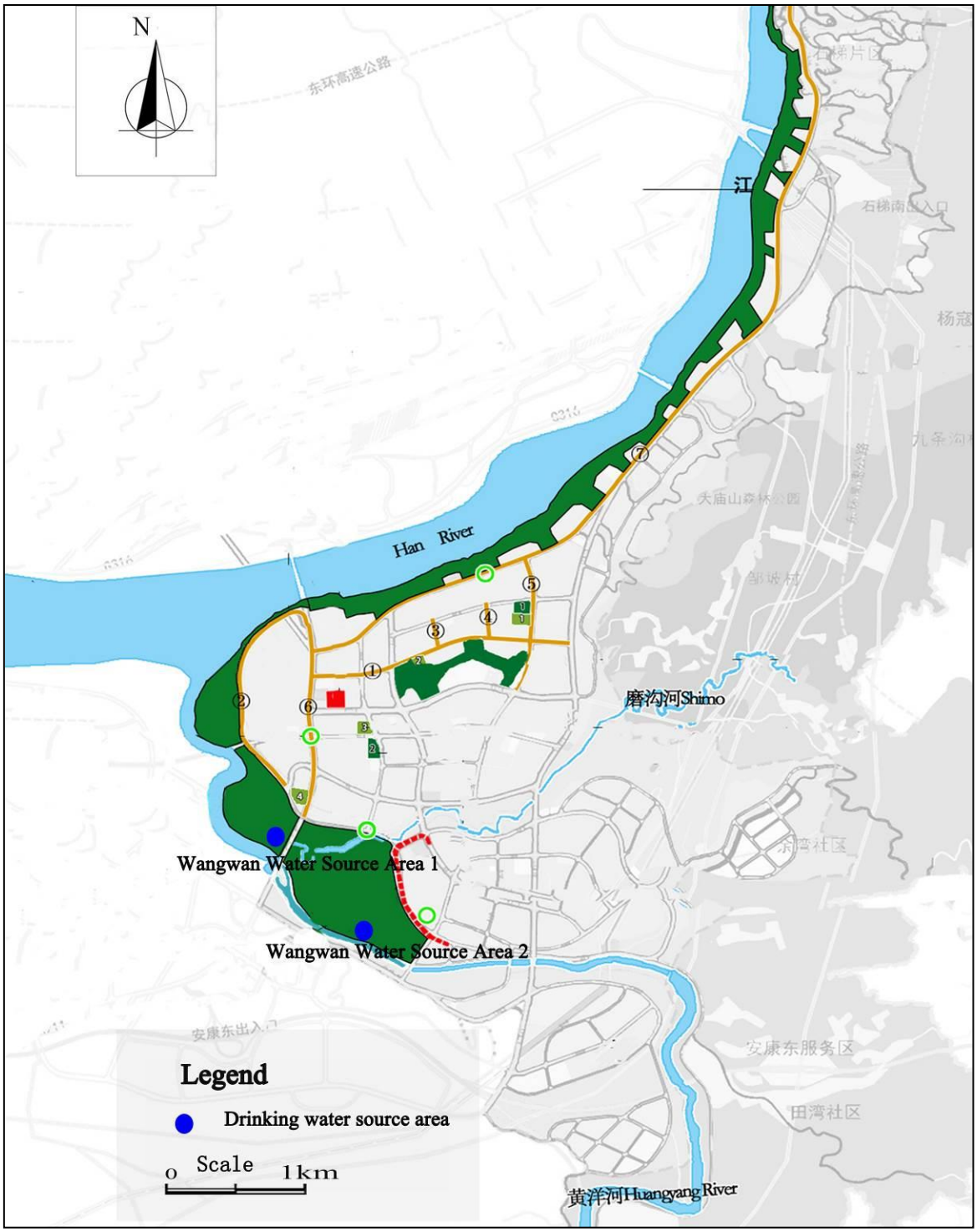


Figure 4.5-4 Location Map of Existing Drinking Water Sources at Wangwan Water Plant

(5) Cultural relics and historic sites

There are five cultural relics protection sites in the vicinity of the Project, including one provincial-level cultural relics protection site and four county-level cultural relics protection sites. The cultural relics protection sites are shown in Table 4.5-1, and the location map of cultural relics protection sites is shown in Figure 4.5-4.

Table 4.5-1 Specific Situations of Cultural Relics Protection Sites in the Project Area

S/N	Cultural relics protection sites	Class	Address	Period	The Scope of the Protection	Location relationship of the Project
1	Dian'an Tower	Province-level	Group 1 of Dian'an Village, Zhangtan Town	The Republic of China (1912-1949)	Zone A (protected scope): Expand 20m around the tower base; Zone B (construction control zone): Expand 10m around Zone A	In the Project, the distance between Huanta Road and Dian'an Tower is relatively close, about 110m, but it is not within the range of Zone A or Zone B of Dian'an Tower.
2	Dian'an Historic Relics	In county level	Dian'an Village, Zhangtan Town	Ancient ruins	Protected scope and construction control zone: 200m from Hanjiang River in the north, 350m from Provincial Highway 207 in the east, 100m from Huangyang River in the west, and 120m from Village Committee of Dian'an Village in the south.	5m east-west of Huanta Road from the protected scope and construction control zone of Dian'an Historic Relics
3	Lishitan Burial Complex	In county level	Lishi Village, Zhangtan Town	Han Dynasty (202 BC–220 AD) and the Northern and Southern Dynasties (420-589)	Undetermined protected scope	Located next to the Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211.
4	Cuijiapo Burial Complex	In county level	Shuangjing Village, Zhangtan Town	Han Dynasty (202 BC–220 AD) — Northern and Southern Dynasties (420-589)	Undetermined protected scope	Located on the south of Zhenxing Road and on the east of the second bidding section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road).
5	Naliang Ancient Burial Complex	In county level	Houyan Village, Zhangtan Town	Northern and Southern Dynasties (420-589)	Protected scope and construction control zone: 30m from Zhangqing Road in the east	The urban integrated waterlogging prevention and control system in the Project is relatively close to the

S/N	Cultural relics protection sites	Class	Address	Period	The Scope of the Protection	Location relationship of the Project
					and 30m from Tongcun Road in the south with a length of 30m east-west and a width of 30m north-south.	Naliang Ancient Burial Complex, and the project area is not within the protected scope and construction control zone of Naliang Ancient Burial Complex.

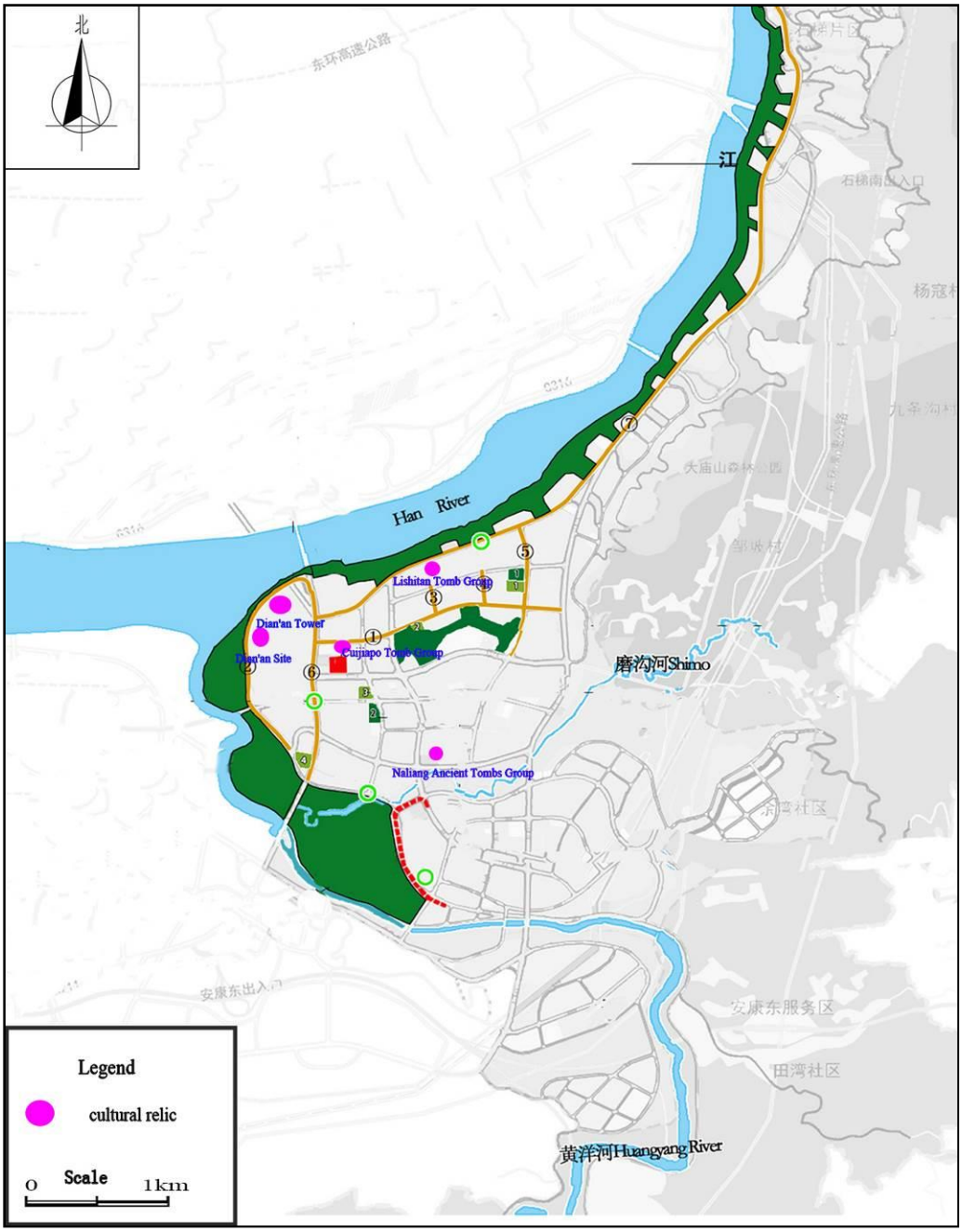


Figure 4.5-5 Distribution Map of Cultural Relics and Historic Sites

4.5.2 Other protection targets

According to the on-site investigation, the main environmental protection targets within the 200m acoustic environment impact evaluation range of the Project are shown in Table 4.5-2 and Table 4.5-3.

Table 4.5-2 Statistics of Environmentally Sensitive Targets of the Project (7 Roads)

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
1	Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	Group 5 of Shuangjing Village	15/35 in the south and north of the road	1	22/89	38/151	The route passes through the village in the form of an embankment. The houses along the road face the planned highway, and most of them are one to two-story brick-concrete structures. The distribution is relatively scattered. The drinking water for villagers is mountain spring water.
2		Shiti Town Government Resettlement Community	15/35 in the south of the road	-1	14/54	0	The route passes through the village in the form of an embankment. The house is located on the east of the route, directly facing the planned highway, and is a 7-story building. The distribution is centralized
3		Group 5 of Shuangjing Village	40/60 in the south of the road	-10	0	10/40	The route passes through the village in the form of a road cut. The houses along the road are located on the east of the route, sideway facing the planned highway, and most of them are one to two-story brick-concrete structures. The distribution is relatively scattered and the drinking water for villagers is mountain spring water.
4		Yangkou Village	46/66 in the south of the road	-2	0	31/124	The route passes through the village in the form of bridges. The houses along the road are located on the east of the route, sideway facing the planned highway, and most of them are one to two-story brick-concrete structures. The distribution is relatively scattered and the drinking water for villagers is mountain spring water.
5		Jiutiaogou Village	74/94 in the south of the road	-4	0	6/24	The route passes through the village in the form of bridges. The houses along the road are located on the east of the route, sideway facing the planned highway, and most of them are one to two-story brick-concrete structures. The distribution is relatively

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
							scattered and the drinking water for villagers is mountain spring water.
6		Group 3 of Langou Village	90/110 in the south of the road	-17	0	10/40	The route passes through the village in the form of bridges. The houses along the road are located on the east of the route, sideway facing the planned highway, and most of them are one to two-story brick-concrete structures. The drinking water for villagers is mountain spring water.
7		Group 5 of Langou Village	73/93 in the south of the road	-3	0	23/92	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, sideway facing the planned highway, and most of them are one to two-story brick-concrete structures. The distribution is relatively scattered and the drinking water for villagers is mountain spring water.
8		Group 9 of Langou Village	15/35 in the south and north of the road	-3	21/85	63/252	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, facing the planned highway, and most of them are one to two-story brick-concrete structures. The drinking water for villagers is mountain spring water.
9		Group 13 of Lishi Village	18/38 in the south of the road	-1	5/23	16/65	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, directly facing the planned highway, and most of them are two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
10		Group 11 of Lishi Village	16/36 in the south of the road	2	11/44	21/84	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, directly facing the planned highway, and most of them are two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
11		Group 9 of Lishi Village	20/40 in the south of the road	-5	4/15	40/160	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, facing the planned highway, and most of them are one to two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
12		Group 8 of Lishi Village	60/80 in the south of the road	-8	0	11/44	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, facing the planned highway, and most of them are two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
13		Dian'an Village	15/35 in the south of the road	1	4/16	22/92	The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, facing the planned highway, and most of them are two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
14		Shiti Town Health Center	15/35 in the south of the road	1	/		The route passes in the form of a bridge. The hospital sideway faces the planned highway and the houses are three-story brick-concrete structures. The hospital has 13 doctors and 5-10 beds.
15		Hanbin District TCM Hospital	15/35 in the south of the road	-8	/		The route passes in the form of a bridge. The hospital directly faces the planned highway and the houses are multi-story brick-concrete structures. The hospital has 100 doctors and 400 beds. Under construction
16		The Third Hospital of Ankang Central Hospital	15/35 in the north of the road	1	/		The route passes through the south of the hospital in the form of a road cut. The hospital sideway faces the planned highway, and the houses are three-story brick-concrete structures. The hospital has 1813 doctors and 1390 beds.
17	Huanta Road	Dian'an Village	11/17 in the east of the	-1	0	111/358	Demolition and relocation of houses within the construction site.

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
			road				The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, directly and sideway facing the planned highway, and most of them are two to three-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
18		Shuangjing Village	11/17 in the east of the road	-1	0	135/405	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the east and the west of the route, sideway facing the planned highway, and most of them are two to three-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
19		Dian'an Primary School	East of the road 173/179	-1	0		The route passes in the form of an embankment. Dian'an Primary School has its back to the planned highway and the houses are three-story brick-concrete structures. The hospital has 32 teachers and 61 students.
20	The Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)	Dian'an Village	15/35 in the left and right of the road	1	0	174/525	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the east and the west of the route, directly facing the planned highway, and most of them are two to four-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
21		Shuangjing Village	15/35 in the left and right of the road	1	0	127/385	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the east and the west of the route, directly facing the planned highway, and most of them are two

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
							to four-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
22		Wangwan Village	Left and right of the road 15/35	1	0	145/440	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the west and east of the route, directly facing the planned highway, and most of them are two to four-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
23		New Hope Kindergarten	East of the road 20/40	1	/		The route passes through the village in the form of an embankment. The medical school directly faces the planned highway and the houses are three-story brick-concrete structures. The hospital has 16 teachers and 211 students.
24		The Third Hospital of Ankang City	East of the road 15/35	1	/		The route passes through the west of the hospital in the form of a road cut. The hospital directly faces the planned highway, and the houses are three-story brick-concrete structures. The hospital has 1813 doctors and 1390 beds.
25	Zhenxing Road	Dian'an Village	East and west of the road 17/30	1	0	10/41	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the north and the south of the route, sideway facing the planned highway, and most of them are two to three-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
26		Lishi Village	East and west of the road 19/32	1	0	136/416	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the east and west of the route, directly facing

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
							the planned highway, and most of them are one to two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
27		Shigou Village	North of the road 20/33	2	0	24/97	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on the north of the route, directly facing the planned highway, and most of them are two to three-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
28		Hanbin District TCM Hospital	North of the road 17/30	1	/		The hospital has its back to the planned highway and the houses are multi-story brick-concrete structures. The hospital has 100 doctors and 400 beds. Under construction
29	Lvyuan Road	Lishi Village	East and west of the road 16/25	1	0	74/235	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on both the east and west of the route, directly facing the planned highway, and most of them are one to two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
30		Hanbin District TCM Hospital	160/169 in the left of the road	-8	/		The route passes in the form of a bridge. The hospital sideway faces the planned highway and the houses are multi-story brick-concrete structures. The hospital has 100 doctors and 400 beds. Under construction
31	Chunlin Road	Lishi Village	97/106 in the west of the road	4	0	19/62	Demolition and relocation of houses within the construction site. Mostly one to two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
32	North section of	Shigou	East of the	-3	0	24/97	Demolition and relocation of houses within the

S/N	Project	Name	Distance of the first row from the red line/center line (m)	Difference in height from houses (m)	Number of households/persons within the evaluation scope		Note
					Category 4a	Category 2	
	Yong'an Road	Village	road 50/63				construction site. The route passes through the village in the form of an embankment. The houses along the road are located on the east of the route, directly facing the planned highway, and most of them are one to two-story brick-concrete structures. The drinking water for villagers is from the urban water supply.
33		Langou Village	East and west of the road 12/25	3	0	47/156	Demolition and relocation of houses within the construction site. The route passes through the village in the form of an embankment. The houses along the road are located on the east and west of the route, directly facing the planned highway, and most of them are two to three-story brick-concrete structures. The drinking water for villagers is from the urban water supply.

Table 4.5-2 Statistics of Environmentally Sensitive Targets of the Project

S/N	Project name	Sensitive point	Direction/Distance	Number of households/persons	Note
1	**Hanjiang River Riverside Ecological Green Corridor Project (Phase I)**	Group 5 of Shuangjing Village	S/105	60/240	The drinking water for villagers is mountain spring water.
2		Shiti Town Government Resettlement Community	S/95	14/54	The drinking water for villagers is mountain spring water.
3		Group 5 of Shuangjing Village	S/85	10/40	The drinking water for villagers is mountain spring water.
4		Yangkou Village	S/75	31/124	The drinking water for villagers is mountain spring water.
5		Jiutiaogou Village	S/102	6/24	The drinking water for villagers is

S/N	Project name	Sensitive point	Direction/Distance	Number of households/persons	Note
					mountain spring water.
6		Group 3 of Langou Village	S/115	10/40	The drinking water for villagers is mountain spring water.
7		Group 5 of Langou Village	S/101	23/92	The drinking water for villagers is mountain spring water.
8		Group 9 of Langou Village	S/5	63/252	The drinking water for villagers is mountain spring water.
9		Group 13 of Lishi Village	S/31	16/65	The drinking water for villagers is from the urban water supply.
10		Group 11 of Lishi Village	S/32	21/84	The drinking water for villagers is from the urban water supply.
11		Group 9 of Lishi Village	S/48	40/160	The drinking water for villagers is from the urban water supply.
12		Group 8 of Lishi Village	S/88	11/44	The drinking water for villagers is from the urban water supply.
13		Dian'an Village	S/43	22/92	The drinking water for villagers is from the urban water supply.
14		Shiti Town Health Center	S/125	/	The drinking water for villagers is from the urban water supply.
15		Hanbin District TCM Hospital	S/195	/	The drinking water for villagers is from the urban water supply.
16		The Third Hospital of Ankang Central Hospital	S/5	/	The drinking water for villagers is from the urban water supply.
17	Huangyang River Water Environment Improvement and Ecological Restoration Project	Dian'an Village	N/16	40/160	The drinking water for villagers is from the urban water supply.
18		Shuangjing Village	N/15	11/44	The drinking water for villagers is from the urban water supply.
19		Wangwan Village	N/10	22/92	The drinking water for villagers is from the urban water supply.
20		Houyan Village	S/2	45/238	The drinking water for villagers is from the urban water supply.
21	Parking lot 4	Wangwan Village	E/5	22/92	The drinking water for villagers is from

S/N	Project name	Sensitive point	Direction/Distance	Number of households/persons	Note
					the urban water supply.
22	Community Park 2	Shuangjing Village	W/5, E/5	60/225	Demolition and relocation of houses within the construction site. The drinking water for villagers is from the urban water supply.
23	Parking lot 3	Shuangjing Village	S/5	21/84	Demolition and relocation of houses within the construction site. The drinking water for villagers is from the urban water supply.
24	Community Park 1, Parking Lot 1	Langou Village	E/76	22/76	The drinking water for villagers is from the urban water supply.
25	Chengdong Sports Park in Ankang and Parking lot 2	Lishi Village	N/5	300/1140	Demolition and relocation of houses within the construction site. The drinking water for villagers is from the urban water supply.
26		Hanbin District TCM Hospital	S/195	/	Demolition and relocation of houses within the construction site. The drinking water for villagers is from the urban water supply.

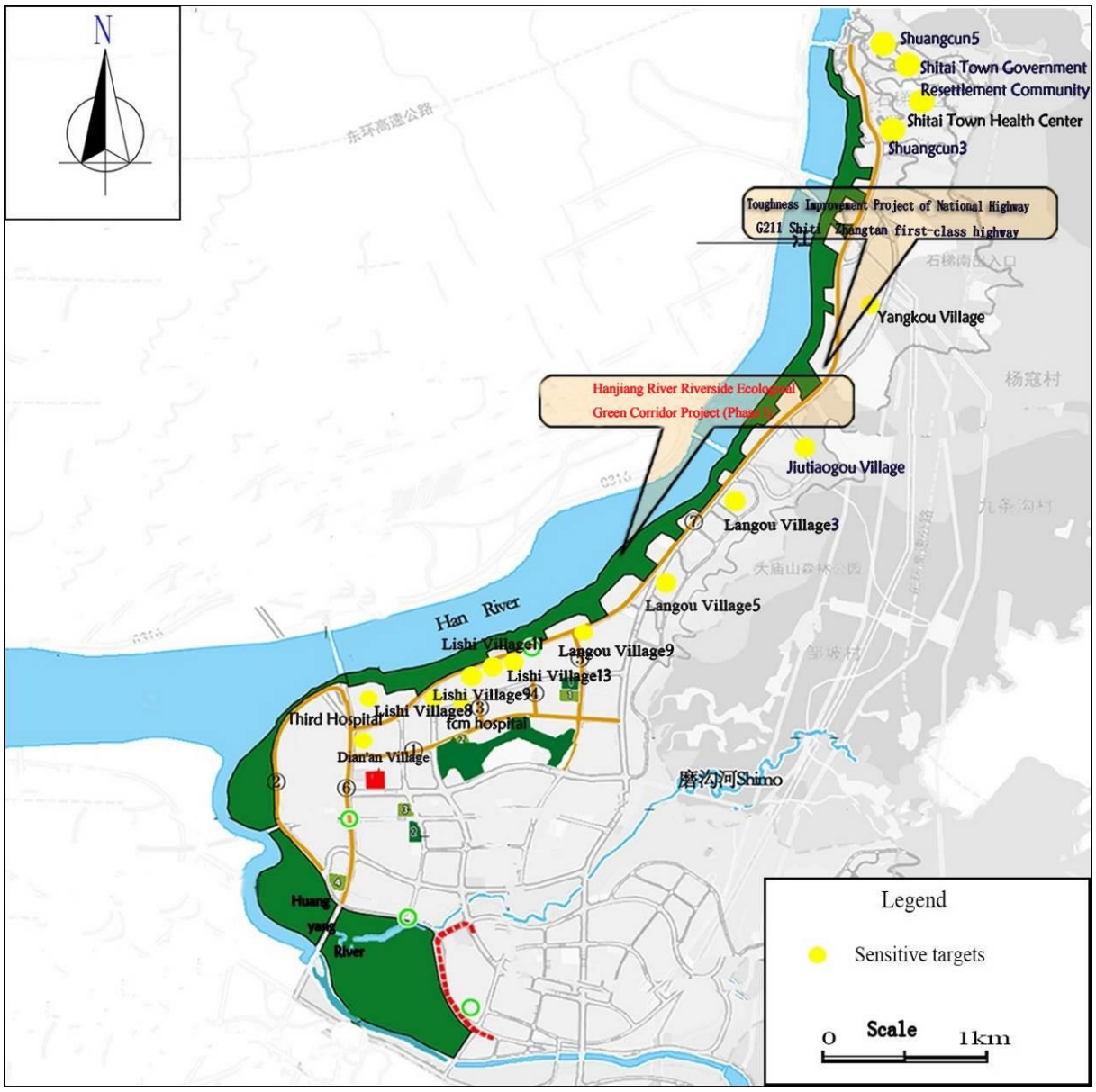


Figure 4.5-6 Project Sensitive Targets Map of Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211 and Hanjiang River Riverside Ecological Green Corridor Project (Phase I)

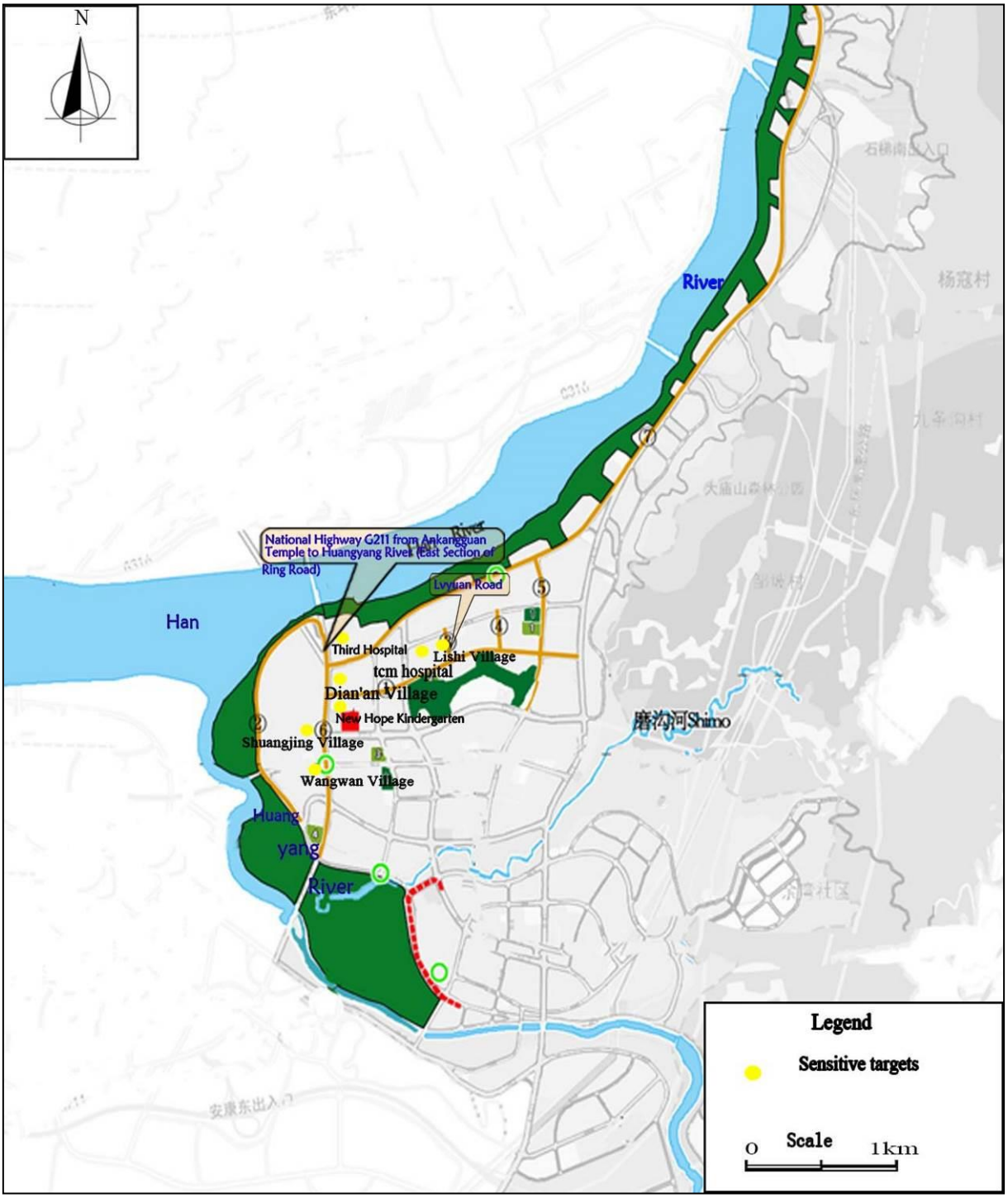


Figure 4.5-7 Sensitive Targets Map of the Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) and Lvyuan Road

