EIA Report of Shaanxi Zhongsheng SZSHPS-2013-075

Assessment Certificate Category: Grade A

Assessment Certificate No.:3607

Environmental Impact Assessment Report of Shaanxi Small Towns Infrastructure Project with World Bank Loan

(Draft for review)

Entrusted by:	**Foreign Loan Supporting Project Management Office of Shaanxi Province**
Assessed by:	**Shaanxi Zhongsheng Environmental Technologies Development Co., Ltd.**

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Content

0 Foreword

0.1 Project Background

Located in the inland of northwest China, Shaanxi remains an important province in northwest region. It borders on Shanxi and Henan Province in east, Hubei, Sichuan Province and Chongqing in south, Gansu Province and Ningxia Hui Autonomous Region in west and Inner Mongolia in north. Covering an area of 205800 km^2, Shaanxi is comprised of 10 cities, 107 counties (districts) (including 80 counties, 3 country-level city and 24 districts) and 1581 towns.

Fig. 0.1-1 Schematic Diagram of Shaanxi's Geographic Loation in China (in red)

Currently, Shaanxi is at the critical period for fast economic growth and rapid urbanization. In 2012, the growth rate of Shaanxi GDP was 12.9%, ranking the fifth in China, and the per capita GDP increased from 10594 Yuan in 2005 to 38557 Yuan in 2012. The urban and rural resident's annual average income reached 20734 and 5763 Yuan respectively with relative annual average growth rate of 13.6% and 14.6% respectively. 19 of 83 counties（include county-level city） in Shaanxi Province have a population over 100000 persons. 90% of the towns in Shaanxi have a population less than 10000 persons, and the urbanization rate is much lower than the national average level.

The investigation shows that the towns in Shaanxi are characterized by narrow road, broken pavement and lower traffic capacity, and most roads have no supporting rainwater or sewage

pipe network. A great majority of towns lack the sound water supply pipe network, so villagers have to dig well for supplying water generally, and a few towns with water supply pipe network project have problems of narrow coverage, incomplete facilities or ageing facilities without maintenance. The social and economic statistical yearbook 2013 shaanxi province shows that Shaanxi's input in small town infrastructure only accounts for 56% of national average level. Compared with that in central and east region, the small town development of Shaanxi has not been given attention in the process of urbanization. In addition, Shaanxi is insufficient in town infrastructure construction and operation management that is featured by focusing on short-period effect, construction, quantities but ignoring planning, maintenance and quality, and development of small towns needs concept innovation of management.

Shaanxi Province government has proposed to solve the realistic problems of fund shortage for constructing the infrastructure in some small towns with World Bank (WB) loan, and initially proposed the Shaanxi small town infrastructure construction project concept with WB loan at early 2012. The National Development and Reform Commission and Ministry of Finance issued the Notice of Request on Alternative Project Planning in Fiscal Year(FY)2013-2015 with WB Loan on Jul. 25,2012 (see Attachment 1 for details), in which Shaanxi small town infrastructure construction project is included with loan arranged for USD 150 million. In Aug. 2012, the State Council approved the alternative project planning in FY 2013-2015 with WB loan.

WB delegation pre-identified Shaanxi small town infrastructure construction project on Nov. 22~23, 2012, marking WB's official kicking-off of the project preliminary preparatory work.

WB delegation identified Shaanxi small town infrastructure construction project on Apr. 8~12 and May 13-15, 2013. During the visit, the delegation went to the project construction site for field survey. The site of project selected and scheme identification has been completed through the visit, thus the feasibility study may be started. The feasibility study report of Shaanxi small town infrastructure construction project with WB loan (first draft) was prepared by consultant unit in Sep. 2013.

0.2 Assessment Category

(1) National EIA category

According to provisions of the Environmental Impact Assessment Law of the People's Republic of China, the project falls into the category in which the project may cause slight environmental impact, need the EIA report list and the environmental impact generated need to be analyzed or specially assessed. However, according to the provisions of the Environmental Impact Assessment Category Management List for Construction Project, the project shall be prepared with the EIA report. The assessment indicates that the regional project is featured by large quantities and wider area, and subprojects are different in environmental sensitivity. Therefore, the environmental assessment report shall be the EIA report.

(2) WB EIA category

According to the category of WB EIA Guideline (OP4.01), the project falls into the category B in which the negative impact of the project is less than that of Category A, and the impact is limited to the small scope of partial proposed construction site, and most of them can be reversed and can be controlled with measures, and the EIA report and environmental management plan (EMP) are needed.

In conclusion, the finalized EIA report of the project has been submitted to Shaanxi Department of Environmental Protection and WB for review and approval. Meanwhile, the special EMP prepared has been submitted to WB for review and approval.

0.3 Overview of Environmental Assessment

The construction unit (employer) have carried out many rounds of selection and determined to entrust Shaanxi Zhongsheng Environmental Technologies Development Co., Ltd. to implement the EIA of the project on Aug. 28, 2013. On Sep. 6, 2013, PPMO issued the information of the project EIA on its official website for the first time. On Sep. 10, 2013, the assessment unit finished preparation of the outline of the project EIA. On Sep. 2 to Nov. 3, 2013, the assessment unit carried out the field survey and collected the information on current environmental situation of proposed site. Meanwhile, they organized many public consultation meetings with coordination of the county project management office (CPMO). On Nov. 10, 2013, the Environmental Impact Assessment Report of Shaanxi Small Town Infrastructure Construction Project with WB Loan (first draft) was completed. On Nov. 22, 2013, the assessment unit published the second notice for public engagement of the project EIA on Sanqin Daily, and then carried out the public opinion survey in form of random questionnaire at the proposed project site. The report was revised and improved according to the result of public opinion feedback. The Environmental Impact Assessment Report of Shaanxi Small Town Infrastructure Construction Project with WB Loan (draft for review) was finished preparation in Feb. 2014, and submitted to Shaanxi Foreign Fund Utilization Office who has submitted such report to Shaanxi Department of Environmental Protection for review and approval.

0.4 Project Feature

The small town infrastructure construction project with WB loan, as the municipal infrastructure construction project, will be favorable for improvement of regional environmental health and living standard, and have remarkable positive environmental effect. However, due to the scattered proposed construction site of the project, many counties and districts involved, the environmental condition of subprojects varies, so does the environmental sensitivity. Furthermore, the project has a lot of works, including the new municipal road, reconstruction of road with drainage, and construction of the water supply pipe network and it is inevitable to generate some negative environmental impact.

The major environmental impact of the project will occur during construction and include

dust generated as a result of construction, construction equipment and vehicle exhaust, dust on the road and asphalt smoke, and the waste water concrete during mixing of concrete, curing of the structure and pavement and vehicle washing, the noise impact generated by the construction vehicle and equipment, and environmental impact due to excavation, storage and disposal of earthwork and stonework during construction, occupation of land, soil and vegetation damage due to stone and earthwork, and ecological impact such as the water and soil erosion, and social impact of the construction activity on trip and life. The major environmental impact in the operation period mainly includes road traffic noise, vehicle exhaust, dust, rainwater and sewage discharge.