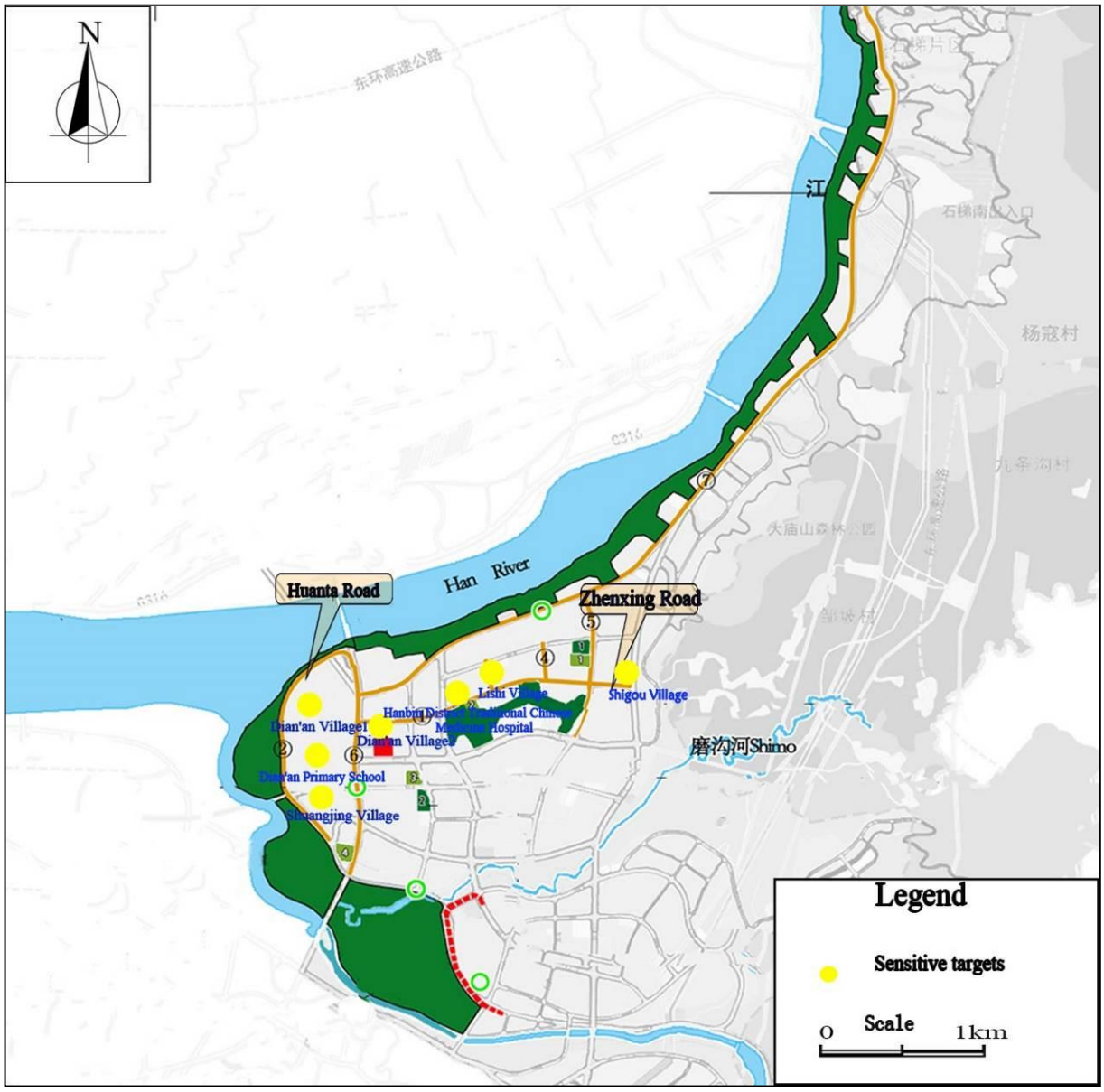


Figure 4.5-8 Sensitive Targets Map of Huanta Road and Zhenxing Road

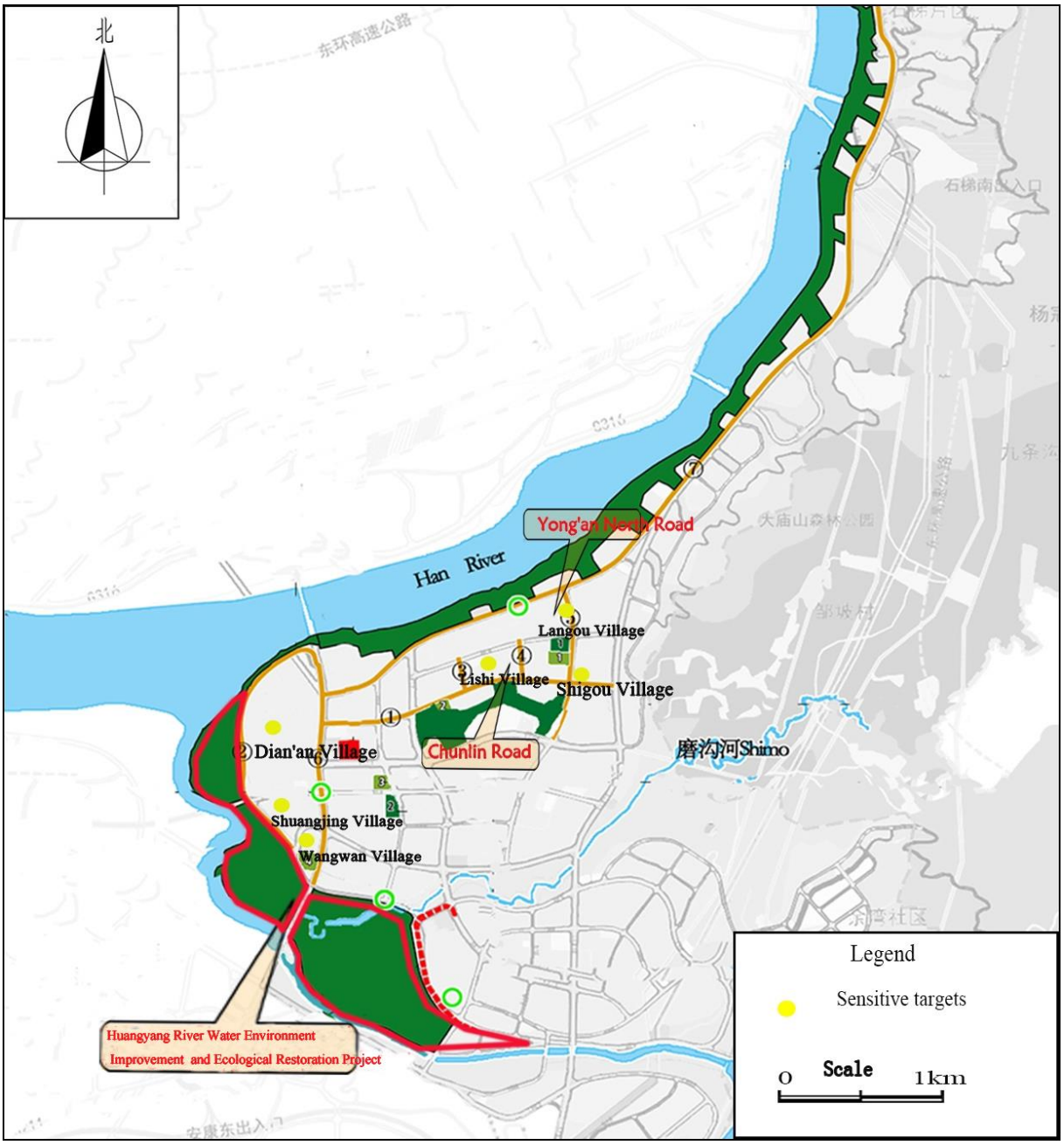


Figure 4.5-9 Sensitive Targets Map of Chunlin Road, North Section of Yong'an Road and Huangyang River Water Environment Improvement and Ecological Restoration Project

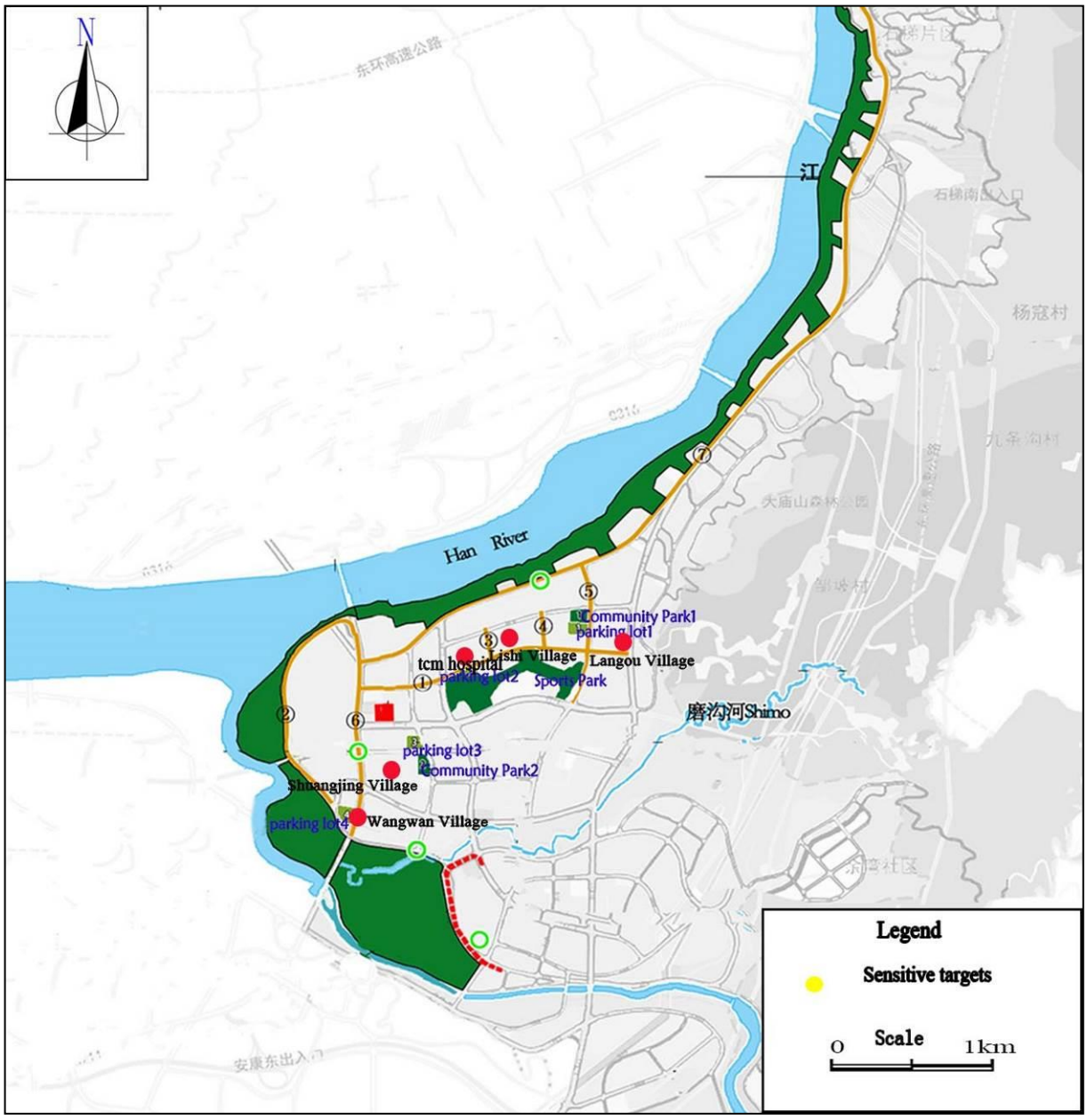


Figure 4.5-10 Distribution Map of Sensitive Sites for Other Subprojects

4.6 Due diligence for related facilities

According to the *Environmental and Social Framework (ESF)* of the Asian Infrastructure Investment Bank (AIIB), "associated facilities" are activities that are not included in the description of the Project set out in Project Management Agreement, but are intrinsically related to the construction elements of the Project, and which, through consultation between AIIB and the Project Office of Urban Construction Bureau, the AIIB determines are: (a) directly and materially related to the Project; (b) carried out, or planned to be carried out, contemporaneously with the Project; and (c) necessary for the Project to be viable and would not be carried out if the Project did not exist.

According to the definition of associated projects mentioned above, after identification, there are no associated facilities for the Project. The identification and overview of associated facilities can be found in Table 4.6-1 and Table 4.6-2.

4.6.1 Sewage treatment stations

According to the on-site investigation, there are currently 8 operational domestic sewage treatment stations in Zhangtan Town. The treatment processes, treatment capacities, and operational conditions of these domestic sewage treatment stations are shown in Table 4.6-1.

According to the *Overall Plan for Chengdong New Area of Ankang City (2018-2035)*, Zhangtan Town plans to construct Zhangtanbei Sewage Treatment Plant and Zhangtan (Chengdong New Area) Sewage Treatment Plant. Zhangtanbei Sewage Treatment Plant is designed to treat 5,000m³/d, and Zhangtan Sewage Treatment Plant is designed to treat 18,000m³/d. After the completion of the construction of the two sewage treatment plants, the sewage in Zhangtan Town will be uniformly discharged into the aforementioned two sewage treatment plants for centralized treatment.

Table 4.6-1 Summary of Existing Domestic Sewage Treatment Stations in the Project Area

Name of sewage treatment station	Longitude and latitude	Treatment process	Treatment scale	Operating condition
Dian'an Village Sewage Treatment Station	N32.7039, E109.0658	Anaerobic tank - facultative tank - secondary precipitation - Submersible artificial wetland (DWWSCW)	50t/d	It has been constructed and is operating normally.
Wangwan Village Sewage Treatment Station	N32.70009, E109.0650	Anaerobic tank - facultative tank - secondary precipitation - Submersible artificial wetland (DWWSCW)	150t/d	It has been constructed and is operating normally.
Tianwan Community Sewage Treatment Station	N32.67389, E109.1087	Anaerobic tank - facultative tank - secondary precipitation - Submersible artificial wetland (DWWSCW)	80t/d	It has been constructed and is operating normally.
Zhangtan Community Sewage Treatment Station	N32.6905, E109.0793	MBR membrane	200t/d	It has been constructed and is operating normally.
Houyan Village Sewage Treatment	N32.6918, E109.0795	AOC + integrated treatment + sterilization	300t/d	It has been constructed and is

Name of sewage treatment station	Longitude and latitude	Treatment process	Treatment scale	Operating condition
Station				operating normally.
Old Street Sewage Treatment Station	N32.4180, E109.456	AOC + integrated treatment + sterilization	300t/d	It has been constructed and is operating normally.
Zhangtan Community West Section Sewage Treatment Station	N32.6980, E109.0771	A^3O+MBBR	200t/d	It has been constructed and is operating normally.
Zhangtan Community East Section Sewage Treatment Station	N32.6981, E109.0774	A^3O+MBBR	200t/d	It has been constructed and is operating normally.

4.6.2 Roads

According to the on-site investigation, the specific situations of the road construction are shown in Table 4.6-2.

Table 4.6-2 Specific Situations of Existing Road Construction in the Project Area

Project	Construction content	Dependability analysis	Note
Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)	Running from north to south and crossing G316, the road project connects to the Ankang North Ring Road under construction, with the establishment of Guanmiao Interchange, crosses the Hanjiang River, passes through the Dian'an Village, Shuangjing Village, Wangwan Village, and stops at the level crossing of South Ring Road and Zaoyuan Road, with a construction length of about 4.029km. The starting coordinates are N32°43'6.7118", E109°03'38.573", and the ending coordinates are N32°41'11.936", E109°03'51.188". The starting point of the project route is located in the north side of Jinxing Village, Guanmiao Town, Hanbin District, Ankang City, and the end point is located at the intersection of Zaoyuan Road and the South Ring Road. The total length of the route is 4.029km, five bridges are set	On October 13, 2021, the Ankang Ecological Environment Bureau Hanbin Branch issued an EIA approval for the Project; it meets the requirements.	The construction project includes the Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) in the Project, which is 1254m in length.

Project	Construction content	Dependability analysis	Note
	up with a total length of 1724.4m, accounting for 42.80% of the total length of the route. There is one culvert, one reconstruction of Zaoyuan Road interchange and five level crossings. The construction includes road projects (including the reconstruction project of National Highway 211 and reconstruction project of National Highway 316), new construction of bridge projects (including the construction of Guanmiao Hanjiang River Bridge (approach bridge and main bridge), reconstruction project of Huangyang River Bridge, new construction project of Zaoyuan Road Interchange and construction project of National Highway 211 subsidiary small bridges), landscape lighting and related ancillary works, with a total construction length of 4.029km.		

Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211: the starting point of the route is located at the bridgehead of the Shiti Hanjiang River Bridge to connect G316, and the end point is located in Dian'an Village, Zhangtan Town to connect the G211. The geographical coordinates are E109°06'24.37"-E109°04'12.03", N32°45'18"-N32°42'25.47". The project passes through the Shiti Town and Zhangtan Town in Hanbin District from north to south.

	
G211	Bridgehead of the Shiti Hanjiang River Bridge to connect G316

5. Environmental Impact Analysis

5.1 Environmental impact analysis during the construction period

5.1.1 Water and soil loss and earthwork balance

In the composition of the Project, urban low-carbon and resilient transport facilities involve the reconstruction and expansion of urban roads; urban ecological restoration and green resilient infrastructure construction involves Hanjiang River Rehabilitation and Riverside Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering; the ecological park and urban integrated waterlogging prevention and control system section involves 3 projects: Chengdong Sports Park in Ankang, Community Ecological Park Project, and Urban Integrated Waterlogging Prevention and Control System Construction Project.

In the construction process of the project, land consolidation, earthwork and other constructions will change, damage or bury the original landform and vegetation to different extent, which will reduce or lose the function of water and soil conservation. The main factor leading to water and soil loss during the construction period is that the surface soil is loosened during site leveling and excavation and filling, so that the loss of surface soil will occur when encountering heavy rainfall.

To ensure the safety of main project and prevent severe water and soil loss that may occur during engineering construction, the following measures shall be taken:

① Temporary storage yards of spoil generated during construction and construction materials must be leveled and corresponding enclosing measures must be taken. It is prohibited to dump or stack spoil and muck in any other place;

② During the construction period, make a reasonable planning for earthwork balance, and keep the implementation process reasonably connected to avoid earthwork stacking. If stacking is necessary, pay attention to the reasonable stacking of earthwork, keep a certain distance from surrounding roads, and set up corresponding drainage ditches;

③ Try to avoid the rainy season to prevent abrupt rainstorm from scouring the exposed surface and causing water and soil loss. In the construction stage, necessary slope protection measures (setting up temporary retaining walls) must be taken to avoid large-scale water and soil loss when the construction cannot be carried out in the rainy season;

④ Arrange the operation period reasonably and accelerate the construction progress in time, and clean up the site timely after the construction is completed. The project area shall be

hardened, greened, and planted with trees and grass according to the plan to minimize water and soil loss;

⑤ Minimize the excavation area, reduce the slope of excavation face, and try to achieve excavation with synchronized leveling, filling, tamping and transportation to reduce the reserve of loose soil. Try to make full use of excavation and filling earthwork as well as spoil in each engineering area;

⑥ During the construction process of main project, we should do a good job in preventing water and soil loss, and avoid construction in rainy season to reduce human induced water and soil loss during the construction process; temporary works, construction roads and other projects should be controlled within the scope of land acquisition and occupation as far as possible to reduce damage to the soil and surface vegetation around the project area.

After taking the measures proposed in this assessment, the impact of water and soil loss during the construction period will be further reduced. Compared with the original ecology, the amount of water and soil loss will be greatly reduced to ensure that the ecological environment and landscape are not affected. In addition, water and soil loss of the construction site mostly occurs in the early stage of construction. With the progress of the construction period, water and soil loss will be greatly reduced and its impact will be gradually weakened.

The following projects mainly involve earthwork filling and excavation engineering: Hanjiang River Rehabilitation and Riverside Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering.

According to the feasibility study design of the project, in order to make effective use of land resources and achieve earthwork balance, we start the design from maximizing the overall function of the park, and make overall arrangements of the relations between various scenic spots, facilities and landscapes in the park. As required by relevant specifications and combined with the actual situation of the site, the vertical design of the Project refers to the height and slope of the original site, and each node basically maintains the terrain of the original site except for special structures.

During earthwork construction, we should reasonably arrange the excavation sequence, and properly arrange the allocation of excavation and filling amount of earthwork, so as to balance the amount of excavation and amount of filling for earth-rock engineering.

According to the *Feasibility Study Report of Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, the amount of excavation and amount of filling for

each project are shown in Table 5.1-1 below.

Table 5.1-1 Earthwork Balance Table for the Project, Unit: m^3

S/N	Section	Engineering project	Backfilling earth - rock	Excavating earth - rock	Discarded earth - rock	Borrowing earth - rock
1	Urban Low-carbon and Resilient Transport Facilities	Ankang Chengdong City-Industry Integration Demonstration Area — Zhenxing Road	67900	608400	540500	-
2		Ankang Chengdong City-Industry Integration Demonstration Area — Huanta Road	607845	347114	-	260731
3		Ankang Chengdong City-Industry Integration Demonstration Area — Lvyuan Road	8413	7763	-	650
4		Ankang Chengdong City-Industry Integration Demonstration Area — Chunlin Road	62470	72479	10009	-
5		Ankang Chengdong City-Industry Integration Demonstration Area — Yongan Road North Section	76984	103475	26491	-
6		The Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road)	67294	72575	5281	-
7	Urban Ecological Restoration and Green Resilient Infrastructure Construction Project	Protection Zone 1 Project of Zhangtan Town Section Protection Engineering	706166	129298	-	576868
8	Total		1597072	1341104	582281	**838249**

As can be seen from the above table, following the principle of spoil earthwork first used as borrowing earthwork, it is calculated that the final volume of silty clay to be purchased for the project is 255,968m^3, so as to achieve earthwork balance for the project.

Earthwork excavation mainly includes earth-rock of foundation trench at embankment foundation. Earthwork excavation is carried out mainly by mechanical construction and supplemented by manual work; excavated and usable materials shall be preferred as embankment filling materials, and the rest shall be provided by the material yard.

At present, it is impossible to determine the location and scale of the filling material yard in the feasibility study stage. This assessment requires that in the process of designing and selecting material yard in the later stage, it is necessary to avoid it being located in or near natural habitats, important habitats and altered habitats with important biodiversity value, and to handle legal environmental protection procedures and administrative license.

5.1.2 Environmental impact analysis of temporary occupied land

According to the construction scheme of key project, the temporary occupied land of Low-impact and Resilient Road Engineering is all arranged within the permanent land of the project, and no temporary occupied land is arranged outside the site boundary. The temporary occupied land is mainly used for material storage yard, construction road, etc. The construction scheme of Protection Zone 1 Project of Zhangtan Town Section Protection Engineering takes into account the centralized layout of living quarters, finished material storage yard, auxiliary production enterprises and warehouses of building materials such as cement and steel bars according to local conditions. The sand and gravel processing system is located near the material yard, and the concrete mixing station can be arranged according to the progress of the project.

According to relevant provisions of the *Wetlands Conservation Law of the People's Republic of China* and the *Regulations on Wetlands Conservation in Shaanxi Province*, this assessment requires that it is prohibited to set up construction, production and living areas such as borrow/spoil site, material storage yard, construction camp, precast yard and mixing station within Hanjiang River Wetland in the construction process. Set up diversion ditches around the material and earthwork areas to prevent rainwater from forming surface runoff and carrying a large amount of sediment and other materials into surface water.

At the present stage, the location of material yard for the Project has not been determined, and the EIA puts forward the site selection requirements for the material yard, which shall not be located in or near natural habitats, important habitats and altered habitats with important biodiversity value.

According to the definition given in ESF, natural habitats refer to areas where most of the plant and/or animal species gathered are native, and/or where human activities have not substantially altered the main ecological functions and species composition of the local areas; important habitats refer to areas with high importance or value in terms of biodiversity. In the

future project implementation process, the selection of material yards requires the cooperation of material yard enterprises with corresponding environmental protection procedures and material yard business licenses. To obtain corresponding environmental protection procedures in China, such material yards must meet the requirements of site selection and land occupation, and not involve ecological conservation red line and permanent basic farmland, namely, including natural habitats, important habitats and altered habitats with important biodiversity value.

According to the above earthwork balance table, it can be seen that 255968m^3 of earth-rock needs to be purchased for project construction. The assessment requires that the quantity of earth-rock should be further optimized in the design process of the next stage. According to the actual construction situation, all excavated earth-rock should be reused in the project without being discarded.

The number of workers at the peak of project construction is estimated to be 200. Since it is impossible to determine the specific number of migrant workers and local construction workers in the feasibility study stage, the assessment requires that workers from surrounding villages and towns shall be selected as construction workers as much as possible, for they do not need accommodation at the construction camp. If a construction camp is really necessary, local private houses can be rent and mobile dry toilets shall be set up to ensure the effective collection of domestic sewage and waste. If they need dining and washing in the construction camp, they shall be managed in a centralized and unified way, such as centralized dining and washing, so as to minimize the amount of domestic sewage. Control the amount of detergent in the washing process, and replace it with hot water or other methods to reduce the detergent content in sewage. Set up temporary septic tanks in the construction camp, and prohibit the discharge of domestic sewage into water source conservation areas and nearby rivers and canals during the construction period. Regarding construction wastewater, set up oil separators to collect wastewater from overhauling and vehicle cleaning, and reuse it after oil separation and sedimentation treatment. Do not discharge it into nearby water bodies.

Strengthen the construction period management, shorten the construction period, and carry out the construction strictly according to construction method specified in the feasibility study scheme. Put an end to barbaric construction and eliminate the impact of construction on water bodies.

5.1.3 Atmospheric environmental impact analysis

During the construction of the project, the exhaust gas emitted by various fuel-powered machinery and transport vehicles, as well as the dust generated in the process of earth cutting,

moving, filling, tamping and vehicle transport will cause atmospheric pollution to surroundings. The main pollutants of atmospheric pollution include nitrogen dioxide, carbon monoxide, sulfur dioxide and dust, with dust pollution being the most prominent. The exposed mound causes a sudden increase in the content of floating dust in the atmosphere when the wind blows dust and vehicles pass by, which will have an impact on surrounding buildings, plants and sensitive points.

Dust comes from land clearing, excavation, backfilling, earthwork transfer and stacking, mostly caused by vehicles driving back and forth on the construction site. The emission of dust is proportional to the area of construction site and the frequency of construction activities, directly proportional to the content of sediment particles in the soil, and also related to local meteorological conditions such as wind speed, humidity, sunlight, etc. At present, there is no sufficient experimental data to derive the emission amount of dust. The analogy method is adopted in this assessment. We conducted an investigation and measurement according to dust emission data on the construction sites of four municipal projects (two with enclosures and two without enclosures) from Beijing Research Academy of Environmental Sciences, and the wind speed during measurement was 2.4m/s. The results are shown in Table 5.1-2.

Table 5.1-2 Research Data on Environmental Pollution Caused by Construction Dust

Project name	Enclosure	TSP concentration (mg/m^3)						
		Downwind direction of the construction site						Control point in upwind direction
		20m	50m	100m	150m	200m	250m	
South Second Ring Tiantan Section Project	None	1.54	0.981	0.635	0.611	0.504	0.401	0.404
South Second Ring Taoranting	None	1.467	0.863	0.568	0.570	0.519	0.411	
Mean		1.503	0.922	0.602	0.591	0.512	0.406	
West Second Ring Reconstruction Project	Enclosed by metal plate	0.943	0.577	0.416	0.421	0.417	0.420	0.419
Chegongzhuang West Road Thermal Engineering	Enclosed by color strip cloth	1.105	0.674	0.453	0.420	0.421	0.417	
Mean		1.042	0.626	0.435	0.421	0.419	0.419	

According to the measurement results, the construction dust without enclosures has a wide pollution range and high concentration. Its pollution range can reach about 250m in the downwind direction, and the maximum pollutant concentration is up to about 0.756mg/m^3,

which is 1.87 times that of the control point. When enclosure measures are taken, the pollution range of construction dust can reach about 200m in the downwind direction, and the maximum pollutant concentration is up to about 0.585mg/m^3, which is 1.4 times that of the control point.