0.5 Major Environmental Problems Concerned in Environmental Assessment

The major concerned environmental problems of the project include the current environmental condition and sensitive target survey in the assessed area, investigation and analysis of relevant works (for example water source, sewage treatment plant and garbage dump), environmental impact and protective measures, analysis of alternatives, public engagement and consultation and EMP.

0.6 Major Conclusion in Report

The small town infrastructure construction project with WB loan will help to develop major towns in Shaanxi, accelerate the process of urbanization, improve the urban and town infrastructure, guarantee urban and town economic development and improve the urban management level. The project area has better environmental quality currently, and its negative impact mainly involves in the water, economical environment and water and soil erosion. In addition, such impact will mainly occur during construction of the project, and has mild magnitude. When the environmental protection measures are taken accordingly, various negative impacts will be mitigated to a certain level. Generally, the project construction is remarkable in environmental, economic and social effect, so is its positive impact. Therefore, construction of the project is feasible from the viewpoint of environmental protection.

0.7 Acknowledgement

It is appreciated that the assessment has been greatly supported by Shaanxi Development and Reform Commission, Shaanxi Department of Environmental Protection, Shaanxi Environmental Engineering Evaluation Center, Xi’an, Xianyang, Tongchuan, Weinan, Baoji, Hanzhong and concerned county or district environmental protection bureau, PPMO (Foreign Loan Supporting Project Management Office of Shaanxi Province) and subproject CPMO, feasibility study preparation company (Shaanxi Engineering Consulting Center and Shaanxi

Qinghua Engineering Consulting Co.,Ltd), WB delegation and relevant companies as well as individuals during preparation of the report.

1 General Provisions

1.1 Basis of Preparation

1.1.1 Authorization of Assessment

(1) Letter of Authorization for Environmental Impact Assessment by Foreign Loan Supporting Project Management Office of Shaanxi Province (see Attachment 2 for details).

1.1.2 Laws and regulations

(1) Environmental Protection Law of the People's Republic of China issued in Dec. 1989

(2) EIA Law of the People's Republic of China issued in Sep. 2003

(3) Water Pollution Control Law of the People's Republic of China amended in Feb. 2008

(4) Atmospheric Pollution Control Law of the People's Republic of China amended in Apr. 2000

(5) Law of Ambient Noise Pollution Control of the People's Republic of China issued in Oct. 1996

(6) Law of Solid Waste Environmental Pollution Control of the People's Republic of China issued in April 2005

(7) Urban and Town Planning Law of the People's Republic of China issued in Jan. 2008

(8) Cultural Relics Preservation Law of the People's Republic of China issued in Oct. 2002

(9) Land Management Law of the People's Republic of China as secondary amendment in Aug. 2004

(10) Water and Soil Conservation Law of the People's Republic of China amended in Mar. 2011

(11) Water Law of the People's Republic of China issued in Oct. 2002

(12) Flood Control Law of the People's Republic of China issued in Jan. 1998

(13) River Management Regulation of the People's Republic of China issued by the State Council in Jun. 1988

(14) Wild Plant Protection Regulation of the People's Republic of China issued by the State Council in Sep. 1996, No. 204 Decree

(15) Environmental Protection Management Regulation for Construction Project issued by State Council in Nov. 1998, No. 253 Decree

(16) Basic Farmland Protection Regulation issued by State Council in Jan. 1999, No. 162 Decree

(17) Regulation for Scenic Spot issued by State Council in Dec. 2006, No. 474 Decree

(18) Land Reclamation Regulation issued by State Council in Nov. 1988, No. 19 Decree

1.1.3 Rules and regulations issued by ministry or commission

(1) Classified Environmental Impact Assessment Management List for Construction Project issued by the Ministry of Environmental Protection in Oct. 2008

(2) Regulation for Control and Management of Pollution in Drinking Water Source Protection Area issued by the Ministry of Environmental Protection ((89) Huan Guan Zi No. 201)

(3) Notice on Strengthening Management of Social and Domestic Noise Pollution issued by the Ministry of Environmental Protection (Huan fa [1999] No. 210)

1.1.4 Local laws and regulations

(1) Procedure by Shaanxi Province for Implementation of Environmental Impact Assessment Law of the People's Republic of China issued in Apr. 2007

(2) Shaanxi Ecological Function Zoning (Shaanxi Zheng Ban Fa [2004] No. 105) issued in Nov. 2004

(3) Shaanxi Water Function Zoning (Shaanxi Zheng Ban Fa [2004] No. 100) issued in Sep. 2004

(4) Environmental Protection Regulation for Shaanxi Urban Drinking Water Source Protection Area issued in Mar. 2002

(5) Shaanxi Energy Conservation Regulation issued in Dec. 2006

(6) Shaanxi Water Conservation Procedure issued in Sep. 2003

(7) Shaanxi Industrial Water Consumption Quota (Shaanxi Zheng Fa [2004] No.18)

(8) Shaanxi Regulation for Protection of Wild Plant issued in Oct. 2010

(9) Shaanxi Regulation for Preservation and Management of Cultural Relics amended in 2004

1.1.5 Normative Documents

(1) National Ecological Environmental Protection Outline issued in Nov. 2000 (State Council Fa [2000] No. 38)

(2) Several Comments on Strengthening Environmental Protection Management of Construction Project during Development of West Region (Huan Fa [2001] No. 4)

(3) State Council's Determination on Implementation of Scientific Outlook on Development and Strengthening Environmental Protection (Guo Fa [2005] No. 39)

(4) Technical Policies on Control Ground Traffic Noise Pollution issued by the Ministry of Environmental Protection (Huan Fa [2010] No.7)

(5) Principle and Technical Method for Ambient Air Quality Function Zoning (HJ14-1996)

(6) Technical Specification for Applicable Urban Environmental Noise Zoning (GB/T 15190-94)

(7) Technical Specification for Water and Soil Conservation of Development Project (GB/T50433-2008)

1.1.6 Technical guideline and specification for EIA

(1) Technical Guideline for EIA-General Principle (HJ2.1-2011)

(2) Technical Guideline for EIA-Atmospheric Environment (HJ2.2-2008)

(3) Technical Guideline for EIA- Ground Water Environment (HJ/T2.3-93)

(4) Technical Guideline for EIA-Acoustic Environment (HJ2.4-2009)

(5) Technical Guideline for EIA-Ecological Impact (HJ19-2011)

(6) Technical Guideline for EIA-Groundwater Environment (HJ610-2011)

(7) Technical Guideline for Environmental Risk Assessment of the Construction Project (HJ/T169-2004)

(8) Tentative Procedure for Public Engagement in Environmental Impact Assessment (Huan Fa [2006] No.28)

1.1.7 WB Safeguard policies

(1) WB Operational Policy/Procedure-Environmental Assessment (OP/BP4.01)

(2) WB Operational Policy/Procedure-Natural Habitat (OP/BP4.04)

(3) WB Operational Policy/Procedure- Pest Management (OP4.09)

(4) WB Operational Policy/Procedure-Minorities (OP4.10)

(5) WB Operational Policy/Procedure-Physical Cultural Resources (OP4.11)

(6) WB Operational Policy/Procedure-involuntary Resettlement (OP/BP4.12)

(7) WB Operational Policy/Procedure-Forestry (OP4.36)

(8) WB Operational Policy/Procedure- Safety of Dam (OP/BP4.37)