Dust pollution is easy to occur during storage and transportation of bulk materials, and the impact range can reach 150m in the downwind direction during transportation.

The construction machinery and heavy-duty diesel vehicles used in the construction process are required to use diesel fuel that meets the National Phase VI Motor Vehicle Pollutant Emission Standards. It is prohibited for construction machinery and transport vehicles to emit black smoke. In addition, the project is located in an open area with good ventilation conditions, so the impact on sensitive points after atmospheric diffusion is relatively small.

During the construction period, after the construction dust prevention and control measures proposed in the EIA report are taken and the construction is organized in accordance with relevant requirements of the *Regulations of Shaanxi Province on Prevention and Control of Air Pollution (2019 Revision)*, *Special Action Plan for the Control of Atmospheric Pollution in Shaanxi Province (2023-2027)*, and "Six 100%", the dust emissions from the construction site can meet the relevant requirements of the local environmental protection standards in Shaanxi Province, specifically the *Limiting Value of Fugitive Dust Emissions from Construction Sites* (DB61/1078-2017). In addition, as the construction period ends, the dust gradually disappears, and the impact on the regional environmental air quality is not significant.

5.1.4 Water environmental impact analysis

Since the Project involves Hanjiang River Rehabilitation and Riverside Green Corridor Project, etc., construction along the river may result in oil stain run, emitted, dripped and leaked from construction machinery, and/or a certain amount of oily wastewater generated by outdoor construction machinery after being washed by rainwater, etc. Domestic waste generated by the on-site construction personnel camp may be washed into the river by rainwater and also affect the water quality of river.

If the road materials are not properly stored during the construction period, they may be washed into water bodies by rainwater, which may cause river blockage, slow water flow, river water pollution, etc., and affect the water quality. Therefore, protection and management measures shall be strengthened according to the characteristics of different road materials in order to minimize the impact on water environment and water quality.

Concrete mixing station is mainly used for mixing cement stabilized crushed stone for the

base course of pavement engineering. Wastewater will be produced in the production process of mixing concrete, mainly in the form of flushing wastewater from the concrete drum and charging bucket. The discharge of wastewater generated by concrete has the characteristics of high concentration of suspended solids, small water volume and intermittent centralized discharge. According to relevant data, the volume of wastewater generated by each flushing of concrete drum and charging bucket is about 0.5m^3, with a SS concentration of about 5,000mg/L and pH value of about 12. The concentration of pollutants in the wastewater greatly exceeds the requirements of Level I standard limits given in the *Integrated Wastewater Discharge Standard*. Therefore, such wastewater needs to be reused after centralized treatment by a sedimentation tank and cannot be directly discharged.

It is required that the construction camp and temporary storage area of construction materials and equipment shall be far away from Hanjiang River to ensure that their wastewater will not flow into Hanjiang River and affect the water quality of river.

After the sand and gravel flushing wastewater is treated by a sedimentation tank, most of the suspended matters are removed, so it can be recycled for sand and gravel flushing and concrete curing to achieve zero discharge of wastewater.

Concrete curing wastewater is weakly alkaline and the main pollutant is SS, with lower concentration.

The pipeline pressure test will produce a small amount of wastewater, which will be reused to the maximum extent after being collected and treated by a sand basin. It will be used for vehicle washing and sprinkling water for dust suppression on construction sites and material storage yards, and the rest water will be used for greening of trees on surrounding roads, which will not have a significant impact on the environment.

Water gushing may occur during the construction of the tunnel section of the proposed north section of Yong'an Road, which will not only affect the working environment, but also make the tunnel face unstable, and reduce the effect of shotcrete and anchor rod construction. In addition, it may cause problems such as surface water depletion, environmental pollution and ecological impact. The assessment suggests that in the construction stage, the New Austrian Tunneling Method (NATM) principle can be adopted to arrange holes axially along the tunnel excavation contour line (including the bottom) in a radial pattern (also arrange holes in the center of excavation face), and to conduct full cross-section fully enclosed deep hole grouting and consolidation to stop water, so that a water-blocking curtain (in reinforcement zone) is formed around the tunnel and excavation face, cutting off the groundwater flow path, maintaining the stability of surrounding rock, and enhancing construction safety.

For the stratum with complex structure and abundant water, it is necessary to accurately

forecast the engineering geology and hydrogeological conditions within the range of 20~25m in front of the working face, in order to provide the basis for developing construction schemes and determining grouting parameters.

Highway tunnel construction usually adopts the construction technology of supporting while tunnelling, which can effectively control the occurrence of vegetation death in the upper area of the tunnel caused by groundwater dewatering in the construction process. Small-dose multi-point blasting can be adopted to ensure bedrock integrity and reduce water gushing of tunnel. The assessment requires us to strengthen water volume monitoring in the process of tunnel construction, and carry out timely grouting for water plugging when large water gushing is found, which can reduce the water inflow.

According to the field investigation, it is found that the two water supply wells of Wangwan Water Plant are located in the flood land of Huangyang River, one on the south side of Huangyang River channel and the other on the north side of Huangyang River channel, which are within the scope of Huangyang River Water Environment Improvement and Ecological Restoration Project. It is required to avoid the water supply wells and set up intercepting ditches during construction to ensure that the water supply wells are not affected by the construction process.

5.1.5 Noise and vibration impact analysis

I. Urban Low-carbon and Resilient Transport Facilities

During highway construction, there are many types of working machines, such as diesel pile drivers, drilling machines, vacuum pressure pumps and concrete mixing equipment during highway foundation treatment, as well as bulldozers, road rollers, graders and loaders during subgrade filling. The noise value of these machines is 76~95dB (A) in the distance of 5~15m from the source, and the sudden and unsteady-state noise sources will have a certain impact on the surroundings. According to the measured data of commonly used machinery, the pollution source intensities are shown in Tables 5.1-3 respectively.

Highway construction is different from general building construction, and the characteristics of the noise generated are mainly manifested in the following aspects:

(1) There are many kinds of construction machinery. Different construction machinery is available in different construction stages, and the construction machinery used in the same construction stage is also different, so that the construction noise has the characteristic of occasionality.

(2) The noise sources of different equipment have different characteristics, and the noise of

some equipment is vibrating, sudden and impulsive, with great impact on people; some equipment (such as mixer) has low frequency, which is not easily attenuated and makes people feel agitated; all noises of construction machinery are relatively high, but there is still a significant difference in noise levels between them, and the running noise of some equipment can be as high as 90dB or more.

(3) Construction noise source is different from the general fixed noise source, because it includes both fixed noise source and flowing noise source. Construction machinery is often exposed outdoors, and it will move in a certain small range within a certain period of time, which increases the noise pollution range during this period compared with the fixed noise source, but the construction noise pollution is still in a local range compared with the flowing noise source.

(4) The construction equipment and its impact range are relatively small, so the noise of construction equipment can basically be considered as a point sound source.

(5) For specific sections of highway, construction noise pollution only occurs for a period of time.

Table 5.1-3 Noise Values of Highway Construction Machinery

S/N	Machinery type	Type	Distance from measuring point to construction machinery (m)	Maximum noise level Lmax dB (A)
1	Wheel loader	ZL40	5	90
2	Wheel loader	ZL50	5	90
3	Motor grader	PY16A	5	90
4	Vibrating roller	YZJ10B	5	86
5	Double-wheel double-vibration road roller	CC21	5	81
6	Three-wheel road roller		5	81
7	Rubber-tyred roller	ZL16	5	76
8	Bulldozer	T140	5	86
9	Hydraulic wheel excavator	W4-60C	5	84
10	Electric generating set	FKV-75	1	98
11	Tapered reverse tilting concrete mixer	JZC350	1	79

II. Urban Ecological Restoration and Green Resilient Infrastructure Construction Project

Construction noise is mainly produced by construction machinery and transport vehicles, and different noises are produced in different stages, different places and different operation natures. It mainly includes Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project,

and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering. The machinery involved in construction mainly includes dump trucks, loaders, excavators, bulldozers, rotary drilling rigs, vibrators, compactors, etc., with the noise levels shown in Table 5.1-4.

Table 5.1-4 Noise Source Intensity of Main Construction Machinery

Equipment name	Noise level/distance [dB(A)/m]
Dump truck	85/5
Loader	80/5
Excavator	85/5
Bulldozer	90/5
Rotary drilling rig	75/5
Vibrator	95/5
Compactor	80/5
Submersible pump	85/5

During the construction of the Project, all kinds of construction machinery can be located anywhere within the construction area, but the position is relatively fixed during a certain period of time, and the impact on external environment can be calculated through the geometric divergence attenuation formula of point sound source in a semi-free sound field:

$$Lp(r) = L(ro)-20lg(r/r_0)$$

Where: Lp(r) — sound pressure at the receiving point, dB (A);

L(ro) — sound pressure at reference point ro, dB(A);

r — distance from the receiving point to the sound source, m;

ro — distance from the reference point to the sound source, m.

According to the confirmation letter of project standards, the assessment of environmental noise status at sensitive points along the line shall be subject to Category 2 standard of the *Environmental Quality Standard for Noise* (GB3096-2008). Therefore, the noise impact range of construction machinery is predicted based on standard values of Category 2 area (60dB(A) in the daytime and 50dB(A) in the nighttime), with prediction results shown in Table 5.1-5.

Table 5.1-5 Maximum Impact Range of Noise from Construction Machinery

Noise generating equipment	Maximum impact range of Category 2 area (m)	
	Daytime	Night
Dump truck	89	281
Loader	50	158
Excavator	89	281
Bulldozer	158	500
Rotary drilling rig	28	89
Vibrator	281	889
Compactor	50	158
Submersible pump	89	281

The prediction results indicate that the impact range of construction machinery is 50-281m in the daytime and 89-889m in the nighttime in Category 2 area.

This assessment recommends the following control measures to mitigate the impact of construction noise on the surroundings:

(1) During the construction, the construction unit shall strictly implement relevant provisions in the *Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011) to avoid the occurrence of incident on disturbing residents.

(2) The construction unit shall schedule the construction work reasonably. Construction activities involving high-noise equipment are prohibited during the night (22:00~6:00) and midday (12:00~14:00) to avoid disturbing the nearby residents. If night construction is carried out when continuous operation is necessary due to the process requirements of construction project or special needs, the construction unit must report the construction date and time to the local competent department of environmental protection 7 days in advance with the certificate issued by the construction management department, and post notices at surrounding noise-sensitive points, then the night construction can only be carried out after being approved and filed by the competent department of environmental protection.

(3) The noise generated by construction machinery is often characterized by burstiness, irregularity, discontinuity and high intensity. The construction unit shall mitigate the noise by reasonably arranging the operation time of construction machinery, and reduce the number of noisy construction machinery operating at the same time to minimize the sound source superposition effect.

(4) Regarding noise sources such as material transportation, knocking, and human shouting during construction period, the construction unit is required to conduct civilized construction and strengthen effective management to mitigate their impact.

(5) Measures such as slowing down and no honking shall be taken for transportation at night; during the construction period, mobile sound barriers shall be set up at the construction site near sensitive points adjacent to the construction site to reduce noise, and the attenuation of mobile sound barriers shall not be less than 25dB(A); construction shall be prohibited at night.

(6) Reduce the traffic noise during transportation: select low-noise construction vehicles, prohibit transport vehicles that do not meet the national noise emission standards from entering the work area, minimize the transportation volume at night, regularly repair and maintain the transport and construction vehicles, and reduce or eliminate honking. Strengthening the management of road traffic during construction and keeping the roads unblocked are also important means to mitigate the impact of traffic noise during the construction period.

Construction machinery and transportation noise will have short-term and temporary adverse impact on surroundings during the construction period of the project. We should strengthen project management, arrange construction time reasonably, prohibit the construction of high-noise equipment at night, and take relevant measures such as noise reduction and sound insulation to reduce the impact of noise on the environment during the construction period. If continuous construction is really necessary at night, an application must be submitted to the competent department of environmental protection in advance. After approval, night construction can only be carried out on the specified date and period, and notices of construction section shall be posted in prominent positions nearby to gain the understanding of surrounding residents.

Construction noise will disappear with the completion of the project, which is temporary and local impact, and has less impact on the environment on the premise of implementing the measures proposed in the EIA.

III. Ecological Park and Urban Integrated Waterlogging Prevention and Control System Project

The construction content of this project mainly includes several stages: foundation excavation, construction of main body and installation of auxiliary facilities, and different construction machinery will be used in each stage. According to the construction machinery for road engineering recommended in the *Specifications for Environmental Impact Assessment of Highways* and the commonly used machinery and equipment in China's current transportation construction projects, the construction equipment with great environmental impact includes excavators, bulldozers, loaders, concrete trucks, road rollers, etc.

The Employer shall take corresponding control measures to reduce the impact of construction noise on surroundings, including arranging construction time reasonably, strengthening

construction management and other noise reduction measures. The impact of noise will be acceptable after the above measures are taken.

IV. Green and Low-Carbon Urban Operation System

Main construction content of the Project is to build a green and low-carbon urban operation management and data center.

The construction period is mainly divided into earthwork stage, foundation construction stage, structure construction stage and decoration stage. Main pollutants generated in each construction stage are as follows:

(1) Earthwork stage: Main noise sources in this stage include excavators, bulldozers, loaders and various transport vehicles. Most of these construction machines are mobile sound sources, with 70% of the noise levels concentrated at 75~105dB(A).

(2) Foundation construction stage: Main noise sources in this stage include various air compressors, vibrators, etc. which are basically fixed sound sources. Although their construction time accounts for a small proportion of the entire construction period, they produce louder noise.

(3) Structure construction stage: This stage takes the longest period in building construction, with many kinds of construction equipment used. Main sound sources include various transportation equipment, vibrating rods, electric saws, abrasive cutoff saws, etc., and the sound power level is about 95~100dB(A). In order to reduce the impact on surrounding sensitive points, construction is prohibited during midday and nighttime, and enclosures are set up around the site area to reduce construction noise and dust pollution.

(4) Decoration stage: The decoration stage generally accounts for a larger proportion of the total construction schedule, but has less number of sound sources and fewer strong noise sources. Main noise sources include grinders, electric drills, cutting machines, etc., and the sound power level of most sound sources is about 90dB(A). Even if some sound sources have higher sound power, they are used for a short time and some are still used in the room. Therefore, it can be considered that the decoration stage cannot constitute the main noise source of construction.

In view of the above characteristics of project construction, the assessment requires that we shall adopt the following measures during the construction period to reduce the impact of construction noise on surroundings: selecting low-noise and low-vibration construction technology and machinery, strengthening equipment maintenance, setting up enclosures, making a reasonable layout, prohibiting night construction, selecting reasonable

transportation route and time for construction equipment and materials, limiting speed and prohibiting honking when transport vehicles pass through residential areas, and arranging construction schedule reasonably, etc.

5.1.6 Solid waste impact analysis

I. Urban Low-carbon and Resilient Transport Facilities

It mainly includes the construction and reconstruction projects of 7 roads, including the construction of public transport network and slow traffic system. The solid waste during the construction period mainly includes excavated and discarded earth-rock, drilling slag, construction waste and domestic waste.

Excavated and discarded earth-rock: A spoil site shall be set up for the project. The excavated earth-rock shall be prioritized for reuse in other construction works of the project, and all the surplus earth-rock shall be piled up in the designated spoil site as required, and shall not be piled up or placed in disorder.

Construction waste: It mainly includes construction waste formwork, building material leftovers, broken steel joints, packing bags, and construction waste generated by demolition. All construction wastes shall be sold for comprehensive utilization in brick making.

Domestic waste: The solid waste includes the domestic waste of on-site construction personnel and the construction waste generated from highway construction sites. During the construction period, the maximum number of construction personnel can reach approximately 200 person-times. Based on the waste generation rate of 1kg/d·person, the daily waste generation of construction personnel is approximately 200kg/d; when parking lots in 4 areas are constructed simultaneously, the maximum number of construction personnel can reach approximately 50 person-times. Based on the waste generation rate of 1kg/d·person, the daily waste generation of construction personnel is approximately 50kg/d. Domestic waste shall be transported to the domestic waste landfill site for disposal periodically.

Solid waste during the construction period will be disposed of reasonably and will not have adverse impact on surroundings.

II. Urban Ecological Restoration and Green Resilient Infrastructure Construction Project

It mainly includes Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering. In the process of project construction, some spoil will be generated during the construction of pipelines, reservoirs, drainage ditches and related landscape node engineering. In the process of

project construction, efforts should be made to achieve the balance between the excavation and filling earthwork as well as comprehensive utilization of the area. The unbalanced earthwork may have an impact on the environment during transportation and disposal. If the vehicles are overloaded, the soil will be scattered all over the ground along the road, and the road will be dusty in sunny days and muddy in rainy days, affecting the passing of pedestrians and vehicles and the environmental quality. Random littering and placing of muck will affect land utilization and unimpeded flow of river, destroy the natural ecological environment, and affect urban construction and cleanliness. Vehicles carrying spoil shall not be overloaded to prevent soil from scattering along the road. In order to prevent the pollution of land by solid waste in the construction process, appropriate protective measures shall be taken.

The specific measures are as follows:

① Temporary soil stacking yards shall be sprinkled with water to prevent dust or covered with dust screen, and drainage ditches shall be set up around to prevent water and soil loss.

② The excess excavated earth shall be promptly cleared and transported to the nearby construction waste dump site for landfill without arbitrary dumping or unloading.

③ Night operation shall be carried out as far as possible, and the spoil transportation shall be sealed to ensure that the muck truck is not overloaded, so as to prevent muck scattering during transportation. After the daily cleaning and transportation work is completed, the construction site shall be backfilled, compacted and cleaned to ensure clean and tidy surroundings.

④ The material transportation of construction vehicles shall try to avoid the peak traffic hours at sensitive points, and take corresponding appropriate prevention measures to reduce the traffic pressure and material leakage during material transportation and possible secondary dust pollution. Therefore, after the above measures are taken, there will be less impact on surroundings.

Domestic waste from construction personnel shall be collected separately, piled up in fixed places, timely cleaned and transported to the waste transfer station by special garbage trucks of the urban appearance department, and delivered to the municipal waste landfill site for sanitary landfill.

In summary, if the solid waste generated during the construction process of the Project can be promptly removed, it will not have a significant impact on the surrounding environment.

III. Ecological Park and Urban Integrated Waterlogging Prevention and Control System Project

The solid waste in the Project mainly includes construction waste, and all the excavated soil will be backfilled without generating any spoil. All construction wastes shall be sold for comprehensive utilization in brick making.

Domestic waste from construction personnel shall be collected separately, piled up in fixed places, timely cleaned and transported to the waste transfer station by special garbage trucks of the urban appearance department, and delivered to the municipal waste landfill site for sanitary landfill.

IV. Green and Low-Carbon Urban Operation System

The solid waste includes the domestic waste of on-site construction personnel and the construction waste generated from construction sites. During the construction period, the maximum number of construction personnel can reach approximately 20 person-times. Based on the waste generation rate of 1kg/d·person, the daily waste generation of construction personnel is approximately 20kg/d.

All construction wastes shall be sold for comprehensive utilization in brick making. Domestic waste from construction personnel shall be collected separately, piled up in fixed places, timely cleaned and transported to the waste transfer station by special garbage trucks of the urban appearance department, and delivered to the municipal waste landfill site for sanitary landfill.

In summary, if the solid waste generated during the construction process of the Project can be promptly removed, it will not have a significant impact on the surrounding environment.

5.1.7 Ecological impact analysis

I. Urban Low-carbon and Resilient Transport Facilities

It mainly includes the construction and reconstruction projects of 7 roads, green public parking lot project in the core area of Chengdong New Area in Ankang, and new energy street lamp construction project, all of which are located within the urban area. Thus, the surrounding areas are mature urban living areas, and the vegetation is mostly urban green belts, therefore, no special or ecologically sensitive areas are involved. After the construction is completed, the landscape greening project will be restored immediately. The construction of these projects will have minimal impact on the regional vegetation system. Additionally, the main construction site of the project is in the urban area. The solid waste generated includes demolished concrete pavement materials and some unusable old rain sewage pipes. The construction unit promptly carries out the removal to minimize the temporary occupation of land during the construction. Therefore, the construction of the Project will have minimal

impact on the regional ecological environment. The proposed construction of the North Section of Yong'an Road includes a short tunnel of approximately 380m in length. The tunnel lining will be designed and constructed based on the new austrian tunnelling method (NATM) principles. The ventilation system of the tunnel will mainly adopt full cross-section longitudinal jet ventilation, semi-transverse ventilation, and full transverse ventilation. The tunnel excavation is transported in a trackless manner, with simultaneous excavation from both the entrance and exit. The waste slag is primarily utilized for structures and road embankment. Through the above measures, the impact of the tunnel construction on vegetation coverage and biodiversity is reduced, and it will not cause significant loss of vegetation coverage. After the construction is completed, it is required to restore vegetation on temporary occupied land and access roads.

II. Urban Ecological Restoration and Green Resilient Infrastructure Construction Project

The construction projects include Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering.

(1) Analysis of impact on aquatic ecosystem during the construction period

There are no aquatic genetic resource protection zones, aquatic organism nature reserves, or concentrated fish farms in the construction area of the Project. According to the animal survey report, there are no rare aquatic organisms in the river section where the project is located. The Project does not involve channel construction or sediment dredging and will not cause changes in hydrological regime or water quality. Therefore, the Project would have limited impact on aquatic ecosystem.

The construction of the embankment project will excavate some of the sediment（Estimated to be approximately 100 cubic meters）, which will may have a certain impact on the environment of the river. These impacts are mostly detrimental and localized, but at the same time they are reversible and have a relatively short duration. After the environmental and social management measures related to construction projects (such as cofferdam construction, isolation and protection measures), the short-term impact on aquatic ecosystems caused by construction is relatively small, and will be restored together with the Huangyang River ecological restoration project in this project.

① Aquatic plants

Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and Protection Zone 1 of Zhangtan Town Section Protection Engineering include embankment project, embankment

top road, and embankment slope regreening. The project will change the current situation of the slopes on both sides, altering the living environment for emergent aquatic plants. During the construction period, emergent aquatic plants on both sides will be damaged to varying degrees. However, after the construction is completed, emergent aquatic plants and floating aquatic plants can recover in a relatively short period of time, resulting in minimal impact on the overall ecological environment of the riverbank.

② Benthic animal

Most benthic animals live in the sediment for a long time and have strong regional characteristics and weak migration ability. They usually have little or no ability to avoid sudden environmental changes. Excavation of foundation pits during construction can have a certain impact on the habitats of various benthic organisms. The excavation area of the foundation pit is relatively small, and after construction is completed, the ecological chain will not be greatly affected.Nevertheless, this project will also take relevant environmental and social management measures to reduce the impact on the surrounding ecology and promote the restoration of the ecosystem after construction is completed.

③ Fish

According to the animal survey report, there are a total of 33 species of fish belonging to 3 orders and 6 families. Among them, there are 20 species from the Cyprinidae, accounting for 60.6%; 7 species from the Bagridae, accounting for 21.2%; 2 species from the Cobitidae, accounting for 6.06%; 2 species from the Siluridae, each accounting for 6.06%; and 1 specie from the Serranidae and 1 specie from Synbranchidae, each accounting for 6.06%. Due to their strong migration ability, fish can seek out suitable habitat in surrounding riverway. Therefore, the adverse impact of construction on fish is minor. Although the noise mainly occurs, it is temporary. In summary, there are no protected or endangered species as all aquatic organisms are common to the river's aquatic environment. Therefore, the loss of biomass and net production of aquatic communities during the construction period is not significant, and the resulting loss of biodiversity is also not substantial.

(2) Analysis of impact on terrestrial ecology during the construction period

The impacts of the Project on the terrestrial ecological environment during the construction period include the land use, vegetation, and soil erosion during the construction process. The construction process destroys existing vegetation, causing bare ground and creating conditions for soil erosion during the rainy season. In addition, the construction will involve excavation and filling of earth and stone, and the bare ground will generate a large amount of dust during the dry season, which will have a certain impact on vegetation.

According to *Survey Report on the Current Status of Wildlife in Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, since the project area is mainly dominated by farmland ecosystems (85% of the survey area), amphibians are distributed only along the river, the banks of the Huangyang River, and near the water network within the farmland. A total of six species of amphibians belonging to two orders and four families were found in this survey area. According to the *List of National Key Protected Wild Animals (2021)* and the *List of Local Key Protected Animals of Shaanxi Province*, combined with the field survey, seven species of national second-class protected wild animals were found in this survey area, including mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten and Felis bengalensis. Local key protected animals of Shaanxi Province: the Elaphe carinata.

Among them, mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten, Felis bengalensis, and Elaphe carinata are listed as the species of Least concern (LC) in 2021 on the International Union for Conservation of Nature Red List of Threatened Species, and the Corvus torquatus is classified as the species of Vulnerable (VU).

The Corvus torquatus is a member of the order Passeriformes, the family Corvidaea and the genus Corvus. It is commonly found in the forests and shrubs of low hills, foothills, and plains. It forages in the fields in the early morning and flies back to nearby villages or trees on the edge of the forest to roost in the evening. It mainly feeds on small animals such as locusts, mole crickets, beetles, caterpillars, snails, frogs, lizards, as well as crops, plant seeds, garbage, and carrion.

Mandarin ducks are migratory birds, so in local surveys, they are considered as passing birds. Four species of hawks and falcons, including the sparrow hawks, Accipiter soloensis, Buteo buteo and falco tinnunculus, primarily feed on field mice. The yellow-throated marten and the Felis bengalensis, two species of beasts, mainly inhabit the farmland ecosystem. Based on field surveys for animals, the evaluation area of the Project does not involve habitats of national second-class protected wild animals.

In the process of construction operation, the noise of construction machinery and personnel activities will have a certain impact on wildlife. At the same time, the indiscriminate discharge of domestic sewage and construction wastewater may also affect the living environment of aquatic organisms. It is required to reduce the construction area, minimize unnecessary noise and personnel activities, and ensure that domestic sewage and construction wastewater are collected and treated properly, without any indiscriminate discharge. Additionally, it is necessary to provide education and training to construction personnel, so that they understand the wildlife protection requirements as well as relevant laws and regulations set by

national and provincial government departments. It is important to comply with the law and protect wildlife during the construction process, and the impact will gradually disappear as the construction period comes to an end.

(3) Ecological protection measures

1) Aquatic ecological protection measures are as follows:

① It is prohibited to directly discharge the untreated sewage from construction activities into rivers; keep harmful construction materials, especially dust materials, away from water bodies; minimize the impact on channel water quality and aquatic organisms.

② Construction activities should minimize damage to existing vegetation in the project area. After construction is completed, the vegetation in the project area should be restored promptly to maintain the nearshore aquatic ecosystem.

③ Strengthen the promotion and management efforts of ecological environment protection. The project construction management department should fully recognize the importance of protecting aquatic organisms, increase the study and publicity of the *Law of the People's Republic of China on the Protection of Wildlife*, *Fisheries Law of the People's Republic of China* and other laws and regulations, and strengthen the publicity and education work of contractors and construction personnel. The contract signed by the Employer and the construction unit should should include clauses related to environmental protection, along with specific requirements for environmental protection.

2) Terrestrial ecological protection measures are as follows:

For temporary occupied areas such as construction sites and construction access roads, it is required to promptly clean up any remaining materials after completion. First plant some shallow-rooted herbaceous plants for preliminary greening, and then cultivate the land. Alternatively, remove the hardened surface, backfill other loose soil, and then cultivate the land. It should be noted that applying fertilizers to the reclaimed soil can accelerate vegetation recovery.

The impact on the ecological environment during the construction period will be acceptable after the above measures have been taken.