(9) WB Operational Policy/Procedure-International Watercourse Project (OP7.50)

(10) WB Operational Policy/Procedure- Project in Disputed Area (OP7.60)

(11) WB Operational Procedure-Information Disclosure (BP 7.15)

1.1.8 Relevant planning

(1) Guanzhong-Tianshui Economic Region Development Planning (2006-2020) issued in Jun. 2009

(2) The 12th Five Year Plan in Development of West Region issued in Feb. 2012

(3) The 12th Five Year Planning Outline for Shaanxi National Economic and Social Development issued in Jan. 2011

(4) Shaanxi 12th Five Year Urbanization Development Planning issued in Sep. 2011

(5) Shaanxi Major Demonstration Town and Famous Touristic Town (Block) Development Planning issued in Jul. 2013

(6) Overall Planning of Xianyang Chunhua County Runzhen Township in 2009-2020

(7) Overall Planning of Xianyang Wugong County Wugong Township in 2009-2020

(8) Overall Planning of Xianyang Xunyi County Seat in 2009-2020

(9) Hanzhong Overall Urban Planning in 2010-2020

(10) Control Detailed Planning for Puzhen Township of Hanzhong

(11) Overall Planning of Weinan Chengcheng County in 2009-2020 issued in Dec. 2012

(12) Control Detailed Planning for Chencang District of Baoji in 2012-2030

(13) Hanyin Country Overall Planning in 2011-2020

(14) Tongchuan Overall Planning in 2008-2025

(15) Tongchuan Yintai Beicheng Overall Planning

1.2 Assessment Purpose

According to the environmental features in the project area and Environmental Impact Assessment Law of the People's Republic of China and Environmental Protection

Management Regulation for Construction Project, and Notice on Strengthening Environmental Impact Assessment Management of Construction Project with International Financial Organization issued by formal national environmental protection bureau (Huan Jian [1993] No. 324) and WB Safeguard Policy –Environmental Protection OP4.01 and national as well as WB's procedures for EIA, the purpose of project assessment includes:

(1) To carry out the detailed investigation for the current environmental situation, sensitive target and engineering content;

(2) To identify the environmental impact that may be caused by the project accurately;

(3) To propose the rational recommendations on adjustment of project from viewpoint of environmental protection and feedback to the employer and designer;

(4) To propose the concrete, operable and effective mitigations on the negative environmental impact to minimize the impact;

(5) To implement the information disclosure and public consultation based on relevant requirement and then feedback to the employer and designer;

(6) To prepare the feasible and operable EMP;

(7) To form the EIA technical document that shall meet the requirement for review and approval by national department and WB.

1.3 Assessment Standard

The EIA standard of the project has referred to the Reply on EIA Standard Applicable to Shaanxi Small Town Infrastructure Construction Project with WB Loan by Xi'an, Xianyang, Baoji, Weinan, Tongchuan, Ankang and Hanzhong Environmental Protection Bureau (see Attachement 3 for details) and detailed standard is as following:

1.3.1 Environmental quality standard

(1) According to the Working Scheme of Thorough Improvement Urban Ambient Air Quality of Shaanxi issued on Jul. 6, 2012 by Shaanxi People's Government, Xi'an, Baoji, Xianyang, Tongchuan and Weinan implement the Ambient Air Quality Standard (GB3095-2012) second grade regarding the subproject area ambient air quality, while Ankang and Hanzhong the Ambient Air Quality Standard (GB3095-1996) and its revision (Huan Fa [2000] No.1) second grade;

(2) Tongchuan will implement the Surface Water Ambient Quality Standard (GB3838-2002) grade I regarding the surface water ambient quality; Xianyang the Surface Water Ambient Quality Standard (GB3838-2002) grade IV, and other cities the Surface Water Ambient Quality Standard (GB3838-2002) grade III.

(3) All cities will implement the Groundwater Quality Standard (GB/T14848-93) grade III regarding the groundwater ambient quality.

(4) The urban traffic trunk road and the road within 35m of municipal road boundary line will implement the Acoustic Environmental Quality Standard (GB3096-2008) grade 4a for category 4 area. The urban traffic trunk road and the road outside 35m of municipal road boundary line, and the special sensitive buildings in schools, kindergarten and hospital in the rural area residence environment and assessment scope will implement the Acoustic Environmental Quality Standard (GB3096-2008) category II.

The environmental quality standard for environmental factors is seen in Table 1.3-1.

Table 1.3-1 List of Environmental Quality Assessment Standard

No	Category	Item	Standard Value					Assessment Standard
1	Atmospheric environment	——	——	——	GB3095-1996		GB3095-2012	1. Xi'an, Xianyang, Weinan, Ankang and Hanzhong will implement the Standard (GB3095-1996)and grade II standard (Huan Fa [2000] No.1) 2. Baoji and Tongchuan will implement standard （GB3095-2012）for grade II.
		SO_2	Annual mean	mg/m3	0.06		0.06	
			Daily mean	mg/m3	0.15		0.15	
			Mean per hour	mg/m3	0.50		0.50	
		NO_2	Annual mean	mg/m3	0.08		0.04	
			Daily mean	mg/m3	0.12		0.08	
			Mean per hour	mg/m3	0.24		0.20	
		PM_{10}	Annual mean	mg/m3	0.10		0.07	
			Daily mean	mg/m3	0.15		0.15	
2	Surface water	——	——	——	Category Ⅰ	Category Ⅲ	Category Ⅳ	Tongchuan will implement standard （GB3838 -2002）grade I; and Xianyang Weihe river basin the Grade IV, others the Grade III.
		pH	Concentration limit	/	6~9	6~9	6~9	
		CODcr	Concentration limit	mg/L	≤ 15	≤ 20	≤ 30	
		Ammonia nitrogen	Concentration limit	mg/L	≤ 0.15	≤ 1.0	≤ 1.5	
3	Groundwater	Permanganate Index	Concentration limit	mg/L	≤ 3.0			（GB/T14848-93）Grade III
		Ammonia nitrogen	Concentration limit	mg/L	≤ 0.2			
		Total coliform group	Concentration limit	PCS/L	≤ 3.0			
4	Acoustic environment	L_{Aeq}	Day	dB(A)	60			（GB3096-2008）Grade II
			Night	dB(A)	50			
			Day	dB(A)	70			（GB3096-2008）Grade 4a
			Night	dB(A)	55			

1.3.2 Pollutant discharge standard

(1) All cities will implement the Integrated Emission Standard for Air Pollutant (GB16297-1996) grade II regarding the air pollutant emission.

(2) The water pollutant discharge standard is seen in Table 1.3-2

Table 1.3-2 Environmental Quality Assessment Standard List

Subproject Area	Construction Period	Operation Period	
		Area within Sewage Treatment Plant Receiving Area	Area beyond Sewage Treatment Plant Receiving Area
Baoji	——	The Yellow River Basin Integrated Sewage Discharge Standard (Shaanxi Section) (DB61-224-2011) grade II, and Integrated Sewage Discharge Standard) (GB8978-1996) grade III.	The Yellow River Basin Integrated Sewage Discharge Standard (Shaanxi Section) (DB61-224-2011) grade I, and Integrated Sewage Discharge Standard) (GB8978-1996) grade I.
Xianyang	All will be reused instead of discharging	The Yellow River Basin Integrated Sewage Discharge Standard (Shaanxi Section) (DB61-224-2011) grade I and Integrated Sewage Discharge Standard) (GB8978-1996) grade I.	——
Tongchuan	——	Zero discharge	Zero discharge
Weinan, Ankang and Hanzhong	——	The sewage collected in the sewage pipe network shall be treated in the sewage treatment facilities and then discharge. It is not allowed to discharge the sewage directly to the surface water body. The discharge standard of the sewage treatment facilities employed shall comply with the Standard for Discharge of Urban Sewage Treatment Plant Pollutant and the requirement for receiving sewage by the receiving water body.	——

(3) The construction noise shall comply with the Construction Site Boundary Ambient Noise Emission Standard (GB12523-2011);

(4) The general solid waste shall comply with the Standard for Storing Common Industrial Solid Waste and Control of Disposal Polluted Site (GB18599-2001). The domestic garbage shall comply with the Procedure for Management of Urban Domestic Garbage (No. 157 Decree) by the Ministry of Urban-Town Housing and Construction and Technical Specification for Operation and Maintenance of Domestic Garbage Transfer Station (CJJ109-2006).

Detailed indicators are seen in Table 1.3-3.

Table 1.3-3 Exhaust Gas, Waste Water and Noise Emission Standard

No.	Category	Source of Pollution	Pollution Factor	Standard Value	Assessment Standard
1	Exhaust gas	Dust	Particulate	The concentration difference in the non-organized	（GB16297-1996）

			Matter	discharge monitoring point and reference point shall be lower than 5.0 mg/m^3.				Primary Standard
2	Noise	Equipment and plant	Plant boundary noise	Day		70dB(A)		（GB12523-2011)standard
				Night		55dB(A)		
3	Waste water	Domestic sewage	——	——	——	Grade I A	Grade I B	（GB18920-2002)standard
			COD	Concentration limit	mg/L	≤50	≤60	
			Ammonia nitrogen	Concentration limit	mg/L	≤5	≤8	
			pH	Concentration limit	None	6.0～9.0		
			——	——	——	Grade I	Grade II	（DB61/224-2011)standard
			COD	Concentration limit	mg/L	50	300	
			Ammonia nitrogen	Concentration limit	mg/L	12	25	
			pH	Concentration limit	None	6.0～9.0		
			——	——	——	Grade I	Grade II	（GB8978-1996)standard
			COD	Concentration limit	mg/L	60	300	
			Ammonia nitrogen	Concentration limit	mg/L	15	25	
			pH	Concentration limit	None	6.0～9.0		

1.3.3 Others

The assessment standard for other factors shall comply with national relevant specifications.

1.4 Assessment Period

(1) Current situation assessment level year

The current situation assessment level year is from 2010 to 2013 during which the historical material and recent surveyed information shall be utilized.

(2) Forecast evaluation level year

Construction period: from 2013 to 2015. Operation period: after completion of the project.

1.5 Environmental Impact Identification and Selection of Assessment Factor

1.5.1 Environmental impact identification

The environmental impact shall be identified in construction period and operation period respectively based on the project composition and analysis of project area environmental feature, requirement for relevant technical guidelines for environmental impact assessment and WB's safeguard policies.

1.5.1.1 Identification of environmental impact factor

The engineering environmental impact factor shall be identified according to the environmental impact activity in project construction period and operation period and the proposed site environmental feature, and the identification results are seen in Table 1.5-1.

Table 1.5-1 Environmental Impact Factor Identification Sheet

Period	Activity	Environmental Factor									
		Air	Surface Water	Groundwater	Acoustic Environment	Solid Waste	Ecology	Society	Population Health	Cultural Relics	Others
Construction period	Land occupied temporarily due to construction						√				
	Site clearing	√			√	√	√	√			
	Demolition and resettlement	√				√		√			
	Ground excavation	√			√	√	√				
	Transport and storage of material	√			√						
	Construction of structures	√			√	√					
	Construction of installation works				√	√					

	Construction workers' activity						√		√		
Operation Period	Land occupied by engineering permanently						√	√			
	Water in taking of the project		√								
	Waste water discharge		√						√		
	Exhaust gas emission								√		
	Noise				√				√		
	Solid waste discharge					√			√		
	Impact on landscape						√				
	Absorption of labor for employment							√			
	Improvement of social service facilities							√			

It is seen from Table 1.5-1 that major environmental impact factor during construction includes air, noise, solid waste and ecological impact and that during operation includes surface water, groundwater, acoustic environment, solid waste and ecological environment.

1.5.1.2 Identification of environmental impact result

The construction project environmental impact result shall be identified according to the feature of construction project and the engineering impact environmental factor property identification table, and the results are seen in Table 1.5-2.

Table 1.5-2 Construction Project Environmental Impact Result Identification Sheet

Impact Result / Environmental Element		Nature of Impact					Magnitude of Impact			Scope of Impact	
		Short period	Long period	Reversible	Positive	Negative	Serious	Mild	Minor	Local	Regional
Construction period	Air	●				●		●		●	
	Surface Water	●				●		●		●	

	Groundwater										
	Acoustic Environment	●				●		●		●	
	Solid Waste	●				●		●		●	
	Ecology			●		●		●		●	
	Society	●			●	●		●			●
	Population health	●				●			●		●
	Cultural relics										
	Other										
Operation period	Air										
	Surface Water		●			●		●			●
	Groundwater		●			●			●	●	
	Acoustic Environment		●			●		●		●	
	Solid Waste		●			●		●		●	
	Ecology				●	●			●	●	
	Society				●	●		●			●
	Population health		●		●			●		●	
	Cultural relics										
	Others										

Table 1.5-2 shows that impact results of all environmental factors for the construction project are different.

For construction period, the impact on air, surface water, groundwater, acoustic environment and solid waste is negative in short period with minor magnitude and its scope is limited in local area, and such impact will diminish after completion of construction activity. While its ecological impact is negative and can be reversible, it is the local impact. As for the social impact, on the one hand demolition activity causes certain resettlement works with negative social impact, on the other hand, the project will absorb a certain number of labors, and it is positive for regional social economy. Therefore, the social impact result has two sides with mild magnitude of impact. The scope of impact exceeds assessment area to be the regional impact. As for the population health, construction workers' stay at site will cause the negative impact.

For operation period, all factors have long period impact. In addition to the ecological and social impact that has two sides, the population health is positive, others are negative with mild magnitude of impact. In addition to acoustic environment, groundwater and solid waste impact that is local, other impact on surface water and society shows regional characteristic.

1.5.2 Selection of assessment factor

The assessment factor selection result of the project is seen in Table 1.5-3.