III. Ecological Park and Urban Integrated Waterlogging Prevention and Control System Project

The project includes the construction of Chengdong Sports Park in Ankang, Community Ecological Park, and Urban Integrated Waterlogging Prevention and Control System. The

project construction mainly involves urban and suburban areas, and the construction content is mainly based on maintenance, dredging and cleaning of public service facilities and the pipeline. The project will have little impact on the regional vegetation system. Additionally, the main construction site of the project is in the urban area. The solid waste generated includes demolished concrete pavement materials and some unusable old rain sewage pipes. The construction unit promptly carries out the removal to minimize the temporary occupation of land during the construction. Therefore, the construction of the Project will have minimal impact on the regional ecological environment.

In the process of greening the ecological landscape vegetation in the Chengdong Sports Park in Ankang and Community Ecological Park, it is required to plant native species and strictly prevent the planting of alien invasive species that may affect the overall ecological system function of the project area.

IV. Green and Low-Carbon Urban Operation System

Main construction content of the Project is to build a green and low-carbon urban operation management and data center. The project is located in the northern part of Chengdong New Area, Ankang City, with Qinba Avenue in the north, Boxue Road in the south, Dongcheng Avenue in the west and Chongshan Road in the east. Currently, the land is designated for construction use. As it has not been developed yet, the surrounding residents have converted it into farmland. The project construction will alter the original state of the land, potentially damaging or burying the existing landforms and vegetation. This project will cause a certain degree of change in the production capacity and stability of the evaluation area. However, it will maintain the integrity of the ecosystem and prevent it from degrading to a lower level. The direct loss is acceptable. Overall, the construction period of project has limited adverse impacts on the farmland ecosystem.

5.1.8 Analysis of impacts on the protected plants and animals

5.1.8.1 Analysis of impacts on the protected animals

According to *Survey Report on the Current Status of Wildlife in Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, since the project area is mainly dominated by farmland ecosystems (85% of the survey area), amphibians are distributed only along the river, the banks of the Huangyang River, and near the water network within the farmland. A total of six species of amphibians belonging to two orders and four families were found in this survey area. According to the *List of National Key Protected Wild Animals (2021)* and the *List of Local Key Protected Animals of Shaanxi Province*, combined with the field survey, seven species of national second-class protected wild animals were found in this survey area, including mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo,

Falco tinnunculus, yellow-throated marten and Felis bengalensis. Local key protected animals of Shaanxi Province: the Elaphe carinata.

According to the assessment of species conservation levels by the International Union for Conservation of Nature, most of the animals in the survey area are listed as the species of least concern (LC), while only the Corvus torquatus is classified as a vulnerable species. The survey also confirmed that the Hanjiang River ecosystem serves as a transient stopover for birds and animals, without providing long-lasting spawning and roosting sites.

Amphibians and reptiles may be distributed along the riverside, on both sides of the Huangyang River, and near the water network of farmland. They mainly belong to the Anura, Bufonidae, Dicroglossidae and Ranidae. Based on the field survey of animals, the evaluation area of the Project does not involve the habitat of national second-class protected wild animals. However, if amphibians and reptiles are found during the project construction process, they need to be avoided, and efforts should be made to avoid their activity areas and minimize the impact of construction noise on wildlife. In the next step of the engineering design process, the construction program needs to be refined and optimized to minimize the impact of construction activities on the surrounding animals.

5.1.8.2 Analysis of impacts on the protected plants

According to Survey Report on the Vegetation Status in Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project, the vegetation status in the Hanjiang River and Huangyang River section of Hanbin District, Ankang City was investigated, and the whole survey area was divided into forest ecosystems, farmland ecosystems and riparian wetland ecosystems. It mainly involves 319 species, 84 families and 238 genera of higher plants. The dominant families are Rosaceae, Asteraceae, Gramineae, Cruciferae, and Leguminosae. Among them, there is one species of national key protected wild plant, which is the wild soybean (Glycine soja). During the construction process, it is required to conduct popularization and training on wild plants and their conservation for the construction personnel. At the same time, relevant botanical experts should be invited to identify the construction site to ensure the maximum protection of wild plants during the construction process. Priority should be given to avoiding the growth areas of wild soybeans. If it is necessary to carry out construction activities in the growth areas of wild soybeans, transplant and protection work must be carried out to ensure that the project construction does not have any impact on the protected plants.

5.1.9 Analysis of impacts on material cultural resources

Based on the data collection and current status investigation, the occupation of permanent works of the Project does not involve cultural relics protection sites and their control zones.

The project construction area and the surrounding area involves the Dian'an Tower, a provincial-level cultural relics protection site, and the county-level cultural relics protection site including Dian'an historic relics, Cuijiapo Burial Complex, Cuijiapo Burial Complex and Lishitan Burial Complex.

In the project of Urban Low-carbon and Resilient Transport Facilities, the construction site of Ankang Chengdong City-Industry Integration Demonstration Area - Huanta Road is closer to Dian'an Tower and Dian'an Historic Relics, and the Reconstruction Project of National Highway G211 Ankang Guanmiao-Huangyang River (East Section of the Ring Road) is closer to Cuijiapo Burial Complex. It is required to minimize the construction area during the construction process and set up construction camps and material storage yards away from the cultural heritage protection area. The Project will have minimal impact on the Dian'an Tower and Dian'an Historic Relics after the above measures have been taken.

The construction area of Hanjiang River Riverside Ecological Green Corridor Project (Phase I) may involve Lishitan Burial Complex. Considering that the protected scope of the Lishitan Burial Complex has not been defined yet, the evaluation requires to take corresponding avoidance measures during construction operations, and the construction in the periphery shall not affect the burial complex. The construction area should be minimized, and the construction camp and material storage areas should be set far away from cultural relics protection sites. The Project will have minimal impact on the Lishitan Burial Complex after the above measures have been taken. At the same time, during the construction process, there may be occasional discoveries, which require the popularization and training of relevant knowledge on the protection of cultural relics to the construction personnel. Once the presence of cultural relics or historical sites is discovered during the construction process, construction activities must be immediately halted. After on-site protection measures are taken, the local cultural relics protection site must be promptly notified for further investigation and excavation work. Cultural heritage experts shall notify the relevant institutions about the discovered articles or places; fence off the area where articles or places are located to avoid further interference; cultural heritage experts shall evaluate the discovered articles or places; identify and take actions that are consistent with national legal requirements.

5.1.10 Analysis of impact on the Shaanxi Hanjiang River wetlands

Included in the Urban Ecological Restoration and Green Resilient Infrastructure Construction Project, the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering involves construction operations along the Hanjiang River, which may affect the Hanjiang River wetlands.

According to the survey on the plant samples of the riparian wetland ecosystem along the Hanjiang River in the *Survey Report on the Vegetation Status in Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, this area is dominated by farmland ecosystem and deciduous broad-leaf forests.

According to the *List of National Key Protected Wild Animals (2021)* and the *List of Local Key Protected Animals of Shaanxi Province*, combined with the field survey, seven species of national second-class protected wild animals were found in this survey area, including mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten and Felis bengalensis. Local key protected animals of Shaanxi Province: the Elaphe carinata. Mandarin ducks are migratory birds, so in local surveys, they are considered as passing birds. Four species of hawks and falcons, including the sparrow hawks, Accipiter soloensis, Buteo buteo and falco tinnunculus, primarily feed on field mice, and they are concentrated in farmland more than 10km away from the project area. The yellow-throated marten and the Felis bengalensis primarily inhabit the farmland ecosystem. Therefore, there is no nationally protected wildlife within the Hanjiang River wetlands.

The Hanjiang River Riverside Ecological Green Corridor Project (Phase I) mainly contains five major parts, namely, ecological restoration, landscape layout, service facilities, road transportation system, infrastructure and eco-friendly urban waterfront park. The construction scope does not involve the river channel and wetland areas. During the construction process, it is required to minimize the construction area. Temporary occupied areas such as construction sites and construction access roads should not be set up within the Hanjiang River wetland area. It is required to promptly clean up any remaining materials after completion. First plant some shallow-rooted herbaceous plants for preliminary greening, alternatively, remove the hardened surface, backfill other loose soil, and then cultivate the land for growing the plants.

From an ecological perspective, it is required to invite professional ecosystem experts to optimize the design plans and provide technical guidance during the construction process of ecological restoration and landscape layout, so as to create suitable habitats for birds and other animals, enhance ecological value, and also provide aesthetic appeal.

5.1.11 Analysis of impact on water source

Huangyang River Water Environment Improvement and Ecological Restoration Project involves two water supply source wells of Wangwan Water Plant. These two water supply wells are part of a residential drinking water supply project that utilizes surface water from the riverbed of the Huangyang River（Riverside water wells, depths of 6 meters and 18 meters）. After verification with the Hanbin Branch of the Ankang Ecological Environment Bureau and

the Hanbin District Water Resources Bureau, it has been found that neither water source area has been officially designated as a water source area or protected area (See Appendix1). The Chengdong New Area is preparing to build a new water plant, and the water supply scale will reach 10000 m^3 in the near future. The water source for the new water plant is currently being surveyed and selected. After the new plant is completed, the Wangwan Water Plant will no longer be used. Considering that the construction period of the project will be earlier than the official commissioning of the new factory, the project has carefully evaluated the impact of project implementation on the water source area and proposed an environmental and social management plan.

By comparing the location of the water intake with the main construction activities of this project, the water intake is located in the eco-agriculture area of the Huangyang River water environment management project, which mainly focuses on ecological agriculture and restoration conservation. Considering that the government has not yet designated a water source protection zone, This project requires that the principle of avoidance be adopted during the construction process of other major construction activities, especially in the embankment engineering of Zhangtanji Town, which is relatively close to the water source, Drawing on similar experiences from other domestic projects, It is required to prohibit the establishment of temporary construction sites such as soil collection and disposal sites, construction camps, and material storage yards within a range of 1000m upstream and 100m downstream of the two water intake points, as well as 200m on both sides of the river bank. All wastewater and domestic wastewater generated during the construction process must be collected and not discharged externally,. Therefore, the impact on the Wangwan water source intake is minimal. If the government designates a protected area during the project implementation period, it shall be strictly implemented in accordance with the requirements of the protected area.

5.1.12 Community health and safety

The Urban Low-carbon and Resilient Transport Facilities involves the construction and reconstruction of seven roads; the Urban ecological restoration and green resilient infrastructure construction involves the Huangyang River Water Environment Improvement and Ecological Park Project, Ecological park and urban integrated waterlogging prevention and control system, institutional capacity improvement and project management system construction project.

The project mainly carries out construction operations in the urban and suburban areas, where there are many residents. During the construction process, the noise and dust pollution caused by construction vehicles, transportation vehicles for construction materials and construction waste may affect the safety and health of the surrounding residents.

From the perspective of community health and safety, it is required that construction vehicles should be driven with caution and that construction work should be scheduled reasonably. Construction activities involving noise-producing equipment are prohibited during the night (22:00~6:00) and midday (12:00~14:00) to avoid disturbing the nearby residents. The construction machinery and heavy-duty diesel vehicles used in the construction process are required to use diesel fuel that meets the standards in National Phase VI Motor Vehicle Pollutant Emission. It is prohibited for construction machinery and transportation vehicles to emit black smoke. After the construction is organized in accordance with the requirements of the *Regulations of Shaanxi Province on Prevention and Control of Air Pollution (2019 Revision)*, *Special Action Plan for the Control of Atmospheric Pollution in Shaanxi Province (2023-2027),* and "Six 100%", the dust emissions from the construction site can meet the relevant requirements of the local environmental protection standards in Shaanxi Province, specifically the *Limiting Value of Fugitive Dust Emissions from Construction Sites* (DB61/1078-2017). These measures can mitigate the impact of the construction process on the health and safety of the community. As the construction period ends, the impact on the health and safety of the community also disappears.

5.1.13 Occupational health and safety

During the construction process of the Project, construction personnel may be affected by construction dust and noise. At the same time, all the construction work is carried out in the open air. When working in hot weather, construction personnel need to take personal protective measures and ensure heatstroke prevention and cooling.

For projects with high dust emission, synchronous dust suppression operations are required to ensure the health and safety of construction personnel. At the same time, the construction process should strictly follow the operating procedures, so as to avoid any construction safety hazards and ensure the health and safety of the construction personnel throughout the project.

5.2 Analysis of environmental impacts during operation

5.2.1 Water environmental impact analysis

I. Urban Low-carbon and Resilient Transport Facilities

The project mainly includes the construction and reconstruction projects of 7 roads, green public parking lot project in the core area of Chengdong New Area in Ankang, and new energy street lamp construction project.

Wastewater in the operation period mainly includes the road runoff generated by rainfall, the

domestic water used by the office and vehicle caretaker of Green public parking lot project and used by mobile personnel.

According to the feasibility study, the office and vehicle caretaking are designed to accommodate 65 people. The average water consumption per person for office staff and vehicle caretakers in the Project is calculated based on the general value of the quota for administrative agencies in the *Shaanxi Province Industrial Water Consumption Quota* (Revised in February 2020), which is 68L/d·person; the domestic water consumption is 4.4m^3/d, and the sewage generation is estimated to be approximately 4.0m^3/d, calculated as 90% of the water consumption.

Table 5.2-1 List of Water Supply and Drainage of the Project Unit: t/d

Name	Water consumption standards	Daily water consumption (t/d)	Annual water consumption (t/a)	Discharge coefficient	Discharge volume (t/d)	Discharge volume (t/a)
Domestic water	68L/d·person	4.4	1606	0.9	4.0	1460

Table 5.2-2 List of Water Pollutants Generated and Discharged by the Project
Unit: mg/L

Pollutant	Wastewater volume (t/a)	CODcr	BOD_5	SS	NH_3-N
Concentration of pollutants from sanitary wastewater	1606	500	350	1000	20
Production volume (t/a)		0.803	0.562	1.606	0.032
Concentration after septic tank treatment		200	100	70	20
GB8978-1996 Level III emission standards	1606	500	300	400	--
Emission after septic tank treatment (t/a)		0.321	0.193	0.257	--

Public restrooms are equipped with septic tank. After the sewage is treated in the septic tanks, it is connected to the municipal sewage network and enters the sewage treatment plant for processing, without being discharged.

The pollutants of road runoff generated by rainfall on the road mainly contains suspended solids, petroleum products, and organic substances. road runoff pollution is mainly caused by the scattering of goods during road operations, the deposition of particles from vehicle exhaust on the road surface, fuel leakage on the road surface, and the wear and tear of tires on the road. When the rainfall forms road runoff, these harmful substances are carried into water bodies, leading to a decline in water environmental quality.

From the source of pollutants in road runoff, it can be seen that there are many factors that cause water pollution from road runoff, mainly including meteorological conditions, traffic conditions, land use conditions around the road, and road cleaning and maintenance conditions. In addition, vehicles carrying toxic and hazardous substances can pose a certain risk of pollution when they leak or when the wastewater generated from cleaning the road surface after a traffic accident occurs.

Due to the strong randomness and variability of various factors affecting road runoff, it is difficult to determine the concentration of typical pollutants in road rainwater. The test results of some domestic roads also vary. Relevant data indicates that the concentration of road runoff is the highest during the initial stage of precipitation. Within the first 30 minutes of rainfall, the concentration of pollutants increases with the duration of rainfall; subsequently, the concentration of pollutants gradually decreases. Please refer to Table 5.2-3 for the results of the investigation by analogy.

Table 5.2-3 Monitoring Results of Pollutant Concentrations in Road Runoff at the Beginning of Rainfall (2 Hours)

Project	COD_{cr} (mg/L)	Petroleum (mg/L)	pH
Average of first 2 hours	20.0	7.0	7.4

As can be seen from Table 4-3, the concentrations of the main pollutants in surface runoff after 2 hours meet the Level I discharge standard of the *Integrated Wastewater Discharge Standard* (GB8978-1996), and the impact on the surface water environment is relatively small.

II. Urban Ecological Restoration and Green Resilient Infrastructure Construction Project and Ecological Park Project

The main wastewater generated in this project is domestic sewage from mobile tourists and staff.

According to the information of the study, it can be seen that the maximum capacity of visitors

for the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, the Chengdong Sports Park in Ankang and the Community Park is approximately 1600, 2000, 968 and 239 respectively, with a staff capacity of 100 people. The average water consumption of the staff of this project is 68L/d·person based on the general value of the quota for administrative agencies in the *Shaanxi Province Industrial Water Consumption Quota* (Revised in February 2020); the daily use of mobile personnel is 1 person/times, each time the water consumption is 10L, thus, the water consumption of mobile tourists is 48.07m^3/d; the amount of wastewater discharged is estimated to be 43.26m^3/d, calculated as 90% of the water consumption. The maximum water consumption for staff is 6.8m^3/d, and the sewage generation is estimated to be approximately 6.12$m^{3/d}$ based on 90% of the water consumption. Referring to the *Practical Handbook for Design of Urban Water Supply and Drainage Engineering Specifications*, the predicted concentrations of various pollutants in the wastewater in this section are as follows: SS100~350mg/L, COD200~600mg/L, $BOD_5$100~400mg/L, NH_3-N15~40mg/L, total phosphorus 1.5~2.5mg/L, total nitrogen 50~70mg/L.

Table 5.2-4 List of Water Supply and Drainage of the Project Unit: t/d

Name	Water consumption standards	Daily water consumption (t/d)	Annual water consumption (t/a)	Discharge coefficient	Discharge volume (t/d)	Discharge volume (t/a)
Domestic water consumption of working	68L/d·person	6.80	2482.0	0.9	6.12	2233.8
Domestic water consumption of tourists	10L/time·person	48.07	17545.6	0.9	43.26	15789.9
Total		54.87	20027.6	/	49.38	18023.7

Table 5.2-5 List of Water Pollutants Generated and Discharged by the Project Unit: mg/L

Pollutant	Wastewater volume (t/a)	CODcr	BOD_5	SS	NH_3-N
Concentration of pollutants from sanitary wastewater	18023.7	500	350	1000	20
Production volume (t/a)		9.012	6.308	18.024	0.3460

The sewage is transported through the sewage pipe network to the sewage treatment plant for centralized treatment.

III. Green and Low-Carbon Urban Operation System

The main sources of pollution during the operation period of this project are domestic wastewater from the staff of the operation management and data center.

According to the information of the study, it is known that the office capacity of this project is approximately 500 people. The average water consumption of the staff of this project is 68L/d·person based on the general value of the quota for administrative agencies in the Shaanxi Province Industrial Water Consumption Quota (Revised in February 2020); the maximum domestic water consumption is 34.0m^3/d, and the sewage generation is estimated to be approximately 30.6m^3/d, calculated as 90% of the water consumption. Referring to the *Practical Handbook for Design of Urban Water Supply and Drainage Engineering Specifications*, the predicted concentrations of various pollutants in wastewater in this section are as follows: SS100~350mg/L, COD200~600mg/L, BOD5100~400mg/L, NH3-N15~40mg/L, total phosphorus 1.5~2.5mg/L, total nitrogen 50~70mg/L.

After being treated in septic tank, domestic sewage is connected to the sewage pipe network and enters the sewage treatment plant for unified treatment.

According to the feasibility study on water conservation design, rainwater harvesting is a technical means of collecting rainwater based on demand, treating it to meet the required standards, and utilizing it for purposes such as landscaping, gardening, car washing, road irrigation, and toilet flushing. Among them, the rainwater on the roof is relatively clean, with fewer impurities, sediments, and other pollutants. It can be directly reused after being discharged and simply filtered, making the treatment process simple.

In the "Urban Low-carbon and Resilient Transport Facilities", "Urban Waterlogging Prevention and Control System of Chengdong New Area", "Chengdong Sports Park" and "Community Park" included in the Project, the rainwater is collected, purified and reused through the construction of new rainwater pipe networks, rainwater collection and utilization systems, rainwater storage facilities and other measures.

When developing landscape greening plans, select plant species that require less water and minimize the area of lawns. Choose suitable native plant varieties with low water consumption.

According to the plant species, choose the irrigation method of sprinkler irrigation, micro-sprinkler irrigation, or drip irrigation to achieve efficient and water-saving irrigation, and

equip with a soil moisture monitoring system for water management.

5.2.2 Atmospheric environmental impact analysis

I. Urban Low-carbon and Resilient Transport Facilities

The project mainly involves road dust and vehicle exhaust emissions.

(1) Road dust

Dust will be generated when vehicles are traveling. Vehicles transporting bulk materials that contain dust can cause dust pollution due to scattering and wind blowing. Regular cleaning and watering measures can effectively reduce the impact of dust on roads and bridges in the Project.

(2) Vehicle exhaust emission

During the process of vehicles traveling on the road, vehicle exhaust emissions will have an impact on the ambient air quality. The main pollutants in vehicle exhaust emissions are THC, NOx, and CO. The amount of pollutants emitted is closely related to the traffic volume and also depends on the type and operating condition of the vehicles. The source intensity of pollutants is calculated according to the following formula:

$$Q_j=\Sigma 3600^{-1}A_iE_{ij}$$

Where: Q_j - Emission intensity of gaseous pollutants of type *j*. mg/s.m;

Ai - Hourly traffic volume, vehicles/h, for the forecast year for type *i* vehicles;

E_{ij} - Single-vehicle emission factor for type j emissions from type *i* vehicles under operating conditions for the forecast year, mg/vehicle.m.

The values are taken from the recommended values in Table 5.2-6 in Appendix E of the *Specifications for Environmental Impact Assessment of Highways* (JTJ005-2006).

Table 5.2-6 Pollutant Emission Factors for Various Types of Urban Vehicles
Unit: mg/(vehicle·m)

Calculation of emissions		Minimum-size vehicles	Medium-size vehicles	Maximum-size vehicles
Emission factors for various pollutants	CO	31.34	30.18	5.25
	THC	8.14	15.21	2.08
	NOx	1.77	5.40	10.44

Please refer to Table 5.2-7 for the detailed estimation results of road vehicle exhaust emissions in the Project.

Table 5.2-7 Estimation of Source Intensity of Atmospheric Pollutant Emission (Unit: mg/s·m)

Calculation of emissions		2025	2030	2035	2040	2044
Pollutant	CO	3.07	4.15	5.30	6.42	7.33
	THC	0.87	1.17	1.50	1.81	2.06
	NO_2	0.64	0.87	1.13	1.38	1.59

The project area has favorable dispersion conditions, and the impact of vehicle exhaust on the ambient air quality along the route is relatively small.

According to the *Environmental Impact Assessment for Social and Regional Development Projects*, the pollutants emitted by a single vehicle in the parking lot are: THC5~20mg/(d·vehicle), NOx0.5~2.5mg/(d·vehicle), CO15~40mg/(d·vehicle). In this project, the emissions of the main pollutants from vehicle exhaust in the parking lot are calculated under the worst-case scenario, which are THC 19.56g/d, NOx 2.45g/d, CO 39.12g/d. The ground parking lot is relatively spacious, making it easy for vehicle emissions to disperse. It is expected that there will be no significant impact on the surrounding environment.

(3) Positive environmental impact of low impact design of road LID

According to the *Feasibility Study Report on the Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, it is known that this Low-impact and Resilient Road Engineering combines the conclusions of climate change to propose the concept of road LID design. Under the premise of ensuring urban traffic safety and the stable functionality and benefits of roadside trees, the design of road green spaces and green spaces outside the road boundary should be coordinated, in order to maximize the satisfaction of road rainfall runoff control requirements and improve the design standards for stormwater drainage within the road scope, thereby reducing the amount of road stormwater runoff. Through the design of road LID, enhance urban resilience and achieve the objectives of "no water accumulation in light rain, no waterlogging in heavy rain, no black and odorous water bodies, and alleviation of urban heat island effect".

Sponge facilities mainly include permeable pavement, sunken green space, bioretention grass ditch, ecological tree pool, overflow gutter inlet, and environment friendly gutter inlet.

The main purpose of constructing sponge facilities is to control from the source, i.e., fully utilize the concept of low-impact development (LID) to reduce the discharge of rainwater from the source. Sponge facilities mainly consist of collection facilities, storage facilities, treatment facilities, and reuse facilities. After calculations, it can be seen that adding sponge facilities can increase the total annual runoff control rate within the designed road range from 31.55% to 81.23%, lowering outflow rainfall, reducing the risk of urban waterlogging, and recharging groundwater. The annual total SS removal rate within the road range can reach 63.45%.

In addition, the four proposed parking lots are all designed with sponge facilities, which can significantly improve surface runoff, rainfall regulation and storage, and SS removal rate. The annual SS removal rate can be increased to about 77.5%.

II. Urban Ecological Restoration and Green Resilient Infrastructure Construction Project and Ecological Park Project

The main sources of atmospheric pollution in the Project are unpleasant odor from garbage storage points, garbage bins, and public restrooms, and car exhaust from above ground parking lots.

The garbage bins of the Project are distributed on both sides of the park road, with about 150 garbage bins. They are only used for temporary storage of domestic waste generated by tourists, and there is no treatment process. Since the wastes are cleared daily, domestic waste will not stay in the garbage bins for more than a day, and the impact of unpleasant odor will be relatively minor.

According to the feasibility study data, the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and the Chengdong Sports Park in Ankang of the Project respectively have 18, 20, and 6 public toilets. The waste gas generated in public toilets is the main source of unpleasant odor.

According to the feasibility study data, one parking lot with an area of 6,000 m2 will be built for the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), and two parking lots will be built for Huangyang River Water Environment Improvement and Ecological Restoration Project, with a total parking area of 8,188 m^2. The parking space is approximately one-third of the parking lot project. Based on the most unfavorable scenario calculation, the main pollutant emissions of car exhaust from the parking lot in the Project are THC6.52g/d, NOx 0.82g/d, and CO13.04g/d.

The ground parking lot is relatively spacious, making it easy for vehicle emissions to disperse. It is expected that there will be no significant impact on the surrounding environment.

According to the Feasibility Study Report on the Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project, the sponge facilities in the Chengdong Sports Park in Ankang, once implemented, will significantly improve the designs for surface runoff, rainfall regulation and storage, and SS removal rate, especially with a removal rate of about 79.01% for particulate matter in the atmospheric environment, reaching a removal rate of around 75.03%. Once implemented, the sponge facilities designed for the community parks will also bring significant improvements in surface runoff, rainfall regulation and storage, and SS removal rate. Among them, the removal rate of particulate matter in the atmospheric environment is about 79.20%, and the removal amount can reach about 75.32%.

III. Green and Low-carbon System

According to the *Feasibility Study Report on the Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, the parks, green spaces and corridors, PV canopies in parking lots, new energy street lamps, smart bus systems, and new energy vehicles designed for the Project can help achieve carbon reduction, sequestration, and oxygen release effects.

A PV canopy is planned for the green public parking lot project in the core area of Chengdong New Area in Ankang. This plan involves the construction of four social public parking lots, with 679 parking spaces planned, including 663 car parking spaces with a size of 2.5 × 5.5m, 16 accessible parking spaces, with a size 3.5 × 12.5m. Supposing that all parking spaces are provided with PV canopies and 100% of the canopies are installed, the installation area of the PV canopy is 9,171.45m^2. Based on the installed capacity of 207W for per square meter of PV panels, the total PV installed capacity of the parking lot is 1,894,290Wp.

According to expert statistics, 1 megawatt installed capacity can generate 1.2 million kilowatt-hours of electricity annually, resulting in an annual power generation of approximately 3.506 million kilowatt-hours in parking lots.

Compared to conventional thermal power generation, PV power generation does not cause any pollution to the environment. Solar panels do not emit any gases during the process of absorbing solar energy and generating electricity, while conventional thermal power plants require a large amount of coal for power generation and will also emit a large amount of CO_2 and other exhaust gases into the atmosphere. The emission reduction benefits for saving electricity can be calculated by using coal-fired power generation as a reference. According to expert statistics, for every kilowatt-hour of electricity saved, one correspondingly saves 0.4 kilograms of standard coal or 0.379 liters of diesel or 4 liters of pure water, while reducing pollution emissions by 0.272 kilograms of carbon dust, 0.997 kilograms of CO_2 and 0.015 kilograms of nitrogen oxides.

Based on the above correlations, it can be calculated that PV canopy panels in the four parking lots can reduce carbon emissions by approximately 2,267 tons of CO_2 per year.

The Project plans to construct a total of 3,471 new energy street lamps on the 17 newly constructed and reconstructed roads in the Chengdong New Area, which can save 1.822 million kWh of electricity annually and achieve carbon reduction of 1,822.8 tons of CO_2 per year.