Table 1.5-3 Summary of Assessment Factor Selection Result

Environmental Element	Current Situation Assessment Factor	Impact Assessment Factor	
		Construction period	Operation period
Air	SO_2, NO_2 and PM_{10}	Construction dust and vehicle exhaust	Vehicle exhaust and dust during transport
Surface Water	pH, COD and Ammonia nitrogen	SS, Petroleum, COD and Ammonia nitrogen	COD, BOD_5 and Ammonia nitrogen
Groundwater	Permanganate Index, Ammonia nitrogen and total coliform group	--	--
Acoustic Environment	Equivalent A sound level （L_{Aeq}）	Equivalent A sound level（L_{Aeq}）	Equivalent A sound level（L_{Aeq}）
Solid waste	---	Disposal of construction and domestic garbage	Method for disposal of solid waste
Ecology	Type of vegetation, land utilization, soil erosion, type of plant and sample investigation	Damage of vegetation and water and soil erosion	Damage of vegetation and water and soil erosion impact, ecological stability impact, landscape environmental impact and impact on land utilization
Cultural relics	Scope of protection and construction of control zone	Scope of protection and construction of control zone	Scope of protection and construction of control zone

1.6 Assessment Content and Emphasis

1.6.1 Assessment content

According to the WB EIA requirement, national relevant EIA guideline and specification, assessment of the project includes project overview and analysis, investigation of current environmental situation, verification of EIA and environmental protection measures, analysis of environmental risk and social impact as well as alternative, public engagement and information disclosure. In addition, WB safeguard policies have been analyzed and EMP p has been prepared.

1.6.2 Assessment emphasis

After preliminary analysis of the project environmental impact, the project EIA emphasis can be obtained according to the environmental assessment factor, and details are as follows:

(1) Investigation of current environmental situation: due diligence shall be carried out for current environmental situation, sensitive target, existing facility and content;

(2) Analysis of project engineering: analysis for construction period, operation period source of pollution and construction rationality shall be carried out. The road network correlation shall be noted for the road works;

(3) Environmental impact analysis: ① Analysis for positive effect generated in works shall be carried out, for example, the positive effect convenience on life due to water supply and drainage works and increase of beneficiary population, improvement of sewage treatment reliability rate, improvement of trip thanks to the road works and saving of trip time. ② Environmental impact analysis on ecological environment, water environment, acoustic environment and solid waste as well as resettlement shall be implemented. Special analysis shall be carried out for the accumulative impact on the environment.

(4) Pollution control measures: The feasibility for the protective and restoration measures against environmental impact generated during construction and operation shall be verified;

(5) Public engagement and information disclosure: public engagement such as organize to hold the meeting, disclose information and public investigation

(6) EMP: prepare the feasible operable EMP.

1.7 Grade and Scope of Assessment

The project Assessment grade has been determined through integrated analysis according to provisions in national technical guidelines of EIA on surface water environment, acoustic environment, ambient environment and ecological impact.

(1) Surface water Assessment grade

For the project is the municipal infrastructure project, the project itself will not produce the waste water or sewage. However, considering that construction of the infrastructure will improve the existing water supply condition and collection rate of sewage, the assessment is mainly to analysis the feasibility of sewage treatment facility to be employed. According to the Technical Guidelines of EIA-surface water environment (HJ/T2.3-93), the surface water Assessment grade of the project is determined as grade III.

s (2) Acoustic environment Assessment grade

The acoustic environmental function zone of the project falls into category 2, 3 and 4 zone in the Acoustic Environment Quality Standard (GB3096-2008). The road works for town project mainly includes improvement, widening of the existing urban road and town road pavement, improvement of road lamp and pipe network facility, thus the traffic volume before and after construction of the project changes little and has slight acoustic environment quality impact for the sensitive object in the scope of assessment, and the noise increase at the sensitive point will not exceed 5dB (A). According to the Technical Guidelines of EIA- Acoustic Environment (HJ2.4-2009), the acoustic environment Assessment grade is determined as grade II.

(3) Air Assessment grade

The air impact in construction period is mainly the dust generated by construction and transport vehicles, and has temporary and local feature, and that in operation period mainly includes the exhaust emitted by road transport vehicles. Assessment is only made for brief analysis of the air environment.

(4) Ecological Assessment grade

For the proposed project site is mainly located in the urban and suburbs where it is the urban and suburb agricultural ecological environment and falls into the general area. The road works for town project mainly includes improvement, widening of the existing urban road and town road pavement, improvement of road lamp and pipe network facility, so the project will occupy less than 2km2 of the land. According to the Technical Guidelines of EIA- Ecological Environment (HJ19-2011), the ecological Assessment grade of the project is determined as grade III.

The assessment scope of all elements will be determined according to the technical guideline for EIA for assessment scope of elements, and details are seen in Table 1.7-3.

Table 1.7-3 List of Assessment Scope

Environmental Element	Assessment grade	Scope of Assessment
Surface Water	Grade III	0.5km from upstream and 3km away from downstream of the proposed receiving water body site
Acoustic Environment	Grade II	Within 200m from the proposed site boundary and 200m from both sides of road works
Air	Brief analysis	——
Ecological environment	Grade III	Within 500m from neighboring proposed site

1.8 Environmental Protection Target

1.8.1 Prevention and protection target

(1) To ptimize construction arrangement, control land occupation by construction, optimize construction process, minimize the negative impact of engineering activity on local residents' trip, residential environment and people's health, and protect the environmental quality in the project area and its surrounding area.

(2) To strengthen balanced use of stone and earth, minimize excavation and piling up of stone and earth, select the slag dump and stock yard properly, optimize construction scheme

and minimize impact of project construction on neighboring sensitive target.

1.8.2 Restore control target

To emphasize protection of slope formed due to road engineering excavation and borrow and spoil ground, protect the water and soil resources with engineering and plant measures such as centralized shoring slag and plantation of grass; prevent and control the water and soil erosion and landscape damage as a result of project construction, and meet the regional ecological environmental protection requirement. In addition, the feasible compensation and restoration measures will be taken for the forestry land and farmland that are occupied and damaged by project construction.

1.8.3 Sensitive protection target

1.8.3.1 Water environment sensitive target

The water environmental sensitive protection target involved in the project includes Shichuanhe River, Weihe River, Qishuihe River in Wugong County, Sanshuihe River, Dayuhe River, Qishuihe River in Tongchuan, Hanjiang River and Yuehe River, and details are seen in Table 3.6-1.

According to the letter of environmental protection bureau on implementation of EIA standard, all water environmental sensitive protection targets shall comply with the corresponding standard in Table 1.3-1.

1.8.3.2 Ambient air and acoustic environment sensitive target

The ambient air and acoustic environment sensitive protection target of Shaanxi small town infrastructure construction project with WB loan includes schools and villages that will be impacted by the project, and details are seen in Table 3.6-2.

According to the letter of environmental protection bureau on implementation of EIA standard, the ambient air sensitive protection targets shall comply with the corresponding standard in Table 1.3-1.

1.8.3.3 Ecological environment sensitive target

The ecological environmental protection target in the project area mainly includes agricultural ecological system.

1.8.3.4 Social environment sensitive target

The social environment sensitive target related to Shaanxi small town infrastructure construction project includes the residential areal and cultural relics preservation unit that will be impacted by the project and details are seen in Table 3.6-3.

1.9 Assessment Procedure and Method

1.9.1 Assessment procedure

According to the Environmental Protection Management Regulation for Construction Project, Technical Guideline for EIA, WB's safeguard policies and requirement for EIA of category B project, the project EIA is comprised of preparation of guideline, environmental impact forecast assessment and preparation of report stages, and major assignments in each stage are as follows:

(1) Preparation of guideline

On the basis of preliminary survey of current environmental situation of the project area, national and local relevant laws and regulations and technical standard and WB's requirement for EIA of the project with loan, the EIA work plan, work content and method of the project will be worked out, the suitable similar project will be selected, the major assessment parameter and focus will be initially determined, the grade of each single EIA work will be determined, and work content of items to be assessed will be worked out. In addition, the public consultation and information disclosure will be carried out according to the Tentative Procedure for Public Engagement in Environmental Impact Assessment, and the EIA outline will be prepared.