In this design, bus stops will be set up at an interval of 500m to meet the travel needs of residents in the Chengdong New Area. Therefore, there are a total of 58 bus stops in this design. According to the calculations, the carbon emissions reduced by those choosing the public transportation system are 2,310 * 18.4 * 0.4=17,001.6kg/day, which is equivalent to 6,206 tons of CO_2 per year. The construction of the public transportation network in the Chengdong New Area can help achieve an annual emission reduction of 6,328 tons of CO_2 per year in urban transportation.

The proposed roads will be provided with slow walking walkways. According to data research, the proportion of residents choosing to walk in this area was 18% before the completion of the new area, whereas the proportion is projected to increase to 27% after the completion of the Project. Therefore, the number of people choosing to walk has increased by 3,780. The carbon emissions reduced by those choosing a non-motorized transportation system are approximately 5,078 tons per year.

In summary, it can be seen that once completed, the Project will increase the green area by about 2.06 million square meters, reduce carbon emissions by about 20,270 tons per year, sequestrate carbon by about 5,715 tons per year, and produce oxygen by about 4,172 tons per year.

The construction of this project will promote the formation of a green and low-carbon production and lifestyle as well as urban construction and operation model, increase the proportion of clean energy use, promote the development and utilization of solar energy and other new energy sources, achieve economic growth and carbon emissions decoupling, and formulate and achieve the carbon emission bottom-line goal of the project city. The Project aims to reduce carbon emissions in the project area through various measures and create a leading area for low-carbon city. The development of green, low-carbon and sustainable projects can promote the exploration of new systems and mechanisms for land space development, resource conservation and intensive utilization, economic circular development, ecological improvement, and environmental protection. By developing a number of low-carbon development models and projects that can be promoted and replicated elsewhere,

it aims to promote the pilot construction of low-carbon cities and enable the early realization of the "carbon emission peak and carbon neutrality" goals in Shaanxi Province.

5.2.3 Acoustic Environmental Impact Analysis

The main acoustic environmental impact after the implementation of the Project is the impact of traffic noise on the roads.

5.2.3.1 Traffic noise predictive calculation model

1. Vehicle classification

According to the *Technical Guidelines for Environmental Impact Assessment - Acoustic Environment (HJ2.4-2021)*, small vehicles refer to passenger cars with a seating capacity of less than or equal to 19 seats and trucks with a load capacity of less than or equal to 2 tons, mainly including small passenger cars and small trucks; medium vehicles refer to passenger cars with a seating capacity of more than 19 and trucks with a load capacity of more than 2 tons but less than or equal to 7 tons, mainly including large passenger cars and medium trucks; large vehicles refer to trucks with a load capacity of more than 7 tons but less than or equal to 20 tons and trucks with a load capacity more than 20 tons, generally including large trucks and oversized trucks.

2. Prediction model for equivalent sound level of class i vehicles

Vehicles traveling on highways can be regarded as continuous linear sound sources. According to the *Technical Guidelines for Environmental Impact Assessment - Acoustic Environment (HJ2.4-2021)*, the noise prediction mode is as follows:

$$L_{eq}(h)_i = \left(\overline{L_{0E}}\right)_i + 10\lg\left(\frac{N_i}{V_i T}\right) + \Delta L_{距离} + 10\lg\left(\frac{\psi_1+\psi_2}{\pi}\right) + \Delta L\text{-}16$$

Wherein: $L_{eq}(h)_i$ - the hourly equivalent sound level of class i vehicle, dB (A);

$(\overline{L_{0E}})_i$ - The speed of class i vehicle is V_i km/h, and the average A sound level of energy at a horizontal distance of 7.5m, dB (A);

N_i - The average hourly traffic flow of class i vehicles passing through a certain prediction point during the day and night, vehicles/h;

V_i - The average speed of class i vehicle, km/h;

T - Time to calculate the equivalent sound level, 1 hour;

ΔL distance - distance attenuation, dB (A), for an hourly traffic flow of 300 vehicles/hour or more: ΔL distance=10lg (7.5/r); for an hourly traffic flow less than 300 vehicles/hour: ΔL distance=15lg (7.5/r);

r - distance from the centerline of the lane to the prediction point, m; applicable for noise prediction at prediction points with r greater than 7.5m.

ψ_1, ψ_2 - The flare angle and radian between the prediction point and the two ends of a finitely long road section; as shown in Figure 4.1-1;

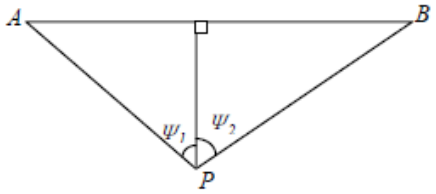


Figure 5.2-1 Correction Function for Finitely Long Road Sections, A-B for Road Sections, and P for Prediction Points

ΔL - Correction amount caused by other factors, dB (A); it can be calculated as follows:

$$\Delta L = \Delta L_1 - \Delta L_2 + \Delta L_3$$

$$\Delta L_1 = \Delta L_{坡度} + \Delta L_{路面}$$

$$\Delta L_2 = A_{atm} + A_{gr} + A_{bar} + A_{misc}$$

Wherein: ΔL_1 - Correction amount caused by line factors, dB (A);

$\Delta L_{坡度}$ - Correction amount of highway longitudinal slope, dB (A);

$\Delta L_{路面}$ - Correction amount caused by road surface materials, dB (A);

ΔL_2 - Attenuation amount caused by the propagation path of sound waves, dB (A);

ΔL_3 - Correction amount caused by reflection, etc., in dB (A).

3. Prediction model for equivalent sound level of traffic noise at observation points

The equivalent sound level of the total traffic flow is:

$$L_{eq}(T) = 10\lg(10^{0.1L_{eq}(h)_{大}} + 10^{0.1L_{eq}(h)_{中}} + 10^{0.1L_{eq}(h)_{小}})$$

Wherein: L_{eq} (T) - The equivalent sound level of the total traffic flow , dB (A);

Leq (h) Large, L eq (h) Medium, L eq (h) Small - Hourly equivalent sound level of large, medium, and small vehicles, dB (A).

4. Predicted value of environmental noise:

Calculation formula for predicted noise value:

$$Leq=10lg\ (10^{0.1Leqg}+10^{0.1Leqb})$$

Wherein: Leq - Predicted noise value of the prediction unit, dB;

Leqg - Noise contribution value generated by the construction project's sound source at the prediction point, dB;

Leqb - Background noise value of the prediction point, dB.

According to the predicted noise value formula, the formula for calculating the environmental noise value is:

$$(L_{eq})_{环} = 10\lg(10^{0.1(L_{eq})_{交}} + 10^{0.1(L_{eq})_{背}})$$

Wherein: $(L_{eq})_{environmental}$ - Environmental noise value of the prediction point, dB (A);

$(L_{eq})_{traffic}$ - Traffic noise value at the prediction point, dB (A);

$(L_{eq})_{background}$ - The background noise value of the prediction point, dB (A).

5. Calculation of correction and attenuation amounts

1) Correction amount caused by line factors ($\triangle L_1$)

① Correction amount of longitudinal slope ($\triangle L_{slope}$)

The correction amount of highway longitudinal slope ($\triangle L_{slope}$) can be calculated using the following formula:

$$\Delta L_{坡度}=\begin{cases}98\times\beta, & 大型车\\ 73\times\beta, & 中型车\\ 50\times\beta, & 中型车\end{cases}$$

Wherein: $\triangle L_{slope}$ - Correction amount of highway longitudinal slope;

β— The longitudinal slope gradient of the highway,%.

② Road surface correction amount ($\Delta L_{road\ surface}$)

The noise correction values for different road surfaces are shown in Tables 5.2-8.

Table 5.2-8 Common Road Surface Noise Correction Amounts

Pavement Type	Correction amounts for different forms of speed/(km/h)		
	30	40	≥50
Asphalt concrete/dB (A)	0	0	0
Asphalt concrete/dB (A)	1.0	1.5	2.0

2) Attenuation amount caused by sound propagation pathways (ΔL_2)

① Calculation of sound barrier attenuation amount (A_{bar})

The infinitely long sound barrier can be calculated as follows:

$$A_{bar}=\begin{cases}10\lg\left[\dfrac{3\pi\sqrt{(1-t^2)}}{4arctg\sqrt{\dfrac{(1-t)}{(1+t)}}}\right], t=\dfrac{40f\delta}{3c}\le 1, dB\\ 10\lg\left[\dfrac{3\pi\sqrt{(t^2-1)}}{2\ln 2\left(t+\sqrt{(t^2-1)}\right)}\right], t=\dfrac{40f\delta}{3c}>1, dB\end{cases}$$

Wherein: f - Acoustic frequency, Hz;

δ— Acoustic path difference, m;

C - Sound velocity, m/s, c=340m/s.

In the evaluation of highway construction projects, the attenuation of the sound barriers calculated using a 500Hz frequency sound wave can be approximated as the attenuation of the A-sound level.

The calculation for finitely long sound barriers:

A_{bar} is still calculated using the above equation. Then make corrections according to Figure A.3 in HJ2.4-2021. The corrected A_{bar} depends on the shielding angle β/θ.

② Attenuation caused by air absorption (A_{atm})

The attenuation caused by air absorption is calculated according to the formula:

Wherein: a - atmospheric absorption attenuation coefficient related to temperature, humidity, and sound wave frequency. In the predictive calculation, the corresponding air absorption coefficient is generally selected based on the annual average temperature and humidity of the area where the construction project is located, as indicated in Table A.2 of the guidelines;

r - the distance from the prediction point to the sound source;

r_0- The distance from the reference position to the sound source.

③ Ground effect attenuation (A_{gr})

The types of ground can be divided into:

A. Solid ground, including paved roads, water surfaces, ice surfaces, and compacted ground.

B. Loose ground, including ground covered by grass or other plants, as well as farmland and other grounds suitable for plant growth.

C. Mixed ground, consisting of solid and loose ground.

When sound waves propagate over loose ground or on mixed ground with mostly loose ground, the octave band attenuation caused by ground effects can be calculated using the following formula provided that only the A-sound level is calculated for the prediction point.

$$A_{gr} = 4.8 - (\frac{2h_m}{r})[17 + (\frac{300}{r})]$$

in which:

r - the distance from the sound source to the prediction point, m;

h_m - average ground clearance of the propagation path, m; which can be calculated according to Figure 4.1-1, h_m=F/r,; F: Area, m^2; r. m; if the calculated A_{gr} is a negative value, then A_{gr} can be substituted with "0".

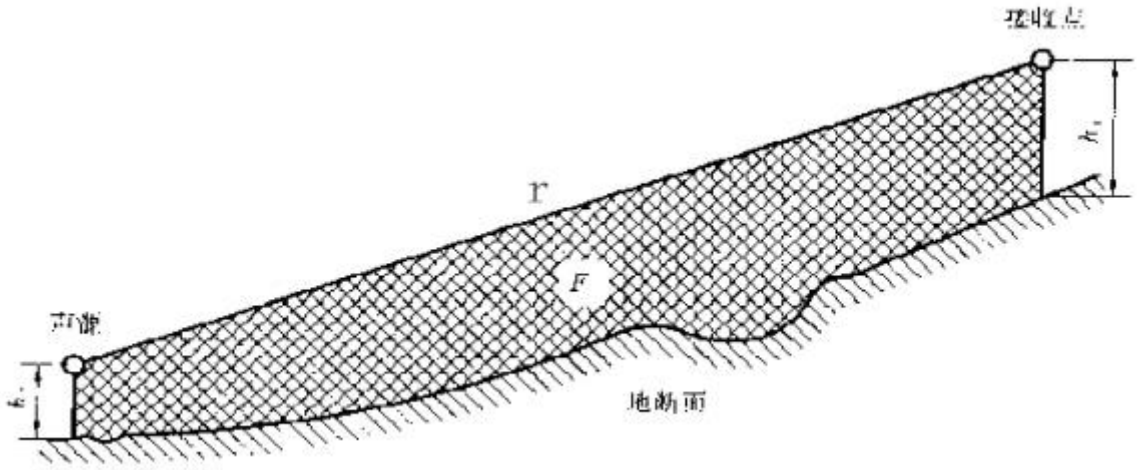


Figure 5.2-2 Method for Estimating the Average Height h_m

④ Attenuation caused by various other factors (A_{misc})

Calculation of noise attenuation in green forest belts

The additional attenuation of green forest belts is related to factors such as tree species, forest belt structure, and density. The green forest belts near the sound source, the green forest belts near the prediction point, or both can attenuate the sound wave.

5.2.3.2 Determination of calculation parameters

(1) Hourly traffic flow (Ni)

The coefficient for converting the traffic flow of each vehicle model into equivalent passenger car flow is determined according to the *Technical Standards for Highway Engineering* (JTG B01-2014), and different vehicle models are merged according to the *Technical Guidelines for Environmental Impact Assessment - Acoustic Environment* (HJ2.4-2021).

According to the calculation of engineering traffic volume, the 16 hour daytime traffic volume of the Project accounts for 90% of the daily traffic volume, and the 8 hour nighttime traffic volume accounts for 10% of the daily traffic volume. The model composition of engineering vehicles and their ratio of daytime and nighttime traffic volume are shown in Tables 5.2-9.

Table 5.2-9 Predicted Annual Hourly Traffic Flow of Highway Section Evaluation (Unit: Veh/h)

Road Segment	Vehicle type	Period	Traffic Flow		
			2025	2031	2039
Zhenxing Road, Huanta Road, Lvyuan	Small	Daytime	212	463	912
		Night	106	231	506

Road Segment	Vehicle type	Period	Traffic Flow		
			2025	2031	2039
Road, Chunlin Road, North Section of Yong'an Road	Medium	Daytime	15	38	57
		Night	8	19	28
	Large	Daytime	40	41	43
		Night	20	21	22
National Highway G211 Ankang Guanmiao-Huangyang River (east section of the Ring Road) Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	Small	Daytime	212	463	912
		Night	106	231	506
	Medium	Daytime	15	38	57
		Night	8	19	28
	Large	Daytime	40	41	43
		Night	20	21	22

(2) Vehicle speed (Vi)

The design speed for Zhenxing Road, Huanta Road, Lvyuan Road, Chunlin Road, and the north section of Yong'an Road is 30km/h, and the design speed for the National Highway G211 Ankang Guanmiao-Huangyang River (east section of the Ring Road) and the Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211 is 40km/h.

(3) Single car radiated sound level

According to the *Technical Guidelines for Environmental Impact Assessment - Acoustic Environment* (HJ2.4-2021), the noise source intensity is calculated using relevant models. In this evaluation, the Loi calculation formula for the single vehicle radiation noise level of each type of vehicle at a reference point (7.5m) as provided in Appendix C of the *Environmental Impact Assessment Specification for Highway Construction Project*s (JTG B03-2006) is used to calculate the traffic noise source intensity.

The radiated noise level (source intensity) of vehicles is related to vehicle speeds and vehicle models, and presents a certain functional relationship. Its calculation formula is as follows:

Small vehicle radiated sound level: $Lo_{small}=12.6+34.73lgV_{small}$

Medium vehicle radiated sound level: $Lo_{medium}=8.8+40.48lgV_{medium}$

Large vehicle radiated sound level: $Lo_{large}=22.0+36.32lgV_{large}$

Among them, V_{small} is the average driving speed of small vehicles;

V_{medium} - average driving speed of medium-sized vehicles;

V_{large} - average driving speed of large vehicles;

According to the above formula, the average radiated sound level of small, medium, and large vehicle models during the operation period for each section of the Project can be derived. The calculation of single vehicle traffic noise source intensity for each characteristic year and vehicle model is shown in Tables 5.2-10.

Table 5.2-10 Single Vehicle Noise Emission Source Intensity of Each Vehicle Model During Operation Period Unit: dB

Section Name	Vehicle type	2025		2031		2039	
		Daytime	Night	Daytime	Night	Daytime	Night
Zhenxing Road, Huanta Road, Lvyuan Road, Chunlin Road, North Section of Yong'an Road	Trolley	63.9	63.9	63.9	63.9	63.9	63.9
	Medium vehicle	68.6	68.6	68.6	68.6	68.6	68.6
	Truck	75.6	75.6	75.6	75.6	75.6	75.6
National Highway G211 Ankang Guanmiao-Huangyang River (east section of the Ring Road) Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	Trolley	68.2	68.2	68.2	68.2	68.2	68.2
	Medium vehicle	73.7	73.7	73.7	73.7	73.7	73.7
	Truck	80.2	80.2	80.2	80.2	80.2	80.2

5.2.3.3 Traffic noise prediction and evaluation

(1) Traffic noise prediction results

This evaluation makes predictions within the range of 20-200m from the centerline on both sides of the highway. The predicted characteristic years are 2025, 2031, and 2039, and the predicted results are shown in Tables 5.2-11. This evaluation calculates the noise compliance distance for each characteristic year, as shown in Tables 5.2-12.

(2) Traffic noise evaluation

From Tables 5.2-11, it can be seen that the predicted traffic noise value of the Project increases year by year along with the increase of traffic volume during the operation period. The contribution value to all sensitive points on the road during the operation period can meet the Category 2 standard of the Environmental Quality Standard for Noise (GB3096-2008), and the contribution value to the surrounding environment is relatively small.

From Tables 5.2-12, it can be seen that the construction of the Project has had a certain degree of impact on the acoustic environment along the line. The farthest compliance distance to reach the standard in the middle stage of Category 4a operation is 28m, and the farthest distance to reach the standard in the middle stage of Category 2 operation is 54m.

Table 5.2-11 Predicted Traffic Noise Values (Flat Embankment) Unit: dB (A)

Road Segment	Year	Date	Calculate the distance between the prediction point and the centerline of the road (m)													
			20	30	40	50	60	70	80	90	100	120	140	160	180	200
Zhenxing Road, Huanta Road, Lvyuan Road, Chunlin Road, North Section of Yong'an Road	2025	Daytime	55.30	51.67	49.46	47.82	46.49	45.36	44.36	43.47	42.65	41.21	39.89	38.76	37.75	36.83
		Night	52.31	48.68	46.46	44.83	43.50	42.36	41.37	40.47	39.66	38.21	36.89	35.77	34.75	33.84
	2031	Daytime	56.73	53.11	50.89	49.25	47.93	46.79	45.80	44.90	44.09	42.64	41.32	40.19	39.18	38.26
		Night	53.77	50.15	47.93	46.29	44.97	43.83	42.84	41.94	41.13	39.68	38.36	37.23	36.22	35.30
	2039	Daytime	58.35	54.72	52.51	50.87	49.54	48.41	47.41	46.51	45.70	44.25	42.93	41.81	40.80	39.88
		Night	55.61	51.98	49.77	48.13	46.80	45.67	44.67	43.78	42.96	41.52	40.19	39.07	38.06	37.14
National Highway G211 Ankang Guanmiao-Huangyang River (east section of the Ring Road) Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	2025	Daytime	59.56	55.93	53.71	52.07	50.74	49.60	48.60	47.70	46.88	45.42	44.15	43.03	42.02	41.10
		Night	56.57	52.94	50.72	49.08	47.74	46.60	45.60	44.70	43.88	42.43	41.16	40.04	39.03	38.11
	2031	Daytime	60.99	57.36	55.14	53.50	52.16	51.03	50.02	49.12	48.30	46.85	45.58	44.46	43.45	42.53
		Night	58.03	54.40	52.18	50.54	49.20	48.07	47.06	46.16	45.34	43.89	42.62	41.50	40.49	39.57
	2039	Daytime	62.58	58.95	56.73	55.09	53.75	52.61	51.61	50.71	49.89	48.44	47.17	46.05	45.04	44.12
		Night	59.84	56.20	53.98	52.34	51.01	49.87	48.87	47.97	47.15	45.69	44.43	43.30	42.29	41.37

Table 5.2-12 Prediction of Distance to Meet Category 4a and Category 2 Traffic Noise Standards

Road Segment	Year	Date	Standard class	Standard value dB (A)	Standard distance (m)	Standard class	Standard value dB (A)	Standard distance (m)
Zhenxing Road, Huanta Road, Lvyuan Road, Chunlin Road, North Section of Yong'an Road	2025	Daytime	*Environmental Quality Standard for Noise* (GB3096-2008) Class 4a	70	2	*Environmental Quality Standard for Noise* (GB3096-2008) Class 2	60	10
		Night		55	15		50	26
	2031	Daytime		70	2		60	14
		Night		55	18		50	31
	2039	Daytime		70	3		60	18
		Night		55	22		50	39
National Highway G211 Ankang Guanmiao-Huangyang River (east section of the Ring Road) Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	2025	Daytime	*Environmental Quality Standard for Noise* (GB3096-2008) Class 4a	70	3	*Environmental Quality Standard for Noise* (GB3096-2008) Class 2	60	20
		Night		55	24		50	45
	2031	Daytime		70	4		60	23
		Night		55	28		50	54
	2039	Daytime		70	6		60	27
		Night		55	35		50	69

5.2.3.4 Prediction and evaluation of noise at sensitive points

The predicted value of environmental noise at sensitive points within the evaluation range during the operation period is derived by adding the predicted value of road traffic noise (appropriately corrected by considering the factors affecting the acoustic environment at the sensitive points) up to the noise background value. When correcting the traffic noise value, factors such as the terrain at the sensitive points, the height difference with the road surface, the slope of the road surface, and green vegetation are comprehensively considered.

The predicted values of environmental noise at sensitive points along the line are shown in Tables 5.2-13. According to the evaluation criteria, the exceeding limit of sensitive points is also provided.

Table 5.2-13 Predicted Values and Exceeding Levels of Environmental Noise at Sensitive Points Along the Main Line in Each Evaluation Year During the Operation Period Unit: dB (A)

S/N	Road	Name of sensitive points	First row distance (m)		Altitude difference (m)	Evaluation Standards	Period	Nosie Background dB(A)	Standards dB(A)	Prediction results, dB (A)								
										2025			2031			2039		
			The distance from centerline	The distance from the red line						Predicted	Value exceeding standard	Increase compared to background value	Predicted	Value exceeding standard	Increase compared to background value	Predicted	Value exceeding standard	Increase compared to background value
1	Road Resilience Improvement Project of Shiti-Zhangtan First-Class Highway of National Highway G211	Group 5 of Shuangjing Village	35	15	-24.45	Class 4a	Daytime	57	70	57.3	/	0.3	57.4	/	0.4	59.2	/	2.2
							Night	46	55	47.7	/	1.7	48.1	/	2.1	53.2	/	7.2
2		Shiti Town Government Resettlement Community	35	15	-19.39	Class 4a	Daytime	57	70	57.4	/	0.4	57.5	/	0.5	57.7	/	0.7
							Night	46	55	48.2	/	2.2	48.7	/	2.7	49.4	/	3.4
3		Group 5 of Shuangjing Village	60	40	-17.57	Class 2	Daytime	57	60	57.5	/	0.5	57.6	/	0.6	57.8	/	0.8
							Night	46	50	48.5	/	2.5	49.0	/	3	49.8	/	3.8
4		Yangkou Village	66	46	-13.45	Class 2	Daytime	57	60	57.1	/	0.1	57.1	/	0.1	57.2	/	0.2
							Night	46	50	46.6	/	0.6	46.8	/	0.8	47.2	/	1.2
5		Jiutiaogou Village	94	74	-17.92	Class 2	Daytime	57	60	57.1	/	0.1	57.1	/	0.1	57.2	/	0.2
							Night	46	50	46.5	/	0.5	46.6	/	0.6	46.9	/	0.9
6		Group 3 of Langou Village	110	90	-14.23	Class 2	Daytime	54	60	54.1	/	0.1	54.2	/	0.2	54.3	/	0.3
							Night	44	50	44.6	/	0.6	44.8	/	0.8	45.2	/	1.2
7		Group 5 of Langou Village	93	73	-18.17	Class 2	Daytime	54	60	54.2	/	0.2	54.2	/	0.2	54.3	/	0.3
							Night	44	50	44.7	/	0.7	45.0	/	1	45.4	/	1.4
8		Group 9 of Langou Village	35	15	-19.45	Class 4a	Daytime	54	70	55.0	/	1	55.3	/	1.3	55.7	/	1.7
							Night	44	55	47.7	/	3.7	48.4	/	4.4	49.5	/	5.5
9		Group 13 of Lishi Village	38	18	-10.77	Class 4a	Daytime	54	70	54.2	/	0.2	54.3	/	0.3	54.4	/	0.4
							Night	44	55	45.1	/	1.1	45.4	/	1.4	45.9	/	1.9
10		Group 11 of Lishi Village	36	16	-10.01	Class 4a	Daytime	54	70	54.2	/	0.2	54.3	/	0.3	54.4	/	0.4
							Night	44	55	45.0	/	1	45.4	/	1.4	45.9	/	1.9
11		Group 9 of Lishi Village	40	20	-13.13	Class 4a	Daytime	54	70	55.4	/	1.4	55.8	/	1.8	56.4	/	2.4
							Night	44	55	48.7	/	4.7	49.6	/	5.6	50.9	/	6.9
12		Group 8 of Lishi Village	80	60	-14.12	Class 2	Daytime	54	60	54.2	/	0.2	54.3	/	0.3	54.4	/	0.4
							Night	44	50	44.9	/	0.9	45.3	/	1.3	45.7	/	1.7
13		Dian'an Village	35	15	5.55	Class 4a	Daytime	55	70	55.8	/	0.8	56.1	/	1.1	56.5	/	1.5
							Night	46	55	48.6	/	2.6	49.3	/	3.3	50.3	/	4.3
14		Shiti Town Health Center	35	15	4.55	Class 2	Daytime	57	60	57.1	/	0.1	57.1	/	0.1	57.2	/	0.2
							Night	46	50	46.7	/	0.7	46.7	/	0.7	47.3	/	1.3
15		Hanbin District TCM Hospital	35	15	3.55	Class 2	Daytime	55	60	55.6	/	0.6	55.7	/	0.7	56.0	/	1
							Night	46	50	47.9	/	1.9	48.4	/	2.4	49.3	/	3.3
16		The Third Hospital of Ankang Central Hospital	35	15	5.55	Class 2	Daytime	55	60	55.7	/	0.7	56.0	/	1	56.3	/	1.3
							Night	46	50	48.3	/	2.3	49.0	/	3	49.9	/	3.9
17	Huanta Road	Dian'an Village	17	11	5.55	Class 4a	Daytime	55	70	55.7	/	0.7	55.9	/	0.9	56.3	/	1.3
							Night	46	55	48.3	/	2.3	49.0	/	3	49.9	/	3.9
18		Shuangjing Village	17	11	0.55	Class 4a	Daytime	67	70	67.1	/	0.1	67.1	/	0.1	67.2	/	0.2
							Night	53	55	54.0	/	1	54.3	/	1.3	54.9	/	1.9
19		Dian'an Primary School	179	173	5.55	Class 2	Daytime	55	60	55.4	/	0.4	55.5	/	0.5	55.7	/	0.7
							Night	46	50	47.4	/	1.4	47.8	/	1.8	48.5	/	2.5
20	The Second Bidding Section of the Reconstruction Project of National Highway G211 Ankang	Dian'an Village	35	15	6.55	Class 4a	Daytime	55	70	55.6	/	0.6	55.8	/	0.8	56.1	/	1.1
							Night	46	55	47.9	/	1.9	48.5	/	2.5	49.4	/	3.4
21		Shuangjing Village	38	18	8.55	Class 4a	Daytime	67	70	67.0	/	0	67.0	/	0	67.1	/	0.1
							Night	53	55	53.4	/	0.4	53.5	/	0.5	53.7	/	0.7
22		Wangwan Village	35	15	-0.45	Class 4a	Daytime	67	70	67.1	/	0.1	67.1	/	0.1	67.1	/	0.1
							Night	53	55	53.7	/	0.7	53.9	/	0.9	54.3	/	1.3
23		New Hope Kindergarten	40	20	2.55	Class 2	Daytime	55	60	56.2	/	1.2	56.5	/	1.5	57.1	/	2.1
							Night	46	50	49.5	/	3.5	50.3	0.3	4.3	51.5	1.5	5.5
24		The Third Hospital of	35	15	3.55	Class 2	Daytime	55	60	56.0	/	1	56.4	/	1.4	56.9	/	1.9
							Night	46	50	49.2	/	3.2	50.0	/	4	51.1	1.1	5.1

S/N	Road	Name of sensitive points	First row distance (m)		Altitude difference (m)	Evaluation Standards	Period	Nosie Backgroud dB(A)	Standards dB(A)	Prediction results, dB (A)								
										2025			2031			2039		
			The distance from centerline	The distance from the red line						Predicted	Value exceeding standard	Increase compared to background value	Predicted	Value exceeding standard	Increase compared to background value	Predicted	Value exceeding standard	Increase compared to background value
	Guanmiao-Huangyang River (East Section of the Ring Road)	Ankang City																
25	Zhenxing Road	Dian'an Village	30	17	5.55	Class 4a	Daytime	55	70	55.1	/	0.1	55.1	/	0.1	55.2	/	0.2
							Night	46	55	46.4	/	0.4	46.5	/	0.5	46.7	/	0.7
26		Lishi Village	32	19	0.55	Class 4a	Daytime	54	70	57.0	/	3	57.8	/	3.8	58.8	/	4.8
							Night	44	55	51.8	/	7.8	53.1	/	9.1	54.7	/	10.7
27		Shigou Village	33	20	0.55	Class 4a	Daytime	57	70	58.7	/	1.7	59.2	/	2.2	59.9	/	2.9
							Night	46	55	52.1	/	6.1	53.2	/	7.2	54.7	/	8.7
28		Hanbin District TCM Hospital	30	17	1.55	Class 2	Daytime	55	60	56.4	/	1.4	56.8	/	1.8	57.4	/	2.4
							Night	46	50	50.0	/	4	50.9	0.9	4.9	52.2	2.2	6.2
29	Lvyuan Road	Lishi Village	25	16	6.55	Class 4a	Daytime	54	70	54.3	/	0.3	54.4	/	0.4	54.5	/	0.5
							Night	44	55	45.3	/	1.3	45.7	/	1.7	46.3	/	2.3
30		Hanbin District TCM Hospital	169	160	5.55	Class 2	Daytime	55	60	55.5	/	0.5	55.7	/	0.7	56.0	/	1
							Night	46	50	47.8	/	1.8	48.3	/	2.3	49.1	/	3.1
31	Chunlin Road	Lishi Village	106	97	0.55	Class 2	Daytime	54	60	54.7	/	0.7	55.0	/	1	55.3	/	1.3
							Night	44	50	46.8	/	2.8	47.5	/	3.5	48.6	/	4.6
32	North section of Yong'an Road	Shigou Village	63	50	5.55	Class 2	Daytime	57	60	57.3	/	0.3	57.4	/	0.4	57.6	/	0.6
							Night	46	50	47.6	/	1.6	48.1	/	2.1	48.9	/	2.9
33		Langou Village	25	12	7.55	Class 4a	Daytime	54	70	54.4	/	0.4	54.6	/	0.6	54.8	/	0.8
							Night	44	55	45.9	/	1.9	46.4	/	2.4	47.2	/	3.2

According to the requirements of EHS General Guidelines of the World Bank Group and in consideration of the actual construction situation in China, it is not feasible to adopt a single standard of 55/45 dB as the environmental quality standard for noise for any residential receptor. Therefore, for this design, the background noise value from the traffic road to the nearest receiving point should not exceed 3dB.

Based on the prediction results of sensitive points, noise prevention and control measures will be taken for sensitive points that exceed the standard in the mid-term of operation. For sensitive points that exceed the standard in the long-term, noise tracking and monitoring will be strengthened during the operation period. Based on the extent of exceeding standard, noise prevention and control measures will be taken in time.

The measures taken for sensitive points comprehensively consider various factors such as the desired noise reduction effect and the applicable conditions of various noise reduction measures. Noise reduction measures provided should be technically feasible, economically reasonable, and fair.

Principle of setting sound insulation windows: Sound insulation windows are suitable for sensitive points with noise level significantly exceeding the standard and good building structure. Indoor noise can be reduced by 15-25dB (A), and there are no requirements for the number, distribution, and the distance from the road of sensitive point houses.

According to the *Technical Policy for the Prevention and Control of Ground Traffic Noise Pollution*, "where the construction or operation of ground traffic facilities causes excessive outdoor environmental noise in noise sensitive buildings, and it is not feasible to adopt outdoor standard compliance technical measures, passive protective measures (such as soundproof doors and windows, ventilation and noise elimination windows, etc.) should be considered for noise-sensitive buildings to provide reasonable protection for the indoor acoustic environment quality.

For sensitive points with a predicted noise value exceeding the standard more than 3dB (A) in the mid-term of operation, noise reduction measures will be taken. For sensitive points with a predicted noise value exceeding the standard less than 3dB (A), cost of noise reduction measures will be reserved, and decisions regarding the adoption of such measures will be made based on the monitoring results in the mid-term of operation.

Combined with the requirements of EHS General Guidelines of the World Bank Group, passive protective measures (soundproof doors and windows, ventilation and noise elimination windows, etc.) are taken for noise-sensitive buildings with predicted values exceeding 3dB (A) during operation, so as to provide reasonable protection for the indoor acoustic environment quality.

Strengthen environmental monitoring of acoustic environmental quality along the highway, monitor the acoustic environmental quality once a year at sensitive points within the assessment scope on both sides of the road, and take corresponding mitigation measures in time according to the degree of acoustic environmental pollution.

Meanwhile, during the operation of the road after construction, strengthen road maintenance, make a reasonable planning of building layout, set up slowing down and no-honking warning signs in residential areas, and strengthen the building sound insulation measures of the newly planned road as well as noise monitoring along the road. In combination with the local ecological construction planning, strengthen the greening work in the greening areas within the land acquisition scope of the project. Carry out the unified greening engineering design for the bank slope, drainage ditch and interchange section; establish the greening forest belt with multilayered structure on both sides of the highway sections in villages, so that it forms a three-dimensional barrier to strengthen the obstruction and absorption of traffic noise.

5.2.4 Impact of solid waste

I. Urban Low-carbon and Resilient Transport Facilities

The Project includes a green public parking lot project in the core area of Chengdong New Area in Ankang. According to the *Feasibility Study Report on Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, there are a total of 65 operation and management personnel for the parking lot. The main solid waste from the Project is domestic waste, and the daily waste from office staff is about 65kg based on the waste volume of 1kg/d per person.

Domestic waste cans shall be collected in a centralized way and handed over to the sanitation department for removal and treatment on a regular basis.

II. Urban Ecological Restoration and Green Resilient Infrastructure Construction Project and Ecological Park Project

The maximum capacity of tourists for the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), Huangyang River Water Environment Improvement and Ecological Restoration Project, and the Chengdong Sports Park in Ankang is approximately 1,600, 2,000, and 968 respectively, with a staff quota of 100 people. Among them, based on the waste generation rate of 0.5kg/d per person for tourists and 1kg/d per person for the staff, the daily amount of waste generated by personnel is approximately 2,384kg/d during the operation period.

Domestic waste cans shall be collected in a centralized way and handed over to the sanitation

department for removal and treatment on a regular basis.

III. Green and Low-Carbon Urban Operation System

The main sources of pollution during the operation period of the Project are domestic wastes from the staff of the operation management and data center.

According to the feasibility study data, it is known that the office capacity of the Project is approximately 500 people. Based on the waste generation rate of 1kg/d per person, the daily amount of waste generated by office workers is approximately 500kg/d.

Domestic waste cans shall be collected in a centralized way and handed over to the sanitation department for removal and treatment on a regular basis.

5.2.5 Community health and safety

Once the Project is completed and put into operation, the impacts on the health and safety of residents in surrounding communities will mainly be caused by traffic road safety, traffic noise, and dust.

Community management personnel are required to provide safety education to residents, so as to raise safety awareness among community residents living along the road, and ensure their own health and safety during road operation.

Meanwhile, the construction of the Hanjiang River Riverside Ecological Green Corridor Project (Phase I) and Ecological Park Project has increased the number of leisure and entertainment venues in the city, providing more opportunities for community citizens to choose from in their cultural life, and bringing positive effects on the healthy life of community residents.

Once put into operation, for the planting of basic farmlands in the Hanjiang River Riverside Ecological Green Corridor Project (Phase I), the ecological park, and the Huangyang River Ecological Restoration Project, there are needs for fertilizing and spraying pesticides for plant diseases and pests. Considering that the Project is close to the Hanjiang River and the daily activity area of community residents, the assessment requires the use of non-toxic and harmless biological insecticides to ensure that the ecology of the Hanjiang River and the health and safety of community residents are not affected.

5.2.6 Analysis of the impact of climate change and carbon sequestration and emission reduction

Urban low-carbon and resilient transportation facilities within the scope of the Project mainly include the construction and reconstruction projects of 7 roads, green public parking lot project in the core area of Chengdong New Area in Ankang, and new energy street lamp construction project.

The construction and reconstruction projects of seven roads have greatly increased the transportation capacity of the urban area, alleviated traffic congestion, and reduced the carbon emissions caused by fuel vehicles due to traffic congestion. These are aimed to improve the road traffic capacity and promote the low-carbon emission reduction effect of urban areas in Ankang.

The green public parking lot project in the core area of Chengdong New Area in Ankang will feature PV canopies above the parking spaces, which will be used for daily use and electric vehicle charging, while the remaining electricity will be connected to the grid. The charging and energy storage smart car sheds are a flexible and interconnected AC and DC hybrid microgrid system that integrates various functions such as electric vehicle charging and discharging, smart energy storage, and distributed PV power generation. The charging and energy storage smart car sheds can enable orderly charging and discharging of electric vehicles, and achieve new energy consumption, peak load shifting and valley load filling, seamless grid connection and off-grid switching, and uninterrupted power supply for important loads. At the same time, it can provide stable DC system and reliable power supply.

In 2021, the total number of motor vehicles in Ankang was 712,400, including 243,400 cars. In order to promote the development of low-carbon cities, Ankang has transformed from its original "intensive" transportation layout to a "lightweight" transportation layout, vigorously advocating public transportation. As of August 2022, Ankang had been operating 68 natural gas buses and 113 pure electric buses over16 routes, with a total length of 231 kilometers, a daily operating mileage of over 30,000 kilometers, and a daily transportation of about 100,000 passengers. Clean energy technology has played a major role in low-carbon transportation. However, the proportion of clean energy vehicles in Ankang is relatively low, and the use of diesel and dual fuel vehicles is still relatively high.

The green public parking lot project can further facilitate the promotion and use of new energy vehicles and reduce the use of fuel vehicles. This has reduced the carbon emissions of fuel powered vehicles in transportation.

The new energy street lamp project saves power demands and reduces carbon emissions in an indirect way.

Urban ecological restoration and green resilient infrastructure construction, ecological parks, and other projects require the planting of a large number of plants.

Through an analysis of the existing types of green vegetation in Ankang and the local climate, soil, environment, water quality, etc., it is found that Hanbin District has four distinct seasons, low annual average precipitation, high evaporation, and high summer temperatures and severe winter climate. Therefore, it is essential to choose vegetation types that are resistant to cold, drought, and high temperatures. Based on the current municipal greening around the Project and the vegetation ratio designed in the feasibility study, the following vegetation is mainly chosen for the landscaping of the community park in the Project:

Evergreen trees: Chinese pine, spruce, etc;

Deciduous trees: catalpa, white birch, white wax, dryland willow, euonymus bungeanus, etc;

Small arbors: boxwood, Prunus cerasifera, clustered Prunus cerasifera, acer ginnala, lilac, etc;

Flowery shrubs: Euonymus japonicus, Bauhinia, Forsythia suspensa, Caryopteris clandonensis, Sorbaria sorbifolia, etc;

Small shrubs: ulmus pumila, Spiraea cantoniensis Lour., Caryopteris clandonensis, redwood, etc;

Flowers: Purple Magnolia, floribunda rose;

Grass: mixed sowing and spread the lawn fully.

In the next implementation stage, it is necessary to invite botanists and ecosystem experts to participate in the scheme design process, ensuring the organic integration of the project and the regional ecosystem, as well as providing effective assistance and technical support in plant selection and avoiding invasive alien species. Plants are one of the most important carbon cycle participants on Earth. They use solar energy through photosynthesis to convert carbon dioxide in the air into organic matter, maintaining the material balance of the ecosystem, and also providing carbon sink storage pools and atmospheric carbon purification services.

In recent decades, significant climate changes have posed a challenge for humanity, and the carbon sequestration capacity of plants are increasingly valued. The main mechanism for plants to sequestrate carbon is photosynthesis, which is the main mechanism by which plants convert solar energy into chemical energy. Plants can convert carbon dioxide in the atmosphere into organic matter by utilizing gas exchange.

In addition, plants can also improve their carbon sequestration capacity through vegetation coverage, soil and water conservation, and natural conservation. Plants contribute to global

climate change via their carbon sequestration capacity. They can help regulate carbon concentration in the atmosphere, reduce greenhouse gas emissions, and thus play a vital role in environmental protection.

The enhancement of plant carbon sequestration capability contributes to the sequestration of atmospheric carbon and the accumulation of soil carbon. The increase in plant carbon storage can not only slow down greenhouse gas emissions in the atmosphere, but also reduce the dispersion of greenhouse gases in the atmosphere, which helps to slow down global climate change. In addition, the enhancement of plant carbon sequestration capability also helps to reduce the loss of soil organic carbon, increase the accumulation of soil organic carbon, improve soil fertility, and thus facilitate the growth and development of crops.

According to *Survey Report on the Vegetation Status in Shaanxi Ankang Green and Low-Carbon Demonstration Urban Development Project*, the vegetation status in the Hanjiang River and Huangyang River section of Hanbin District, Ankang was investigated, and the whole survey area was divided into forest ecosystems, farmland ecosystems and riparian wetland ecosystems. A systematic investigation was conducted on the vegetation in the assessment area, and a total of 319 species, 84 families, and 238 genera of higher plants were investigated. The dominant families are Rosaceae, Asteraceae, Gramineae, Cruciferae, and Leguminosae. The plants have strong vegetation carbon sequestration capability.

The implementation of the Project can further improve the carbon sequestration capacity of plants. In order to improve the carbon sequestration capacity of plants, a series of effective measures should be taken:

Firstly, the photosynthesis of plants should be strengthened to maximize the utilization of solar energy and improve their carbon sequestration capacity.

Secondly, appropriate ecological forest protection, vegetation coverage, and soil and water conservation measures should be taken to make the plants more resistant to the heat and drought, and enhance their environmental adaptability and carbon sequestration capacity.

Thirdly, with reference to 4.2.4 biological monitoring and assessment in the *Technical Guidelines for Protection and Restoration of River and Lake Ecological Buffer Zones*, the monitoring frequency should not be less than once a year to ensure that biodiversity is not affected and remains in an efficient carbon sequestration state.

Finally, more research should be conducted to improve the carbon trading system of forest ecosystems, farmland ecosystems, and riparian wetland ecosystems. Plant varieties with high carbon sequestration capacity should be planted to reduce human interference, protect the natural environment of plants, and effectively improve their carbon sequestration capacity.

In summary, the carbon sequestration capacity of plants is the main biological function of plants, which plays a crucial role in contributing to global climate change and helping humans solve climate change problems. The implementation of the Project can further improve the carbon sequestration capacity of plants in Hanbin District, Ankang. During the implementation of the project, plants are also affected by natural environment and human activities. Therefore, effective management and protection measures are needed to effectively enhance the carbon sequestration capacity of plants and make positive contributions to local climate change.

5.2.7 Analysis of positive effects of ecosystem improvement

After the Project is officially put into operation, it will have enormous positive effects on enhancing the ecosystem value and ecological service functions of the project area. The construction of the Hanjiang River Riverside Ecological Green Corridor Project and Huangyang River Water Environment Improvement and Ecological Restoration Project will effectively enhance the ecosystem functions of the Huangyang River and the Hanjiang River. During the implementation of the overall ecological design scheme of the project, botanists and ecosystem experts will be invited to participate in the design and implementation of the scheme, effectively combining with urban low-carbon facility engineering, and delivering a good job in low-carbon energy conservation efforts such as water resource recycling.

During project implementation, in line with the existing ecological environment of animals and plants, it is hoped to better protect the living and growing habitat of animals and plants, create a better ecological environment for humans and nature, and deliver significant positive environmental effects.

After the completion of the ecological green corridor and ecological park, the species value in the project area can be effectively improved, while increasing the ornamental value of the ecosystem. The completion of the project will lay a solid foundation for achieving the sustainable development goal of creating a green and low-carbon environment in the East New Area of Ankang City.

6. Public Consultation and Information Disclosure

6.1 Public participation

6.1.1 Purpose and significance of public participation

In the process of environmental and social assessment of projects, consultation with stakeholders (or public consultation) is increasingly recognized as an important concept and requirement. It can enhance the authenticity and acceptability of the assessment itself, but more importantly, it can improve the quality of decision-making. The consultation/participation of stakeholders throughout the various stages of project development contributes to improving decision-making and ultimately achieves sustainable development.

Stakeholder consultation is a two-way process. For stakeholders, the consultation process is an opportunity to obtain information about the project, understand its potential impacts, raise questions and concerns, and contribute to the discussion. For project supporters, the consultation process provides an opportunity to learn about stakeholders and their concerns about the project, their needs and expectations, and their suggestions that may be valuable in shaping the project and its design. Listening to the concerns and feedback of stakeholders can be a valuable source of information that can improve the project design and outcomes and help project proponents to identify and control external risks. It can also serve as the foundation for future cooperation and partnerships.

6.1.2 Stakeholder identification

Stakeholders are individuals or organizations who are considered to be interested in or have relevant knowledge about the Project, and their insights or influence can help address the issues arising from the project or impact decisions related to the Project. By definition, there are two types of stakeholders in the Project, as described below.

Primary stakeholders (also known as direct stakeholders) are grassroots stakeholders, such as individuals affected by the project and the public, including women residing in the project area. These individuals are directly exposed to the impact of the project, even though in some cases they may not receive any direct benefits from it.

Secondary stakeholders (also known as institutional stakeholders) are individuals, departments, institutions, and/or organizations that may not be directly affected by the project but have the potential to influence the project and its design. They include project supporters, regulatory agencies, other relevant departments and non-governmental organizations (NGOs) that may play a role in various stages of the project, and the broader community including academia and journalists, as well as the general public.

6.1.3 Methods and content of stakeholder engagement

According to the *Measures for Public Participation in Environmental Impact Assessment* (Order No. 4), and the *Environmental and Social Framework* of the Asian Infrastructure Investment Bank (AIIB), combined with the characteristics of the project, the survey of public participation in the environmental impact assessment is carried out by a combination of online public announcements, symposiums and interviews.

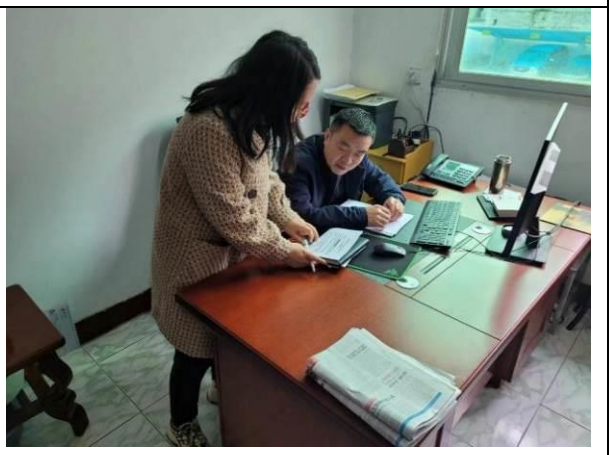
Table 6.1-1 Summary Table of Stakeholder Consultation Activities

S/N	Consultation method	Consultation time	Consultation location	Target audience and purpose of the consultation	Feedback and recommendations
1	Field investigation	2023 March 15	Project site of Chengdong New Area	Asian Infrastructure Investment Bank (AIIB), district government, Project Management Office (PMO), feasibility study preparation unit, social assessment preparation unit, environmental impact assessment unit. Understand what the project may include and initially identify the project's stakeholders.	Actively support the project construction
2	Colloquium	2023 March 16	Meeting room	Asian Infrastructure Investment Bank (AIIB), district government, Project Management Office (PMO), feasibility study preparation unit, social assessment preparation unit, environmental impact assessment unit. Understand what the project may include and initially identify the project's stakeholders.	Actively support the project construction
3	On-site interview	March 18, 2023	Various department offices	Bureau of Forest of Hanbin District, Water Conservancy Bureau of Hanbin District, and Fisheries Station; learn about the project and the surrounding forest land, fisheries, and water conservancy projects	Actively support the project construction
4	Field investigation	2023 April 5-April 6, 2023	Project site of Chengdong New Area	Environmental impact assessment unit and community residents; learn about the project and the surrounding community	Concern about social health and safety risks, environmental impacts and risks during the construction period of the project. Through the visits, the residents expressed their support for the construction of the project.
5	Colloquium	April 7, 2023	Meeting room	Ankang Hydrological Survey Center, Ankang Chengdong New Area Management Committee, Ankang Ecological Environment Bureau Hanbin Branch, Zhangtan Grain Storage Center of Hanbin District, Ankang Natural Forest Protection Center	Actively support the project construction
6	Field investigation	April 8, 2023	Project site of Chengdong New Area	Zhangtan Nine-Year School, the First Kindergarten of Zhangtan Town, Hanbin District, Ankang Mental Health Center	Concern about social health and safety risks, environmental impacts and risks during the construction period of

S/N	Consultation method	Consultation time	Consultation location	Target audience and purpose of the consultation	Feedback and recommendations
					the project. Through the visits, the residents expressed their support for the construction of the project.
7	On-site interview	August 8, 2023	Hanbin Branch of the Natural Resources Bureau of Ankang City	Understand the distribution range of permanent basic farmland within the project area	Actively support the project construction
8	On-site interview	August 8, 2023	Bureau of Forest of Hanbin District	Understand the types and distribution areas of forest land within the project area	Actively support the project construction
9	On-site interview	August 8, 2023	Ankang Ecological Environment Bureau Hanbin Branch	Understand whether the water source of Wangwan Water Plant has been designated as a protected area.	Through interviews, it was found that the two water supply wells have not been delineated within a protected area, and there is active support for the project construction.
10	On-site interview	August 8, 2023 - August 9, 2023	Lishi Village, Wangwan Village, Dian'an Village, Shuangjing Village, Houyan Village	Interviews with the villages involved in the water supply from the Wangwan Water Plant were mainly investigated to see if they support the Project.	Through the visits, the residents have expressed their support for the construction of the project.

Table 6.1-2 Photographs of Stakeholder Consultation Activities

	
Research Symposium on Chengdong New Area	On-site interviews in the Bureau of Forest of Hanbin District

	
On-site interviews in Water Conservancy Bureau of Hanbin District	On-site interviews in Fisheries Station of Hanbin District
	
Interview in Zhangtan Grain Storage Center of Hanbin District	Interviews in Ankang Hydrological Survey Center
	
Interviews in Ankang Ecological Environment Bureau Hanbin Branch	Interviews in Hanbin Branch of the Natural Resources Bureau of Ankang City

	
Interviews in the Bureau of Forest of Hanbin District	Interviews in Shuangjing Village
	
Interviews in Dian'an Village	Interviews in Wangwan Village

6.2 Information disclosure

6.2.1 First information disclosure

The project was first publicly announced for environmental impact assessment on the official website of the Hanbin District People's Government of Ankang City on xx/xx/xxxx (website:)

6.2.2 Second information disclosure

After the preliminary conclusion of the environmental impact assessment, the environmental impact assessment report was fully disclosed on the official website of the Hanbin District People's Government of Ankang City on xx/xx/xxxx (website:)

7. Environmental Management Plan

The purpose of environmental management is to achieve the expected environmental objective by means of planning, organization, coordination, control and supervision, and ultimately to mitigate adverse impacts and enhance favorable impacts. Through the development of environmental management work, we aim to raise the environmental awareness of all employees, promote the enterprise to actively prevent and control pollution, and avoid possible environmental pollution due to poor management.

The environmental management plan of the Project will be reviewed and updated as required at the end of detailed design to keep consistent with the final design. The updated environmental management plan will be incorporated into the bidding documents and contract documents. In this document, the contractor will understand its responsibilities, obligations and investment in implementing the environmental management plan. Environmental monitoring will be used to assess the following items: (1) Actual environmental impact of the project; (2) Implementation of environmental protection measures or compliance with relevant rules and regulations; (3) Trend of environmental impact; (4) Overall effectiveness of mitigation measures.

7.1 Institutional arrangement, strengthening and training plan

7.1.1 Institution set-up

In order to ensure smooth progress of the construction of the Project, Hanbin District of Ankang City plans to set up a three-level organization and management system of "lead agency — implementation agency — implementation unit". The Project will set up a leading group office, which is located in Ankang Municipal People's Government. The organization structure of environmental and social management work for the Project is shown in Figure 7.1-1.

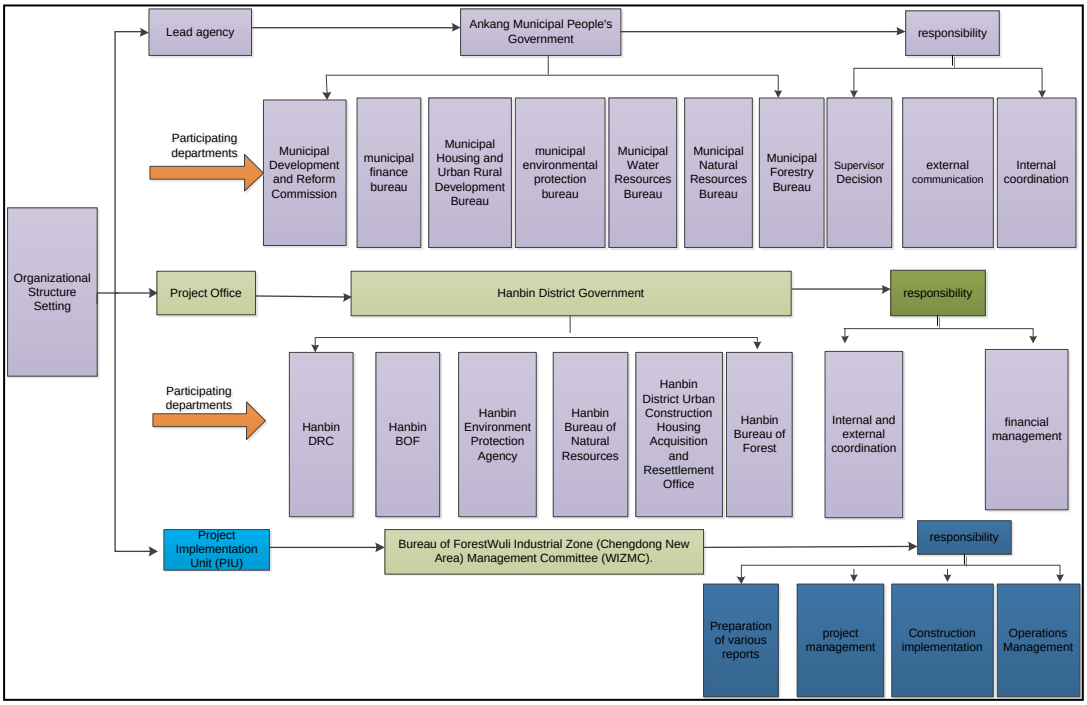


Figure 7.1-1 Organization Structure and Responsibility Chart of the Project

Lead agency: Ankang Municipal People's Government is the lead agency of the Project, consisting of leaders of the District Government, and the principals from the Development and Reform Bureau, Finance Bureau and other project related units, which is responsible for the decision-making management, external communication and internal coordination.

Project Management Office (PMO) sits in Hanbin District Government, with District Mayor acting as the Director of PMO and District Executive Vice Mayor acting as the Deputy Director of PMO.

PMO will be responsible to:

(1) lead the project preparation and implementation in all aspects;

(2) coordinate among all relevant government departments;

(3) lead the communication with the Bank;

(4) supervise the PIU in project preparation and implementation and provide governmental support;

(5) conduct Financial Management of the Project.

(6) prepare and implement the Environmental and Social Management Plan (ESMP), Resettlement Action Plan (RAP), and Stakeholder Engagement Plan (SEP);

(7) provide the Bank with progress reports, audit reports, financial reports, Environmental and Social (E&S) monitoring reports and other reports required on regular basis.