(2) Environmental impact forecast assessment

Further analysis of the project will be implemented by combining the project feasibility design result to determine the major environmental impact and corresponding assessment factor. In addition, the detailed status survey and monitoring will be carried out for the water environment, ambient air and acoustic environment within scope of EIA of the project. The project related county and town social environment current situation will be collected and surveyed. On the basis of these work, the project area current situation assessment of environment and environmental impact forecast assessment will be carried out. In addition, the public engagement work will be carried out according to the Tentative Procedure for Public Engagement in Environmental Impact Assessment.

(3) Preparation of report

The environmental project countermeasure and monitoring plan will be prepared accordingly on the basis of work in phase 1 and 2, and then the environmental protection investment estimate and economic & technical verification will be carried out, finally, the environmental report will be prepared.

The project EIA procedure block chart is seen in Fig. 1.9-1

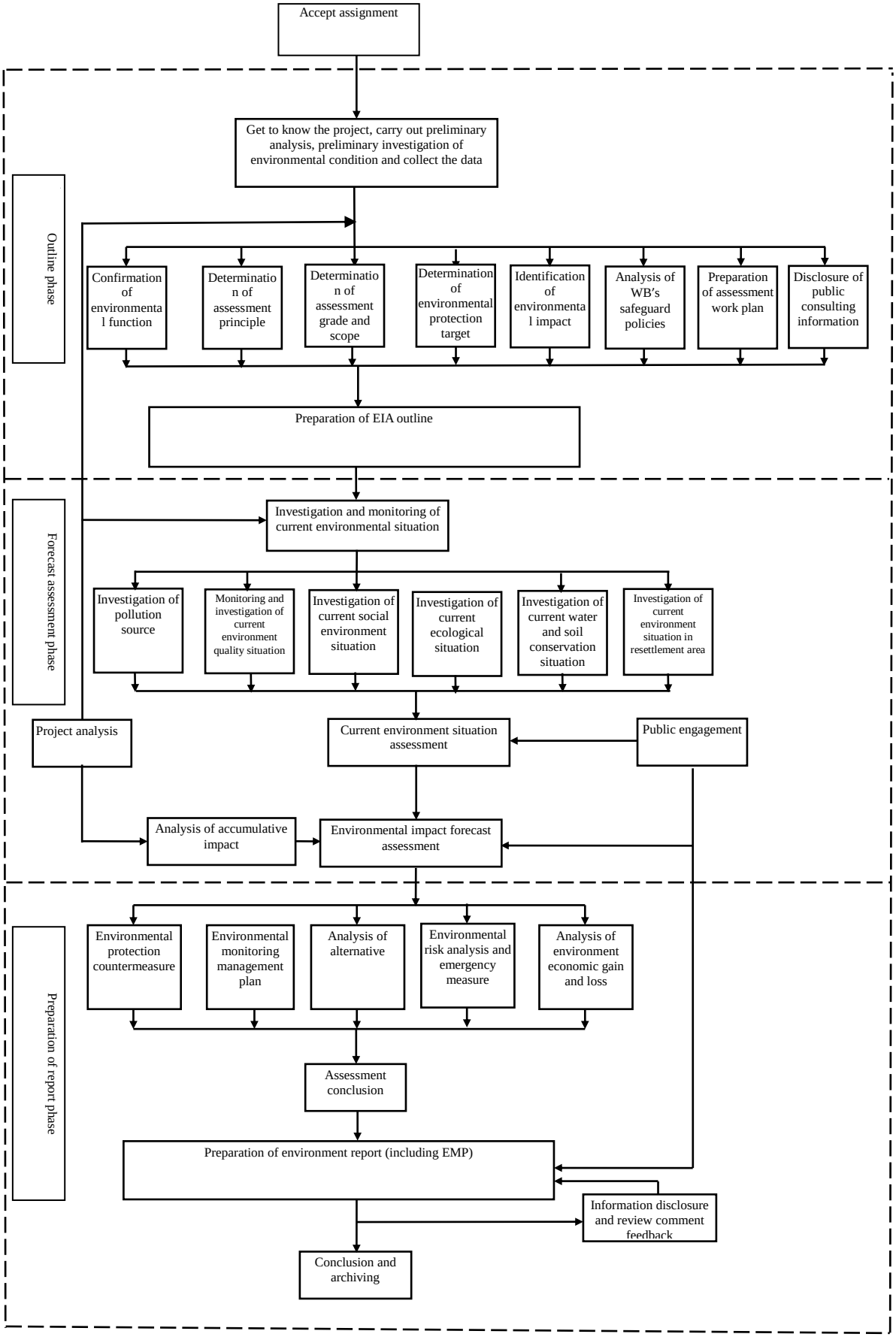


Fig. 1.9-1 Project Environmental Assessment Procedure Schematic Diagram

1.9.2 Assessment method

(1) EIA and REA will be adopted to analyze the environmental impact of subprojects on the basis of preliminary investigation of current environmental situation in the project site;

(2) The WB's safeguard policies applicable to the project will be selected carefully during EIA, and the applicable safeguard policies will be assessed to propose the preventive and mitigation management countermeasures accordingly;

(3) The collection and analysis of relevant base data shall be strengthened, and investigation and assessment of current environmental situation in the project area shall be implemented in an objective and scientific way;

(4) The important and common environmental problems will be selected and identified according to the project and environment feature, and the significant environmental problem and sensitive protection object will be analyzed;

(5) The analog analysis and typical engineering analysis will be adopted to assess the positive and negative, direct and indirect impact of the project on the environment. The pertinent mitigation measures will be proposed for the negative environmental impact caused in the project, and operability of EMP will be highlighted;

(6) The alternatives will be analyzed with respect to zero scheme analysis, comparative selection of different project sites and technical proposal. At the coordination of employer and through communication between the environmental assessment unit and project designer, the project's positive environmental impact should be promoted as much as possible, and the negative one should be prevented;

(7) Public engagement will be carried out according to the Tentative Procedure for Public Engagement in Environmental Impact Assessment. In accordance with the project feature, the initial public engagement shall be conducted in a way the announcement is posted in the subproject area and the seminar will be held. The later public engagement will be conducted when the first draft of EIA report is completed in a way of issuing the public questionnaire and expert consultation in order to investigate the opinion of the project affected general public, management and other organization. Information disclosure will be conducted via posting the announcement, publishing on the newspaper and on the website;

(8) Conclusion shall be made for the feasibility of project from the viewpoint of environmental protection so as to provide the scientific basis for project design and environmental protection management;

(9) Comments and recommendations from project identification mission, preparation mission and WB internal safeguard meeting on the EIA shall be considered during assessment. The problem and suggestion proposed by WB expert on the EIA report shall be analyzed and replied.