Project Implementation Unit (PIU): Hanbin Wuli Industrial Zone (Chengdong New Area) Management Committee (WIZMC). Head of PIU is the Secretary of the Party Committee of WIZMC.

PIU will be responsible to:

(1) prepare and implement, on daily basis, the Project under the guidance of PMO;

(2) communicate with the Bank and facilitate the Bank's due diligence under the guidance of PMO;

(3) manage, on daily basis, the consultant teams, procurement agencies and contractors;

(4) assist the Financial Management of the Project and carry out daily FM work under the guidance of PMO;

(5) assist the daily E&S work of the Project under the guidance of PMO;

(6) conduct procurement activities under the guidance of PMO;

(7) assist PMO in providing the Bank with all reports required on regular basis;

(8) Establish at least one dedicated environmental coordinator responsible for the implementation of the Environmental Management Plan and liaise with AIIB environmental experts during the implementation period.

7.1.2 Capacity strengthening and training

According to the survey, the Project has relatively complete institutional capacity, office conditions and equipment configuration, and the professionals have high quality and domestic experience in preparation, construction and operation of similar projects. However, the Project is funded by the AIIB loan, so it is necessary to be familiar with the operation mode of the AIIB project, especially to be able to fully compare with domestic experience in terms of safety requirements. Therefore, relevant personnel need to further study and receive training on relevant business strategy requirements.

The training plan for environmental management capacity building is shown in Table 7.1-1.

Table 7-1 Training Plan for Environmental Management Capacity Building

Time	Topic	Objects	Contents	Time (s)	Duration (day/ times)	Number of people	Cost (RMB/ person / day)	Total cost (RMB 10,000)
Construction period	Environmental policies and regulations	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC), Construction unit	1) Environmental protection laws and regulations 2) Environmental policies and plans 3) Content of the AIIB's environmental management framework	1	1	20	500	1.0
	Implementation and adjustment of the environmental management plan	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC), Construction unit	1) Environmental management responsibilities during the construction period of the project 2) Main tasks and contents of environmental management during the construction period of the project 3) Public participation during the construction period 4) Internal monitoring of environmental management	1	1	20	500	1.0
	Emergency handling	Construction unit	Emergency plan, emergency handling measures	1	1	20	500	1.0

	Complaint and dispute resolution	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC), Construction unit	Collection, processing and feedback of residents' opinions	1	1	20	500	1.0
	Environmental consultation	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC)	Consultation method, content, and stakeholder consultation	1	1	20	500	1.0
Operation period	Environmental monitoring, inspection and report	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC)	1) Inspection of environmental protection facilities, environmental quality monitoring, preparation of reports 2) Rules and regulations of environmental safety	2	1	5	500	0.5
	Environmental management measures	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC)	Environmental and social management plan during the operation period	1	1	10	500	0.5

	Public participation during the operation period	Project Management Office (PMO), The Wuli Industrial Zone (East City New District) Management Committee (WIZMC)	1) Methods of public participation during the operation period 2) Collection, processing and feedback of public opinions	1	1	10	500	0.5
Total				9	—	125	—	6.5

7.2 Environmental mitigation measures

7.2.1 Environmental impact mitigation measures during the construction period

Table 7.2-1 Environmental Impact Mitigation Measures during the Construction Period of the Project

Project name	Influencing factor	Potential environmental and social risk/impact	Possible mitigation measures
Huangyang River Water Environment Improvement and Ecological Restoration Project，Hanjiang River Riverside Ecological Green Corridor Project (Phase I)	Ecological environment	Impact of land occupation and vegetation destruction on terrestrial plants during the construction period	1) Investigate the vegetation condition before construction, strictly record the vegetation condition before construction, and carry out greening after construction to minimize biomass loss as much as possible; 2) Strictly control the construction scope and minimize the construction activity area as much as possible; 3) Carry out timely ecological restoration and vegetation greening for the temporary occupied areas of construction roads and construction material yards upon completion of construction; 4) It is prohibited to introduce plants with diseases and insect pests as well as alien invasive species. Adopt local species for ecological restoration and greening, and prohibit harmful alien species; 5) Strengthen the management of construction personnel during the construction period, and prohibit the excavation of protected wild plants. Wild soybean (national second-class protected wild plant) was found during systematic survey of vegetation in Huangyang River and Hanjiang River assessment areas. According to relevant requirements of the *Regulations on the Protection of Wild Plants of the People's Republic of China*, wild soybeans shall be subject to in-situ or ex-situ conservation.
		Impact on wild animals during the construction period	1) Optimize the construction route, and prohibit construction vehicles from honking to avoid disturbing the habitat animals; 2) A topsoil layer of 30~50cm shall be reserved for temporary occupied land, and shall be leveled and restored as soon as possible after the construction to ensure the habitat of birds;

			3) During the line transect survey for animals, investigators found no amphibians in need of protection around the proposed project site. Any amphibians and reptiles found in the construction process need to be avoided to prevent affecting their activities; protect the existing wetland area; increase publicity and education to avoid being artificially killed; 4) During the line transect survey for animals, the following species were found: 7 national second-class protected wild animals, including mandarin ducks, sparrow hawks, Accipiter soloensis, Buteo buteo, Falco tinnunculus, yellow-throated marten and Felis bengalensis; 2 "three-have" (with ecological, scientific and social values) protected animals, including the Elaphe carinata and Corvus torquatus, in which the Elaphe carinata is also a locally protected anim. According to the *Wild Animal Conservation Law of the People's Republic of China* (implemented on May 1, 2023), it is prohibited to hunt or kill wildlife under national priority protection; those who hunt terrestrial wildlife with important ecological, scientific or social value and wildlife under special local protection shall obtain a hunting license issued by the wildlife protection department of the local people's government at or above the county level according to law, and shall be subject to the management of hunting quota; it is prohibited to consume wildlife under national priority protection and terrestrial animals protected by the state that have important ecological, scientific or social value, and other terrestrial wildlife; 5) Before entering the construction area, the construction unit must conduct training and education for the construction personnel, and strengthen the publicity and education of ecological protection for them.
		Impact on aquatic ecosystem during the construction period	1) Strengthen publicity and education and strictly control the construction area. In the construction project, the construction scope shall be strictly controlled when it involves any construction that is destructive to the aquatic ecological environment. With sufficient excavation area as the criterion, try not to expand the construction scope in order to minimize the damage to the biological habitat; 2) Avoid the spawning and breeding period of fish, try to choose the winter dry season for construction, and strictly prohibit night construction; 3) Construction vehicles and machinery shall be overhauled and cleaned before entering the construction site. Vehicles and machinery with oil leakage are strictly prohibited to enter the construction river reach and pollute the water body; 4) When rainy day is approaching, strictly manage the solid waste to prevent it from entering the water body with rainwater and threatening the aquatic ecological environment; 5) Set up an ecological environment supervisor to supervise the implementation of ecological protection during the construction period.

		Impact on Shaanxi Hanjiang River Wetland during the construction period	1) The site selection of construction camp and temporary storage area of construction materials and equipment shall avoid important protected wetlands in Hanjiang River; 2) Set up enclosures in the construction area, strictly control the construction scope, and prohibit arbitrary land occupation; 3) Set up temporary septic tanks in the construction camp, and prohibit the discharge of domestic sewage into water source conservation areas and nearby rivers during the construction period. Regarding construction wastewater, set up oil separators to collect wastewater from overhauling and vehicle cleaning, and reuse it after oil separation and sedimentation treatment. Do not discharge it into nearby water bodies to ensure that the river water quality will not be affected; 4) It is prohibited for construction personnel to dig, fill or dump waste in river channel or flood land; 5) Set up diversion ditches around the material and earthwork areas to prevent rainwater from forming surface runoff and carrying a large amount of sediment and other materials into surface water body; 6) The topsoil stripped from temporary occupied land shall be piled up in a centralized way and used as soil for vegetation restoration after construction. Upon completion of construction, the surplus material of temporary occupied land shall be cleaned up in time to carry out ecological restoration, so as to minimize the surface exposure time and restore the original land use function; 7) The following acts that destroy wetlands and their ecological functions are prohibited: ① Discharge industrial wastewater, domestic sewage and other wastewater and sewage polluting wetlands that do not meet the water pollutant discharge standard, and dump, pile up, discard or scatter solid waste; ② No unit or individual may destroy the habitats of birds and aquatic organisms; ③ It is prohibited to introduce and release alien species into wetlands.
		Impact of land occupation on permanent basic farmland during the construction period	1) No unit or individual may change or occupy the basic farmland protection area once it is demarcated according to law. If the site selection of key construction projects such as national energy, transportation, water conservancy and military facilities really cannot avoid the basic farmland protection area and it is necessary to occupy basic farmland, which involves the conversion of agricultural land or land expropriation, approval must be obtained from the State Council; 2) It is prohibited for any unit or individual to build houses, dig sand, quarry, borrow soil, pile up solid waste or carry out other activities that destroy basic farmland in the basic farmland protection area.

		Impact of water and soil loss caused during the construction period	1) Strictly control the construction boundary and reduce the disturbance to surface vegetation; 2) For the exposed surface disturbed by construction, temporary covering measures should be taken to reduce water and soil loss; 3) Earthwork excavation works should avoid the rainy season to prevent the erodible or newly filled exposed surface from being directly washed by rainwater; 4) For temporary construction land, land remediation and greening shall be carried out in time upon completion of construction; 5) Optimize and reasonably arrange the construction period, avoid construction in windy and stormy weather, improve the construction efficiency, shorten the construction time and reduce the ecological impact; make a compact and reasonable process layout to avoid a large area of surface exposure caused by improper process arrangement. Strengthen water and soil conservation, take temporary covering measures to prevent rain wash during earth excavation, and take water and soil conservation measures such as slope protection, retaining ridge and reinforcement in areas with larger altitude difference to minimize water and soil loss.
	Exhaust gas	1) Dust in the construction process 2) Exhaust from mechanical equipment and transport vehicles	1) The construction site shall be provided with a continuous and 100% closed construction enclosure to reduce the escape of dust; 2) The areas within 50m inside and outside the main entrance and exit of the construction site and around the enclosing wall shall be regularly cleaned and sprinkled with water by specially-assigned personnel, with a cleaning rate of 100%; 3) Cement, lime and other building materials liable to generate dust on the construction site shall be stored in the warehouse and tank. Surplus earth and construction waste shall be piled up in a centralized way. Temporary storage yards shall be arranged reasonably, measures such as solidification, covering and greening shall be taken with an implementation rate of 100%. It is strictly prohibited to burn various types of waste on site; 4) The hardening rate of main roads on the construction site is 100%, and water is sprayed regularly to reduce dust; the setting rate of signs at main entrance and exit of the construction site is 100%; 5) The exposed ground and earthwork on the construction site shall be covered with dense screen, or removed in time to restore vegetation; 6) House demolition works within the area of project site must adopt enclosure isolation and 100% wet operation, with measures of sprinkling water or atomizing dust. The waste shall be covered or removed in time. Open demolition is strictly prohibited; 7) On-line monitoring system and video surveillance of dust on construction site shall be

			installed and networked with industry supervision departments. 8) Develop the management system of non-road mobile machinery on the construction site, and establish the management ledger of non-road mobile machinery entering the construction site; the WIZMC and the construction general contractor shall perform the duties of verifying and accepting the entry of non-road mobile machinery, fill in the entry verification and acceptance form of non-road mobile machinery, and verify the registration certificate for environmental protection inspection of non-road mobile machinery to achieve "one form and one certificate for one machine". The entry verification and acceptance form and related materials shall be kept at the construction site for future reference; 9) Urge the owners of non-road mobile machinery to carry out regular maintenance to ensure that the exhaust emission during the use of non-road mobile machinery meets the emission standard; 10) Regularly check the pollutant emission and oil source of non-road mobile machinery in the Project, and demobilize non-road mobile machinery that fails to meet the emission standard and oil consumption standard.
	Noise	1) Noise of mechanical equipment 2) Noise of transport vehicles	1) The noise during the construction period mainly comes from construction machinery and transport vehicles. During the construction period, the construction unit shall select construction machinery and transport vehicles that meet the relevant national standards, adopt low-noise construction machinery and technology, and install vibration damping bases for fixed machinery and equipment with large vibration; strengthen the maintenance and service of various construction equipment on a daily basis, and keep them running better to reduce the noise source intensity; strengthen the management of transport vehicles and strictly control the whistle of vehicles; 2) The construction unit shall arrange appropriate personnel to take turns operating the construction machinery with high radiation and noise to reduce the time workers are exposed to high noise, and pay attention to machinery maintenance to keep the road building machinery at its lowest noise level. For construction personnel near the high radiation and strong sound source, it is necessary to shorten their working hours appropriately in addition to the labor protection measures of issuing sound-proof earplugs; 3) Reasonably arrange the construction time and try to avoid night construction; the construction time of sensitive road sections shall be adjusted as appropriate, and the construction operations with high-noise machinery at night (22:00~6:00) are prohibited; if night construction is necessary due to the construction technology, it is required to obtain the *Night Construction Permit* according to regulations and make an announcement to the nearby residents;

			4) It is necessary to set up temporary construction enclosures (such as color steel plate, enclosing wall, etc.) with noise reduction function during construction near sensitive targets; control the running speed of mechanical equipment such as bulldozers, excavators and road rollers, and strictly prohibit whistling; 5) The strong noise equipment on the construction site should be arranged on the side far away from residential areas, and noise reduction measures such as enclosing the strong noise equipment can be taken.
	Wastewater	1) Production wastewater 2) Domestic sewage	1) Regarding construction wastewater, set up oil separators to collect wastewater from overhauling and vehicle cleaning, and reuse it after oil separation and sedimentation treatment. Do not discharge it into nearby water bodies to ensure that the river water quality will not be affected; 2) Sand and gravel flushing wastewater shall be treated by a sedimentation tank and reused for sand and gravel flushing and concrete curing; 3) If a construction camp is required for the follow-up project construction, the construction camp and temporary storage area of construction materials and equipment shall be far away from Hanjiang River to ensure that their wastewater will not flow into Hanjiang River and affect the water quality of river; 4) The construction unit shall also avoid large-scale earthwork excavation works in the rainstorm season, take necessary water and soil conservation measures for temporary stocking areas of building materials and spoil (muck), and keep the drainage system on the construction site unobstructed; 5) If a construction camp is required for the follow-up project construction, a temporary septic tank shall be set up in the construction camp, and the domestic sewage generated shall be collected in a centralized way and treated regularly, and shall not be discharged at will.
	Solid wastes	1) Construction waste 2) Domestic waste	1) Purchase road building materials according to the project plan and construction schedule, strictly control the use of materials and minimize the surplus materials; 2) All surplus construction wastes shall be sold for comprehensive utilization in brick making; 3) Do a good job in the allocation and utilization of earth-rock to minimize the amount of spoil (muck) generated form engineering construction; excess excavated earth shall be cleared and transported in time without arbitrary dumping; 4) According to the feasibility study report, the Project has no borrow site. The earthwork shall be backfilled with excavated soil first, and the insufficient portion shall be supplemented with purchased soil; at the present stage, the location of spoil site for the

			Project has not been determined, and the EIA puts forward the site selection requirements for the spoil site, which shall not be located in or near natural habitats, important habitats and altered habitats with important biodiversity value, and sand mining on river channel shall be avoided. The excavated earth-rock shall be prioritized for reuse in other construction works of the project, and all the surplus earth-rock shall be piled up in the designated spoil site as required, and shall not be piled up or placed in disorder; 5) Domestic waste from construction personnel shall be collected separately, piled up in fixed places, and cleaned and transported in time.
	Water sources	Impact of construction on water sources (Wangwan Water Plant, namely Drinking Water Source 1# and Drinking Water Source 2#)	At present, the Wangwan water source area has not been officially designated as a protected area. If it is officially approved and the water source protection area is designated, the following requirements need to be implemented in accordance with the Water Pollution Prevention and Control Law of the People's Republic of China: 1) It is prohibited to build, rebuild or expand construction projects unrelated to water supply facilities and water source protection in the first-grade protection zone of drinking water sources; it is prohibited to engage in cage culture, tourism, swimming, fishing or other activities that may pollute drinking water bodies in the first-grade protection zone of drinking water sources; 2) It is prohibited to build, rebuild or expand construction projects that discharge pollutants in the second-grade protection zone of drinking water sources. Those who engage in cage culture, tourism and other activities in the second-grade protection zone of drinking water sources shall take measures according to regulations to prevent pollution of drinking water bodies; 3) It is prohibited to build or expand construction projects that seriously pollute water bodies in the quasi-protection zone of drinking water sources; rebuilding of construction projects shall not increase the amount of sewage; In addition, based on similar or experiential practices, it is recommended that no temporary construction land such as soil collection and disposal sites, construction camps, or material storage yards be set up within a range of 1000m upstream and 100m downstream of the water intake in Wangwan water source area, and 200m on both sides of the river bank. All production wastewater and domestic wastewater generated during the construction process should be collected and reused without being discharged.Timely and reasonable disposal of solid waste, strict control of soil erosion during construction period.
	Accidental discovery procedures	Impact of construction on cultural relics	1) The surrounding area of Hanjiang River Riverside Ecological Green Corridor Project (Phase I) involves Lishitan Burial Complex. The assessment requires to take corresponding avoidance measures during construction operations, and the construction in the periphery

			shall not affect the Burial Complex. We should reduce the construction area and set up the construction camp and material storage yard away from the cultural relics protection site; 2) Project-specific accidental discovery procedures shall be followed in the event of encountering previously unknown cultural heritage during project activities. Cultural heritage experts shall notify the relevant institutions about the discovered articles or places; fence off the area where articles or places are located to avoid further interference; cultural heritage experts shall evaluate the discovered articles or places; determine action measures; conduct training on accidental discovery procedures for project personnel and project staff; 3) Construction can only be resumed after permission is obtained from the cultural relics department.
	Safety and occupational health of workers	(1) Safe operation and health risks of construction personnel; (2) Environment and safety during vehicle maintenance, including the safety and health of maintenance personnel, and the pollution caused by wastewater, used oil, solvent and solid waste produced in the maintenance process	1) Before starting construction, the contractor shall develop a safety and health management plan (including emergency plan for safety accidents) and submit it to PMO for approval; 2) The contractor shall have full-time safety management personnel who shall be responsible for construction safety management; 3) Conduct occupational health and safety training for all construction personnel, and introduce the basic working rules of the construction site, personal protection rules and how to prevent injuries to other employees; 4) Provide construction personnel with suitable personal protective equipment (gloves, helmets, protective shoes, etc.) to achieve adequate protection for them; 5) Maintain vehicles regularly and use manufacturer approved components to avoid serious accidents due to equipment failure or premature component failure; 6) The construction site shall be equipped with appropriate first-aid equipment: ① Correct signs shall be hung for hazardous areas, devices, materials, safety measures and emergency exits; ② Warning boards shall be placed on all live electric devices and wires; ③ The construction site shall be equipped with sufficient fire-fighting equipment to meet the requirements of fire safety related laws and regulations; ④ The construction unit shall establish a safety log, which shall be recorded by the safety officer on a daily basis; ⑤ The construction unit shall establish worker health records and conduct regular physical examination for workers.
	Community health and safety	(1) Impact of construction vehicles	1) Set up a bulletin board at the entrance of the construction site, indicating the project contractor, construction supervision unit, construction period, as well as the hotline and contact name of the local environmental protection bureau, try to gain the affected people's

		(exhaust gas, vehicle transport process) on the surrounding communities; (2) Impact of exhaust gas and noise within the construction site on residents of surrounding communities.	understanding for the temporary disturbance caused by the project construction, and to facilitate the affected people to contact relevant departments when they find that the construction unit has violation operations; 2) Try to reduce the impact of construction on public services. If the impact is inevitable, inform the Wuli Industrial Zone (East City New District) Management Committee (WIZMC), then the WIZMC shall notify the residents, and try to shorten the affected time; 3) Establish an effective complaint mechanism, and the contractor shall assign dedicated personnel to be responsible for the reception; 4) The contractor shall, as requested by the Wuli Industrial Zone (East City New District) Management Committee (WIZMC), attend regular public participation meetings held by the WIZMC in villages of the project-affected area. At the meetings, the construction unit shall send personnel to explain the construction activities and the environmental protection measures that have been taken or will be taken, and listen to and respond to environmental issues and complaints of public concern; 5) Emphasize safety rules for construction vehicle drivers and improve their driving skills; limit the driving time and arrange the driver shift schedule to avoid excessive fatigue; 6) The route of construction vehicles shall try to avoid schools and other areas with children. If it is really impossible to avoid, strengthen the management of drivers and carry out traffic education and pedestrian safety education together with local communities (for example, carry out publicity activities in schools); 7) Try to use locally purchased materials in order to shorten the transport distance. Build relevant facilities (e.g. workers' dormitory) near the project site and transport workers by bus to avoid increasing traffic flow; 8) Adopt traffic safety control measures to warn incoming and outgoing personnel and vehicles of dangerous situations through road signs and signalmen; 9) The material transportation of construction vehicles shall try to avoid the peak traffic hours at sensitive points; 10) Construction shall be arranged during daytime and prohibited at night (10:00 pm - 6:00 am the next day); the spoil transportation shall be sealed to ensure that the muck truck is not overloaded, so as to prevent muck scattering during transportation. After the daily cleaning and transportation work is completed, the construction site shall be backfilled, compacted and cleaned to ensure clean and tidy surroundings.
Low-impact and Resilient Road	Ecological environment	Impact of land occupation and vegetation	1) Investigate the vegetation condition before construction, strictly record the vegetation condition before construction, and carry out greening after construction to minimize biomass loss as much as possible;

Engineering (7 Roads), Parking Lot, Community Park and Sports Park Project, Green and Low-Carbon Urban Operation Management and Data Center, Protection Zone 1 Project of Zhangtan Town Section Protection Engineering		destruction on terrestrial plants during the construction period	2) Strictly control the construction scope and minimize the construction activity area as much as possible; 3) Carry out timely ecological restoration and vegetation greening for the temporary occupied areas of construction roads and construction material yards upon completion of construction; 4) It is prohibited to introduce plants with diseases and insect pests as well as alien invasive species. Adopt local species for ecological restoration and greening, and prohibit harmful alien species; 5) Strengthen the management of construction personnel during the construction period, and prohibit the excavation of protected wild plants.
		Impact on wild animals during the construction period	1) Before entering the construction area, the construction unit must conduct training and education for the construction personnel, and strengthen the publicity and education of ecological protection for them. Through institutionalization, construction personnel are strictly prohibited to hunt wild animals illegally in order to mitigate the impact of construction on terrestrial animals in nature reserves; 2) Optimize the construction route, and take the planned flood control road as the main transportation route for engineering materials to avoid disturbing the habitat animals; 3) Prohibit night construction for projects located at the boundary of wetlands, and prohibit construction vehicles from honking. Vehicles shall try to travel at a low speed during transportation to reduce the disturbance to birds and reduce the damage of dust and exhaust gas to bird habitats; 4) A topsoil layer of 30 ~ 50cm shall be reserved for temporary occupied land, and shall be leveled and restored as soon as possible after the construction to ensure the habitat of birds.
		Impact of water and soil loss caused during the construction period	1) Strictly control the construction boundary and reduce the disturbance to surface vegetation; 2) For the exposed surface disturbed by construction, temporary covering measures should be taken to reduce water and soil loss; 3) Earthwork excavation works should avoid the rainy season to prevent the erodible or newly filled exposed surface from being directly washed by rainwater; 4) For temporary construction land, land remediation and greening shall be carried out in time upon completion of construction; 5) Optimize and reasonably arrange the construction period, avoid construction in windy and stormy weather, improve the construction efficiency, shorten the construction time and reduce the ecological impact; make a compact and reasonable process layout to avoid a

			large area of surface exposure caused by improper process arrangement. Strengthen water and soil conservation, take temporary covering measures to prevent rain wash during earth excavation, and take water and soil conservation measures such as slope protection, retaining ridge and reinforcement in areas with larger altitude difference to minimize water and soil loss.
	Exhaust gas	1) Dust in the construction process 2) Exhaust from mechanical equipment and transport vehicles	1) The construction site shall be provided with a continuous and 100% closed construction enclosure to reduce the escape of dust; 2) The areas within 50m inside and outside the main entrance and exit of the construction site and around the enclosing wall shall be regularly cleaned and sprinkled with water by specially-assigned personnel, with a cleaning rate of 100%; 3) Cement, lime and other building materials liable to generate dust on the construction site shall be stored in the warehouse and tank. Surplus earth and construction waste shall be piled up in a centralized way. Temporary storage yards shall be arranged reasonably, measures such as solidification, covering and greening shall be taken with an implementation rate of 100%. It is strictly prohibited to burn various types of waste on site; 4) The hardening rate of main roads on the construction site is 100%, and water is sprayed regularly to reduce dust; the setting rate of signs at main entrance and exit of the construction site is 100%; 5) The exposed ground and earthwork on the construction site shall be covered with dense screen, or removed in time to restore vegetation; 6) House demolition works within the area of project site must adopt enclosure isolation and 100% wet operation, with measures of sprinkling water or atomizing dust. The waste shall be covered or removed in time. Open demolition is strictly prohibited; 7) On-line monitoring system and video surveillance of dust on construction site shall be installed and networked with industry supervision departments. 8) Develop the management system of non-road mobile machinery on the construction site, and establish the management ledger of non-road mobile machinery entering the construction site; the WIZMC and the construction general contractor shall perform the duties of verifying and accepting the entry of non-road mobile machinery, fill in the entry verification and acceptance form of non-road mobile machinery, and verify the registration certificate for environmental protection inspection of non-road mobile machinery to achieve "one form and one certificate for one machine". The entry verification and acceptance form and related materials shall be kept at the construction site for future reference. 9) Urge the owners of non-road mobile machinery to carry out regular maintenance to

			ensure that the exhaust emission during the use of non-road mobile machinery meets the emission standard; 10) Regularly check the pollutant emission and oil source of non-road mobile machinery in the Project, and demobilize non-road mobile machinery that fails to meet the emission standard and oil consumption standard.
	Noise	1) Noise of mechanical equipment 2) Noise of transport vehicles	1) During the construction period, the construction unit shall select construction machinery and transport vehicles that meet the relevant national standards, adopt low-noise construction machinery and technology, and install vibration damping bases for fixed machinery and equipment with large vibration; strengthen the maintenance and service of various construction equipment on a daily basis, and keep them running better to reduce the noise source intensity; strengthen the management of transport vehicles and strictly control the whistle of vehicles; 2) The construction unit shall arrange appropriate personnel to take turns operating the construction machinery with high radiation and noise to reduce the time workers are exposed to high noise, and pay attention to machinery maintenance to keep the road building machinery at its lowest noise level. For construction personnel near the high radiation and strong sound source, it is necessary to shorten their working hours appropriately in addition to the labor protection measures of issuing sound-proof earplugs; 3) Reasonably arrange the construction time and try to avoid night construction; the construction time of sensitive road sections shall be adjusted as appropriate, and the construction operations with high-noise machinery at night (22:00~6:00) are prohibited; if night construction is necessary due to the construction technology, it is required to obtain the *Night Construction Permit* according to regulations and make an announcement to the nearby residents; 4) It is necessary to set up temporary construction enclosures (such as color steel plate, enclosing wall, etc.) with noise reduction function during construction near sensitive targets; control the running speed of mechanical equipment such as bulldozers, excavators and road rollers, and strictly prohibit whistling; 5) The strong noise equipment on the construction site should be arranged on the side far away from residential areas, and noise reduction measures such as enclosing the strong noise equipment can be taken.
	Wastewater	(1) Production wastewater (2) Domestic sewage	1) Regarding construction wastewater, set up oil separators to collect wastewater from overhauling and vehicle cleaning, and reuse it after oil separation and sedimentation treatment. Do not discharge it into nearby water bodies to ensure that the river water quality will not be affected;