1.10 EIA team

EIA consulting organization is Shaanxi Zhongsheng Environmental Technologies Development Co., Ltd. The profile of Zhongsheng is as follows: Shaanxi Zhongsheng Environmental Technologies Development Co., Ltd is affiliated to Shaanxi Department of Environmental Protection with its predecessor of Shaanxi Environmental Sciences Research Institute. The company is the first one that responded the reform requirement of environmental assessment organization of the Ministry of Environmental Protection. The company became the limited company. As the environmental assessment organization with

Grade A qualification approved by the Ministry of Environmental Protection, the company has six grade A qualifications involving in chemical, petrochemical, pharmaceutical, light and textile industry, chemical fiber, transportation, social, metallurgical, electrometrical and extracting fields, and two grade B qualifications involving in agriculture, forest, water conservation, power transmission and transformation, radio, television and communications, becoming one of the most powerful organizations with completed qualification in Shaanxi as well as northwest China.

The company has been engaged in environmental assessment for more than 3 decades with profound experience, and has carried out the EIA in the projects such as Shaanxi Urban and Town Water Supply Project with Loan from Japanese Government, Shaanxi Rural Safe Drinking Water and Health Promotion with WB Loan, Shaanxi Forestry Ecological Development Project with ADB Loan and Shell Changbei Gas Field Environmental Health and Social Assessment. The EIA team staffing of company is seen in Table 1.10-1.

Table 1.10-1 List of EIA Team

No.	Name	Title	Major	Responsibility	Remarks
1	Zhao Yi	Senior engineer EIA engineer	Water supply and drainage	Project review	Deputy chief engineer of company mainly in charge of EIA technical review
2	Xu Penghai	EIA engineer	Environment ecology	Project principal	He has been responsible for Shaanxi Rural Safe Drinking Water and Health Promotion with WB Loan, Shaanxi Forestry Ecological Development Project with ADB Loan
3	Wang Linyin		Environment engineering	Major participant	Specialized in sewage treatment
4	Jia Jia		Environment engineering	Major participant	Specialized in transport facility planning
5	Liu Liang		Environment engineering	Major participant	He has participated in EIA for refuse landfill for several times
6	Xu Feng	Assistant engineer	Environment engineering	Major participant	Specialized in traffic impact assessment
7	Ding Taohui	Assistant engineer	Environment engineering	Major participant	
8	Wang Jing	Assistant engineer	Machinery manufacturing	Participant	
9	Jia Fei	Assistant engineer	Sociology	Participant	

2 Project Overview and Engineering Analysis

2.1 Project Overview

2.1.1 Project construction background

(1) Background for approval of the project

Located in the landlocked area of northwest China, Shaanxi remains an important province in northwest region. It borders on Shanxi and Henan Province in east, Hubei, Sichuan Province and Chongqing in south, Gansu Province and Ningxia Hui Autonomous Region in west and Inner Mongolia in north. Covering an area of 205800 km^2, Shaanxi is comprised of 10 cities, 107 counties (districts) (including 80 counties, 3 country-level city and 24 districts) and 1581 towns.

Currently, Shaanxi is at the critical period for fast economic growth and rapid urbanization. In 2012, the growth rate of Shaanxi GDP was 12.9%, ranking the fifth in China, and per capita GDP increased from 10594 Yuan in 2005 to 38557 Yuan in 2012. The urban and rural resident's annual average income reached 20734 and 5763 Yuan respectively with relative annual average growth rate of 13.6% and 14.6% respectively. 19 of 83 counties（include county-level city） in Shaanxi Province have a population over 100000 persons. 90% of the towns in Shaanxi have a population less than 10000 persons. Shaanxi urbanization level statistical analysis is seen in Table 2.1-1.

Table 2.1-1 Comparison between Shaanxi and Other Cities on Facility Level

Name	Per Capita Daily Domestic Water Consumption (L)	Water Supply Popularizing Rate （%）	Gas Popularizing Rate（%）	Per Capita Urban Road Area（m^2）	Drainage Pipe Density in Completed Area（km/km^2）	Greening Coverage in Completed Area（%）
The whole country	204.1	91.09	82.08	10.92	7.41	33%
Shaanxi	145.1	93.24	79.82	8.19	5.79	30.2%

The investigation shows that the towns in Shaanxi are characterized by narrow road, broken pavement and lower traffic capacity, and most roads have no supporting rainwater and sewage pipe network. A great majority of towns lack the sound water supply pipeline network, so the villagers have to dig well for water supply generally, and a few towns with water supply pipe network project have problems of narrow coverage, unsound facilities or ageing facilities without maintenance. Relevant statistical data shows that Shaanxi's input in small town infrastructure only accounts for 56% of national average level. Compared with that in central and east region, the small town development of Shaanxi has not been given attention in the process of urbanization. In addition, Shaanxi is insufficient in town infrastructure construction and operation management that is featured by focusing on short-period effect, construction, quantities but ignoring planning, maintenance and quality, and development of small towns needs concept innovation of management.

Therefore, implementation of the project can fill the blank of urban infrastructure and solve the most outstanding prominent problem during urban development. It is greatly remarkable for improvement of urban infrastructure development and urban environment, creation of

better living environment and improvement of living standard.

According to the actual situation of Shaanxi Province, national relevant department and WB requirements, Shaanxi proposed the Shaanxi small town infrastructure construction project concept with WB loan in Nov. 2012, and listed it in FY 2013-2015 alternative planning project. The project proposal was completed preparation in Apr. 2013 and has been reviewed and confirmed by WB. The small town infrastructure construction project in 9 counties of 7 cities in Shaanxi went to next stage. At the end of 2013 the feasibility study report of the project has been completed.

(2) Planning background

Under the strategic background of development of west region, two major regions have been gradually formed in west region, namely Chengdu-Chongqing Economic Belt and Guanzhong-Tianshui Economic Zone. Priority to development of both regional economies is an important task in the west region development strategy. Development of both regions not only boosts economic development of neighboring province, but also leads to economic development of other western provinces. The state council approved and initiated the Guanzhong-Tianshui Economic Zone Development Planning in 2009 for the purpose of promoting Guanzhong-Tianshui region economic growth, urbanization (at 60% in 2020), integration between urban and rural area and boost northwestern regional economic development.

Guanzhong-Tianshui Economic Zone includes Xi'an, Tongchuan, Baoji, Xianyang, Weinan, Yangling, Shangluo (some counties) and Tianshui of Gansu province, covering an area of 79800 km^2 and having population of 28420000 persons. The directly affected region includes Hanzhong and Ankang in southern Shaanxi, Yan'an in northern Shaanxi, Qingyang and southern Gansu. Located in Eurasian continent centre, the economic zone is geographically important for it connects east and west, south and north, becoming the area in west China with better economic foundation, excellent natural condition, profound culture and history and huge development potential.

Shaanxi 12th Five-year Plan specifies the target of developing urban infrastructure and increasing basic service (the urbanization rate is expected to be 57% in 2017) to absorb the rural surplus labors and form the competitive industrial group. Considering the financial and reliable investment, Shaanxi province proposed to give priority to develop 107 key towns with better geological location and potential or the county seat. Development of these towns will not only bring about the economic benefit but also boost neighboring towns and other towns for common development.