			2) Sand and gravel flushing wastewater shall be treated by a sedimentation tank and reused for sand and gravel flushing and concrete curing; 3) If a construction camp is required for the follow-up project construction, the construction camp and temporary storage area of construction materials and equipment shall be far away from Hanjiang River to ensure that their wastewater will not flow into Hanjiang River and affect the water quality of river; 4) The construction unit shall also avoid large-scale earthwork excavation works in the rainstorm season, take necessary water and soil conservation measures for temporary stocking areas of building materials and spoil (muck), and keep the drainage system on the construction site unobstructed; 5) If a construction camp is required for the follow-up project construction, a temporary septic tank shall be set up in the construction camp, and the domestic sewage generated shall be collected in a centralized way and treated regularly, and shall not be discharged at will.
	Solid wastes	(1) Construction waste (2) Domestic waste	1) Purchase road building materials according to the project plan and construction schedule, strictly control the use of materials and minimize the surplus materials; 2) All surplus construction wastes shall be sold for comprehensive utilization in brick making; 3) Do a good job in the allocation and utilization of earth-rock to minimize the amount of spoil (muck) generated form engineering construction; excess excavated earth shall be cleared and transported in time without arbitrary dumping; 4) According to the feasibility study report, the Project has no borrow site. The earthwork shall be backfilled with excavated soil first, and the insufficient portion shall be supplemented with purchased soil; at the present stage, the location of spoil site for the Project has not been determined, and the EIA puts forward the site selection requirements for the spoil site, which shall not be located in or near natural habitats, important habitats and altered habitats with important biodiversity value, and sand mining on river channel shall be avoided. The excavated earth-rock shall be prioritized for reuse in other construction works of the project, and all the surplus earth-rock shall be piled up in the designated spoil site as required, and shall not be piled up or placed in disorder; 5) Domestic waste from construction personnel shall be collected separately, piled up in fixed places, and cleaned and transported in time.
	Cultural relics	Impact of construction on cultural relics	1) No other construction projects or blasting, drilling and excavation operations shall be carried out within the protection scope of cultural relics protection sites; 2) Construction engineering conducted within the construction control zone of the cultural

			relics protection site shall not destroy the historical style and features of the cultural relics protection site; 3) Project-specific accidental discovery procedures shall be followed in the event of encountering previously unknown cultural heritage during project activities. Cultural heritage experts shall notify the relevant institutions about the discovered articles or places; fence off the area where articles or places are located to avoid further interference; cultural heritage experts shall evaluate the discovered articles or places; determine action measures; conduct training on accidental discovery procedures for project personnel and project staff; 4) Construction can only be resumed after permission is obtained from the cultural relics department.
	Safety and occupational health of workers	(1) Safe operation and health risks of construction personnel; (2) Safety and health of vehicle maintenance personnel, and the pollution caused by wastewater, used oil, solvent and solid waste produced in the maintenance process	1) Before starting construction, the contractor shall develop a safety and health management plan (including emergency plan for safety accidents) and submit it to WIZMC for approval; 2) The contractor shall have full-time safety management personnel who shall be responsible for construction safety management; 3) Conduct occupational health and safety training for all construction personnel, and introduce the basic working rules of the construction site, personal protection rules and how to prevent injuries to other employees; 4) Provide construction personnel with suitable personal protective equipment (gloves, helmets, protective shoes, etc.) to achieve adequate protection for them; 5) Maintain vehicles regularly and use manufacturer approved components to avoid serious accidents due to equipment failure or premature component failure; 6) The construction site shall be equipped with appropriate first-aid equipment: ① Correct signs shall be hung for hazardous areas, devices, materials, safety measures and emergency exits; ② Warning boards shall be placed on all live electric devices and wires; ③ The construction site shall be equipped with sufficient fire-fighting equipment to meet the requirements of fire safety related laws and regulations; ④ The construction unit shall establish a safety log, which shall be recorded by the safety officer on a daily basis; ⑤ The construction unit shall establish worker health records and conduct regular physical examination for workers.
	Community health and safety	(1) Impact of construction vehicles (exhaust gas, vehicle transport	1) Set up a bulletin board at the entrance of the construction site, indicating the project contractor, construction supervision unit, construction period, as well as the hotline and contact name of the local environmental protection bureau, try to gain the affected people's understanding for the temporary disturbance caused by the project construction, and to facilitate the affected people to contact relevant departments when they find that the

		process) on the surrounding communities; (2) Impact of exhaust gas and noise within the construction site on residents of surrounding communities.	construction unit has violation operations; 2) Try to reduce the impact of construction on public services. If the impact is inevitable, report to the Wuli Industrial Zone (East City New District) Management Committee (WIZMC), then the WIZMC shall notify the residents, and try to shorten the affected time; 3) Establish an effective complaint mechanism, and the contractor shall assign dedicated personnel to be responsible for the reception; 4) The contractor shall, as requested by the Wuli Industrial Zone (East City New District) Management Committee (WIZMC), attend regular public participation meetings held by Project Implementation Unit (PIU) in villages of the project-affected area. At the meetings, the construction unit shall send personnel to explain the construction activities and the environmental protection measures that have been taken or will be taken, and listen to and respond to environmental issues and complaints of public concern; 5) Emphasize safety rules for construction vehicle drivers and improve their driving skills; limit the driving time and arrange the driver shift schedule to avoid excessive fatigue; 6) The route of construction vehicles shall try to avoid schools and other areas with children. If it is really impossible to avoid, strengthen the management of drivers and carry out traffic education and pedestrian safety education together with local communities (for example, carry out publicity activities in schools); 7) Try to use locally purchased materials in order to shorten the transport distance. Build relevant facilities (e.g. workers' dormitory) near the project site and transport workers by bus to avoid increasing traffic flow; 8) Adopt traffic safety control measures to warn incoming and outgoing personnel and vehicles of dangerous situations through road signs and signalmen; 9) Construction vehicles transporting materials shall try to avoid the peak traffic hours at sensitive points; 10) Construction shall be arranged during daytime and prohibited at night (10:00 pm - 6:00 am the next day); the spoil transportation shall be sealed to ensure that the muck truck is not overloaded, so as to prevent muck scattering during transportation. After the daily cleaning and transportation work is completed, the construction site shall be backfilled, compacted and cleaned to ensure clean and tidy surroundings.

7.2.2 Environmental impact mitigation measures during the operation period

Table 7.2-2 Environmental Impact Mitigation Measures during the Operation Period of the Project

Project name	Influencing factor	Potential environmental and social risk/impact	Possible mitigation measures
Huangyang River Water Environment Improvement and Ecological Restoration Project，Hanjiang River Riverside Ecological Green Corridor Project (Phase I)	Exhaust gas	Odor of waste bin and public toilet	1) The workers shall clean and transport the waste in the waste bin every day; 2) Flush the public toilet in time during use. The workers shall timely clean up the waste every day, spray disinfectant regularly and place deodorant to ensure environmental sanitation of the public toilet; 3) Implement the ambient air monitoring plan, and determine to take supplementary environmental protection measures based on the monitoring results.
	Solid wastes	Waste generated by visitors and staff	1) The management department shall clean the ground regularly and set up multipoint waste bins. Domestic waste shall be collected in a centralized way and then transferred to the sanitation department for cleaning and transportation; 2) Encourage passengers not to litter and ensure the cleanliness and hygiene of public places through publicity and education.
	Wastewater	Surface runoff sewage, domestic sewage of workers and mobile personnel	1) Strengthen daily maintenance and management, keep the ground clean, timely clean up the accumulated dust, debris, oil stain and adsorbate on the ground, reduce SS and petroleum pollutants that enter the surface runoff sewage due to initial rain wash, and maximize the protection of water quality environment along the project; 2) Build a supporting rainwater collection system to collect surface runoff within the area and discharge it through the rainwater system; 3) Domestic sewage enters the sewage pipe network of Chengdong New Area and is treated uniformly by the sewage treatment plant.
	Community	Hazards of	1) Mitigation measures for pesticide pollution: ① Select crops resistant to diseases and

	health and safety	pesticides and fertilizers	pests, and quarantine the seeds during introduction to prevent the spread of diseases, insect pests and weeds; ② Use non-toxic, high-efficiency and residue-free pesticides for insecticide, or use biological control methods; ③ Pay attention to the wind direction and speed when spreading pesticides, and try to avoid pesticides from drifting and flowing into water bodies; ④ Pay attention to the recent weather conditions before using pesticides to avoid rainstorm period; ⑤ Establish and improve the pesticide environmental management system and strengthen pesticide environmental management; 2) Mitigation measures for fertilizer pollution: ① Strengthen education and publicity, raise the environmental awareness of staff, and strictly monitor the pollutants in fertilizers; ② Improve the fertilizing methods: deep placement of nitrogen fertilizer, and concentrated placement of phosphorus fertilizer according to the principle of "heavy for upland field and light for paddy field" to improve the utilization rate of fertilizers; ③ Replace some chemical fertilizers with farmyard manure and promote formula fertilization techniques.
	Water environment		Relying on the existing routine monitoring sections of Hanjiang River and Huangyang River (Laojunguan and Huangyang River enter Hanjiang River), timely check the monitoring data of sections, and handle any abnormalities found in the data immediately.
	Ecological environment		Implement the ecological environment monitoring plan and determine the environmental protection measures for animals and plants based on the survey results. The effectiveness of ecological protection measures and the effect of ecological restoration, etc.
Low-impact and Resilient Road Engineering (7 Roads)	Ambient air	1) Road dust 2) Automobile exhaust	1) Build a new energy vehicle application demonstration benchmark city, promote the construction of a green freight transportation demonstration city, continuously promote the elimination of old vehicles and non-road mobile machinery, promote clean muck trucks and commercial concrete trucks, strengthen the control of emission control areas of non-road mobile machinery, enhance the management of motor vehicles in use, and reduce the generation of automobile exhaust; 2) Strengthen road management and pavement maintenance during the operation period, keep the road in good operation condition, and reduce the generation of dust and automobile exhaust;

			3) Strengthen pavement maintenance and cleaning, and maintain good road conditions. Cooperate with the traffic management, traffic police and other departments to strengthen vehicle monitoring, reduce the number of vehicles with substandard exhaust emissions on the road, and reduce atmospheric environmental pollution; 4) Strengthen greening on both sides of the road, sprinkle water regularly, and enhance the adsorption of dust and automobile exhaust.
	Traffic noise	Impact of traffic noise on surrounding residents	1) Source intensity ① Strengthen road management and restrict vehicles with poor performance from entering the road to control the increase in traffic noise; ② Pay attention to pavement maintenance, maintain a smooth pavement, and avoid poor road conditions that may cause vehicle bumping and increase noise; ③ Strengthen traffic management, strictly implement traffic rules such as speed limiting and no overloading, and set up no-honking signs at road sections passing through villages and towns with great population density and near schools to reduce the problem of disturbing residents due to traffic noise. 2) Transmission route During the operation of the road after construction, make a reasonable planning of building layout and strengthen the building sound insulation measures of the newly planned road. In combination with the local ecological construction planning, strengthen the greening work in the greening areas within the land acquisition scope of the project. Carry out the unified greening engineering design for the bank slope, drainage ditch and interchange section; establish the greening forest belt with multilayered structure on both sides of the road sections in villages, so that it forms a three-dimensional barrier to strengthen the obstruction and absorption of traffic noise. 3) Sensitive points ① Combined with the requirements of EHS General Guidelines of the World Bank Group, passive protective measures (soundproof doors and windows, ventilation and noise elimination windows, etc.) are taken for noise-sensitive buildings with predicted values

			exceeding 3dB (A) during operation, so as to provide reasonable protection for the indoor acoustic environment quality. ② Strengthen environmental monitoring of acoustic environmental quality along the highway, monitor the acoustic environmental quality once a year at sensitive points within the assessment scope on both sides of the road, and take corresponding mitigation measures in time according to the degree of acoustic environmental pollution. 4) Control requirements for planning and construction of villages and towns along the line During the operation of the road after construction, strengthen road maintenance, make a reasonable planning of building layout, set up slowing down and no-honking warning signs in residential areas, and strengthen the building sound insulation measures of the newly planned road as well as noise monitoring along the road. In combination with the local ecological construction planning, strengthen the greening work in the greening areas within the land acquisition scope of the project. Carry out the unified greening engineering design for the bank slope, drainage ditch and interchange section; establish the greening forest belt with multilayered structure on both sides of the highway sections in villages, so that it forms a three-dimensional barrier to strengthen the obstruction and absorption of traffic noise.
	Wastewater	Surface runoff sewage	1) Strengthen daily maintenance and management, keep the ground clean, timely clean up the accumulated dust, debris, oil stain and adsorbate on the ground, reduce SS and petroleum pollutants that enter the surface runoff sewage due to initial rain wash, and maximize the protection of water quality environment along the project; 2) Build a supporting rainwater collection system to collect surface runoff within the area and discharge it through the rainwater system.
	Solid wastes	Solid wastes	1) The management department shall clean the ground regularly and set up multipoint waste bins. Domestic waste shall be collected in a centralized way and then transferred to the sanitation department for cleaning and transportation; 2) Encourage passengers not to litter and ensure the cleanliness and hygiene of public places through publicity and education.

	Ecological environment	Ecological environment	1) Strengthen the maintenance and management of greening vegetation along the line during the operation period to ensure the survival rate of greening tree species; 2) Clean along the road regularly. Through the formulation and publicity of laws and regulations, prohibit the passengers from littering drink bags, pop-top cans and other barbage on the road, to ensure driving safety and cleanliness and hygiene on both sides of the road.
Parking Lot, Community Park and Sports Park Project	Exhaust gas	Odor of waste bin and public toilet	1) The workers shall clean and transport the waste in the waste bin every day; 2) Flush the public toilet in time during use. The workers shall timely clean up the waste every day, spray disinfectant regularly and place deodorant to ensure environmental sanitation of the public toilet; 3) Implement the ambient air monitoring plan, and determine to take supplementary environmental protection measures based on the monitoring results.
	Wastewater	Surface runoff sewage, domestic sewage of workers and mobile personnel	1) Strengthen daily maintenance and management, keep the ground clean, timely clean up the accumulated dust, debris, oil stain and adsorbate on the ground, reduce SS and petroleum pollutants that enter the surface runoff sewage due to initial rain wash, and maximize the protection of water quality environment along the project; 2) Build a supporting rainwater collection system, etc. to collect surface runoff within the area and discharge it through the rainwater system; 3) Domestic sewage enters the sewage pipe network of Chengdong New Area and is treated uniformly by the sewage treatment plant.
	Noise of social activities	Noise of social activities	1) We should enhance the awareness of noise pollution prevention and control of the surrounding residents and staff, consciously reduce the emission of noise of social activities, and actively carry out noise pollution prevention and control activities; 2) Public place manager should reasonably specify the area, period and volume of entertainment, fitness and other activities, and strengthen management by taking measures such as setting up automatic noise monitoring and display facilities; 3) When organizing or carrying out entertainment, fitness and other activities in community

			parks, we should observe the regulations of the public place manager on the activity area, period, volume, etc; do not use audio equipment to generate excessive volume against the rules.
	Solid wastes	Waste generated by visitors and staff	1) The management department shall clean the ground regularly and set up multipoint waste bins. Domestic waste shall be collected in a centralized way and then transferred to the sanitation department for cleaning and transportation; 2) Encourage passengers not to litter and ensure the cleanliness and hygiene of public places through publicity and education.
Green and low-carbon urban operation management and data center	Wastewater	Domestic wastewater from office staff	After being treated in septic tank, domestic sewage is connected to the sewage pipe network and enters the sewage treatment plant for unified treatment.
	Solid wastes	Domestic waste from office staff	Domestic waste cans shall be collected in a centralized way and handed over to the sanitation department for removal and treatment on a regular basis.

Figure 7.2-1 Pictures of Wild Soybeans

7.3 Environmental monitoring plan

7.3.1 Monitoring purpose

Environmental monitoring is an important part of environmental management work. Develop necessary environmental monitoring plans and strictly implement them as planned. In this way, we can effectively check the effectiveness of environmental management work of each subproject, and make necessary adjustments and improvements in time, so as to ensure the normal operation of environmental governance facilities and the implementation of environmental protection measures, and ensure the normal and effective progress of environmental protection management work to effectively protect the environment.

7.3.2 Content of environmental monitoring

Environmental monitoring includes two stages: construction period and operation period of the project, with the purpose to comprehensively and timely grasp the pollution dynamics of the proposed project, and to understand the degree and scope of impact of project construction on environmental quality changes in the project construction area as well as environmental quality dynamics during the operation period.

According to the engineering features of the Project, environmental monitoring plans are developed for the construction period and operation period respectively, as shown in Table 7.3-1.

Table 7.3-1 Environmental Monitoring Plan of the Project

Environment type		Monitoring point location	Monitoring item	Monitoring frequency	Executive standard	Monitoring agency	Supervisory agency
Before construction	Ecological environment	Project location	Flora, vegetation type and community structure within the scope of project area, and key species, constructive species and dominant species in the community; fauna, species composition and distribution characteristics; the type, area and spatial distribution of ecosystem; the distribution, ecological characteristics and population status of important species, and the distribution and status of important habitats.	1 time	/	The Wuli Industrial Zone (East City New District) Management Committee (WIZMC) entrusts a qualified institution to undertake monitoring tasks in the form of a contract	Ankang Ecological Environment Bureau Hanbin Branch
Construction period	Ambient air	Residential areas near the construction site (sensitive points with relatively serious impact are selected from each subproject)	TSP	During the construction period, monitoring shall be carried out once every quarter, and continuously for 7 days each time.	*Limiting Value of Fugitive Dust Emissions from Construction Sites* (DB61/1078-2017)		
	Environmental noise	Monitor sensitive points at noisy processes	Continuous equivalence sound level A	During the construction period, monitoring shall	*Environmental Quality Standard for Noise*		

		according to the construction progress		be carried out once every quarter, and continuously for 2 days each time, once day and once night	(GB3096-2008)		
	Water environment	Routine monitoring sections of Hanjiang River and Huangyang River	pH, CODcr, BOD_5, NH_3-N, SS, petroleum, etc.	Relying on the existing routine monitoring sections of Hanjiang River and Huangyang River (Laojunguan and Huangyang River enter Hanjiang River), timely check the monitoring data of sections, and timely handle any abnormalities found in the data	Category II standard of *Environmental Quality Standards for Surface Water* (GB 3838-2002)		
Operation period	Ecological environment	Project location	1. Flora, vegetation type and community structure within the scope of assessment,	1 time	/		

			and key species, constructive species and dominant species in the community; fauna, species composition and distribution characteristics; the type, area and spatial distribution of ecosystem; the distribution, ecological characteristics and population status of important species, and the distribution and status of important habitats. 2. Aquatic organisms, aquatic habitats and fishery status within the assessment scope; the distribution, ecological characteristics, population status and habitat status of important species; the investigation of fish and other important aquatic animals, including species composition, population structure, spatial and temporal distribution of resources, distribution and environmental conditions of important habitats such as spawning ground, feeding ground and overwintering ground, as well as behavioral habits such as migration route and time.				
	Environmental noise	Sensitive points along the road	Continuous equivalence sound level A	During the operation period of 5 years, monitoring shall be carried out	*Environmental Quality Standard for Noise* (GB3096-200		

				twice a year, once every year after the 5 years, and continuously for 2 days each time, once day and once night	8)		
	Water environment	Routine monitoring sections of Hanjiang River and Huangyang River	pH, CODcr, BOD_5, NH_3-N, SS, petroleum, etc.	Relying on the existing routine monitoring sections of Hanjiang River and Huangyang River (Laojunguan and Huangyang River enter Hanjiang River), timely check the monitoring data of sections, and timely handle any abnormalities found in the data	Category II standard of *Environmental Quality Standards for Surface Water* (GB 3838-2002)		

7.4 Environmental protection investment estimation

The estimations of environmental protection measures for subprojects are shown in Tables 7.4-1 ~ 7.4-3.

Table 7.4-1 Environmental Protection Investment for Low-impact and Resilient Road Engineering (7 Roads)

Category	Treatment measures	Quantity	Expenses (RMB '0,000)	Note
I. Environmental protection measures during the construction period			**978**	**/**
1	**Protection measures on water environment**	**/**	**42**	**/**
①	**Sedimentation tank for sand and gravel flushing wastewater**	**6**	**12**	**/**
②	**Construction wastewater oil separator**	**10**	**10**	**/**
③	**Construction camp domestic sewage treatment — septic tank**	**10**	**20**	**/**
2	**Protection measures on atmosphere environment**		**215**	**/**
①	**Construction enclosure**	**/**	**120**	**/**
②	**Wet operation**	**/**	**20**	**/**
③	**Dense screen covering measures**	**/**	**20**	**/**
④	**Vehicle washing platform**	**2**	**5**	**/**
⑤	**Construction road hardening**	**/**	**50**	**/**
3	**Noise control**	**/**	**160**	**/**
①	**Low noise equipment**	**/**	**100**	**/**
②	**Vibration reduction measures**	**/**	**60**	**/**
4	**Solid waste**	**/**	**58**	**/**
①	**Temporary stacking site for construction waste**	**/**	**50**	**/**
②	**Waste bin**	**Several**	**8**	**/**
5	**Protection measures on ecological environment**	**/**	**503**	**/**
①	**Vegetation restoration**	**/**	**300**	**/**
②	**Warning boards for ecological environment protection**	**4**	**3**	**/**
③	**Soil and water conservation**	**/**	**200**	**/**
II. Environmental protection measures during the operation period		**/**	**295**	**/**
1	**Traffic flow monitoring and traffic information monitoring system**	**4 sets**	**200**	**/**

Category	Treatment measures	Quantity	Expenses (RMB '0,000)	Note
2	Sound proof window		30	
3	Landscaping		50	
4	Waste bin	Several	15	/
Total investment in environmental protection			1273	/

Table 7.4-2 Schedule of Environmental Protection Investment Estimation for Parking Lot, Community Park and Sports Park Project (Unit: RMB '0,000)

Category	Treatment measures	Quantity	Expenses (RMB '0,000)	Note
I. Environmental protection measures during the construction period			189	/
1	Protection measures on water environment	/	43	/
①	Sedimentation tank for sand and gravel flushing wastewater	5	15	/
②	Construction wastewater oil separator	5	18	/
③	Construction camp domestic sewage treatment — septic tank	5	10	/
2	Protection measures on atmosphere environment		31	/
①	Construction enclosure	/	20	/
②	Wet operation	/	5	/
③	Dense screen covering measures	/	6	/
⑤	Construction road hardening	/	10	/
3	Noise control	/	23	/
①	Low noise equipment	/	8	/
②	Vibration reduction measures	/	10	/
4	Solid waste	/	12	/
①	Temporary stacking site for construction waste	/	10	/
②	Waste bin	Several	2	/
5	Protection measures on ecological environment	/	81	/
①	Vegetation restoration	/	30	/
②	Warning boards for ecological environment protection	4	1	/
③	Soil and water conservation	/	40	/
II. Environmental protection measures during		/	80	/

Category	Treatment measures	Quantity	Expenses (RMB '0,000)	Note
the operation period				
1	Landscaping		50	
2	Waste bin	Several	30	/
Total investment in environmental protection			269	/

Table 7.4-3 Huangyang River Water Environment Improvement and Ecological Restoration Project，Hanjiang River Riverside Ecological Green Corridor Project (Phase I) and Protection Zone 1 Project of Zhangtan Town Section Protection Engineering (Unit: RMB ’0,000)

Category	Treatment measures	Quantity	Expenses (RMB '0,000)	Note
I. Environmental protection measures during the construction period			317	/
1	Protection measures on water environment	/	49	/
①	Sedimentation tank for sand and gravel flushing wastewater	/	20	/
②	Construction wastewater oil separator	/	18	/
③	Construction camp domestic sewage treatment — septic tank	/	11	/
2	Protection measures on atmosphere environment		36	/
①	Construction enclosure	/	20	/
②	Dense screen covering measures	/	6	/
③	Construction road hardening	/	10	/
3	Noise control	/	18	/
①	Low noise equipment	/	8	/
②	Vibration reduction measures	/	10	/
4	Solid waste	/	12	/
①	Temporary stacking site for construction waste	/	10	/
②	Waste bin	Several	2	/
5	Protection measures on ecological environment	/	202	/
①	Vegetation restoration	/	100	/
②	Warning boards for ecological environment protection	Several	2	/

Category	Treatment measures	Quantity	Expenses (RMB '0,000)	Note
③	**Soil and water conservation**	**/**	**100**	**/**
II. Environmental protection measures during the operation period		**/**	**100**	**/**
1	**Waste bin**	**Several**	**10**	**/**
2	**Environmental monitoring during the operation period**	**/**	30	Water quality monitoring, ecological monitoring
3	**Ecological investigation**		**60**	
Total investment in environmental protection			**417**	**/**

7.5 Document management and reporting mechanism

7.5.1 Recording mechanism

For the effective operation of the environmental management system, the organization must establish a perfect recording system and retain records of the following aspects:

(1) Relevant laws and regulations;

(2) Administrative license issued by the government;

(3) Relevant environmental and social impacts; environmental factors and related EIA documents and EMP reports;

(4) Training records;

(5) Monitoring data;

(6) Problems in environmental management, environmental protection, and social management work;

(7) Mitigation measures and their effectiveness;

(8) Other project-related information;

(9) Review records of project documents.

In addition, the organization must improve the management of the above types of records, including: record identification, collection, cataloging, archiving, storage, management, maintenance, query, retention period, disposal, etc.

7.5.2 Reporting mechanism

The construction unit, monitoring unit and WIZMC shall record the progress of the project, the implementation of environmental management plan, and the results of environmental

monitoring during project implementation and timely report to relevant departments. It mainly includes the following six items:

(1) The monitoring unit shall make a detailed record of the implementation of the environmental management plan on a monthly basis, and the weekly and monthly reports shall include the implementation of environmental protection measures, the development of environmental monitoring, and monitoring data.

(2) The construction unit shall make a detailed record of the progress of the project and the implementation of environmental management plan on a quarterly basis, and submit the report to WIZMC semiannually and send a copy to the local environmental protection bureau at the same time. The requirements shall be clearly stated in the contractor's contract.

(3) The monitoring unit shall promptly submit the monitoring report to the WIZMC after completing the entrusted monitoring task;

(4) In case of an environmental complaint, the WIZMC shall notify the local administrative department of environmental protection, and report it level by level if necessary.

(5) The semi-annual implementation report of environmental management plan of the Project must be completed and submitted to the Bank within the specified time.

The implementation report of environmental management plan may include the following main contents:

1) Implementation situation of the training plan;

2) Progress of the project, such as the specific construction content and the proportion of completed work;

3) Implementation of environmental protection measures, development of environmental monitoring, and main monitoring results of the project;

4) Whether there is a public complaint, if a complaint occurs, record the main content, the solution and public satisfaction of the complaint;

5) Existing problems and solutions;

6) EMP implementation plan of the next year.

Appendix 1 Hanbin District Water Resources Bureau, Ankang City Ecological Environment Bureau Hanbin branch on Zhangtan town Wangwan water plant and water source

关于张滩镇王湾水厂及水源地的情况说明

汉滨区城东新区张滩镇王湾水厂目前主要供给奠安村、双井村、王湾村、立石村、后堰村等四个村庄居民的饮用水，现有两个水源地，分别为王湾 1#水源地和王湾 2#水源地。其中 1#水源地取水口坐标为东经 109.0718° 北纬 32.6906° ，位于张滩镇南侧，黄洋河东侧；2#水源地取水口位于东经 109.0773° 北纬 32.6833° ，张滩镇南侧，黄洋河西侧。两个水源地取用黄洋河河滩浅层地下水，已建傍河水井，水井深度分别为 6 米和 18 米，目前均未划分正式水源保护区和保护范围。城东新区正在筹备新建水厂一座，近期供水规模为 1.0 万 m^3/d，远期规模为 1.8 万 m^3/d，水源为地表水，新建水厂的水源地正在踏勘选址中，后期待城东新区新水厂建设完成后，统一由此新建水厂进行供水，王湾水厂不再使用。

根据《安康城东新区绿色低碳环境可持续发展示范项目可行性研究报告》，黄洋河水环境治理和生态修复项目工程内容包括在黄洋河及王湾水源地周边开展有机农业种植、生态修复、水环境治理及张滩集镇段防护工程的建设等，鉴于该类活动对水环境的影响较小，同意该项目的建设，但是要求工程建设期施工废水及生活废水全部收集不外排，产生的弃土弃渣等及时合理处置，并且采取临时覆盖等措施减少水土流失，以进一步减轻对黄洋河

及王湾水源地水质的影响。

汉滨区水利局

安康市生态环境局汉滨分局

2023 年 11 月 30 日