To further implement the Guanzhong-Tianshui Economic Zone Development Planning approved by the state council and promote urbanization and integration between urban and rural areas in Shaanxi, and explore the new urbanized pattern that is suitable for our national situation, Shaanxi will take opportunity of WB loan to develop the small town infrastructure project. Through development of demonstration project, the urban infrastructure will be improved to foster the new growth area in economy, optimize the scientific urban planning and arrangement and transfer rural surplus labors in a larger scale. In addition, such move will improve all provincial infrastructure development level and play an important role for boosting urban industrial development, further giving play to Guanzhong-Tianshui economic zone city and town system and integrating the rural and urban development in the economic zone.

It is proposed in the concept of relevant city and town system in the Guanzhong-Tianshui Economic Zone Development Planning that the system is comprised of the key city,

secondary key city, tertiary city, major town and ordinary town. The future urbanization will transfer from the single metropolis scale to better city group and development of medium and small city. Therefore, the project is mainly to promote urbanization of the tertiary and quaternary towns. Implementation of the project will further strengthen infrastructure development, build the convenient urban-rural sharing infrastructure network with proper arrangement and advanced facility, and lay the solid foundation for strengthening the internal economic link in Guanzhong-Tianshui Economic Zone and opening wider to internal and outside world.

The strategic goal proposed in urban development guideline and strategy of Shaanxi Urban System Planning is as follows: the urban infrastructure level is expected to be improved at end of planning, the urban economy is further developed, the urban residents' living standard is improved remarkably and the urban management system that is adaptable to market-oriented economy will be determined basically. Implementation of the project will further improve the infrastructure, residents' living environment quality and promote Shaanxi urban development efficiently.

It is pointed in Shaanxi General Touristic Town Tourism Development Plan in 2011-2020 that a series of famous touristic town with unique theme, convenient traffic condition, supported service, beautiful environment, attractive and popularity that integrates leisure sightseeing, vacation and cultural experience will be built in Shaanxi through promotion of developing the touristic town so as to better protect, explore and utilize Shaanxi unique national culture, local historical culture and beautiful environment, finally, Shaanxi will be developed into a domestic and international influential tourist destination that integrates harmonious development between tourism and town development. The Chenlu Ancient Town in Yintai District and Wugong Town in Wugong County in the project have been proclaimed as famous historical and cultural town and implementation of the project will further accelerate development of famous touristic and cultural town.

2.1.2 Necessity of project construction

(1) Be beneficial to development of Guanzhong-Tianshui Economic Zone and establishment of Shaanxi urban system

For the project is located in Guanzhong-Tianshui Economic Zone, it is aimed to accelerate economic development and realize the economic zone development goal by combining the 12th Five Year Plan that is under implementation. It is pointed in Shaanxi Urban System Planning that coordinated urban and regional development of Shaanxi needs stable acceleration of urbanization, promotion of rational utilization and protection of provincial spatial resources, and achieve sustainable development in urban population, economy, resource and environment. It is needed to improve and upgrade the traditional industry, improve infrastructure and ecological environment development, promote urbanization of the whole province, and build Shaanxi into the economic powerful province, and reach the domestic development level social and economic development goal in 15 years. To accelerate accomplishment of the planning goal, Shaanxi will actively take the opportunity of WB investment to implement the small town infrastructure construction project, and learn the advanced concept from the similar project implemented by WB and implement the planning during promoting Shaanxi urban system development. The project is implement small town infrastructure construction with WB fund and advanced concept, and plays a demonstrative and promotion role in enhancing the economic strength in the economic zone, accelerating integration between urban and rural area and building the urban system in the economic zone.

(2) Be beneficial to acceleration of major town development and urbanization of Shaanxi

According to the standard proposed in Outline of Shaanxi's Acceleration of County Region Urbanization, Shaanxi has determined 107 major towns with better basic condition and huge development potential. In Mar. 2011, Shaanxi initiated development of 31 major demonstration towns, a significant breakthrough made in Shaanxi for accelerating integration between urban and rural area and boosting new urbanized development. According to the requirement of relevant centralized residence of rural people, relative sound of facilities and urban-rural public service, Shaanxi has worked out the Standard for Shaanxi Major Town Development (tentative) and has specified the concrete index for development of major town municipal infrastructure, public service facility, housing and new district.

Development of major towns accelerates Shaanxi's urbanization effectively. The urbanization rate of Shaanxi reached 50.02% in 2012, the pyramid urban system has been formed, which consists of Guanzhong urban cluster with Xi'an-Xianyang integration as center, 3 metropolis, 6 medium cities, 34 small cities and 837 towns.

(3) Be beneficial to improvement of urban infrastructure and assurance of urban economic development

Compared with national average level, Shaanxi lags behind in urban infrastructure. The share of investment of per capita municipal public facility is 10% lower than national average level, and the per capita municipal public facility input in the organic town only accounts for 56.16% of national level. Thus, implementation of the project is to fill the blank of urban infrastructure development, solve the most prominent problem in urban development and will be of great significance for improving urban infrastructure development. The project after implementation will improve the urban environment, create better living environment and quality and lay the solid foundation for fostering long-term competitiveness of the city.

(4) Be beneficial to improvement of urban management level

Recently, it is a very critical problem that how to manage the city properly, to further promote urban management level and city quality and increase urban competitiveness under the new situation with acceleration of urban development. The domestic and international advanced model and WB's advanced experience for urban management will be drawn from planning, construction to operation of the project, three stages will be coordinated for mutual development so as to achieve the circulating urban management integrating planning, construction and operation. Meanwhile, the policy and law system for urban planning, construction and management will be further improved to give full play to government's function and improve government's capability for urban management.

2.1.3 Analysis of compliance among proposed project and relevant policies and regional planning

2.1.3.1 Analysis of compliance between proposed project and national industrial policy

Consisting of construction of urban municipal road works and water supply and drainage pipe network, the project is the urban public transport, town water supply and drainage pipe network and urban rainwater collection and utilization project in category 22- urban infrastructure encouraged in Indicative Catalog for Adjustment of Industrial Structure (2011 edition), complying with national industrial policy.

2.1.3.2 Analysis of compliance between proposed project and relevant planning

(1) National level planning

The national level planning involved in the project includes Guanzhong-Tianshui Economic Zone Development Planning and the 12th Five-Year Planning for Development of West Region, and detailed compliance analysis is seen in Table 2.1-2.

Table 2.1-2 Analysis of Compliance between Proposed Project and National Level Planning

Analysis Basis	Concrete Requirement	Planning Project	Compliance
Guanzhong-Tianshui Economic Zone Development Planning	The concept on urban system proposes five-level urban system consisting of major city, secondary major city, tertiary city, major town and ordinary town. Development of future urbanization will transfer from the metropolis scale to development of medium and small city.	The project is mainly to promote urbanization of tertiary and fourth layer towns in the planned area. Implementation of the project will further strengthen the infrastructure development, build the convenient urban-rural sharing infrastructure network that is proper in layout and advanced in facility so as to lay the solid foundation for enhancing economic link in Guanzhong-Tianshui Economic Zone and expanding opening to internal and outside world.	Compliance
12th Five-Year Planning for Development of West Region	The major target is to further improve the infrastructure. The integrated transportation network has been formed generally, and the traffic circle taking 2h in the major city cluster has been completed, and asphalt road to town and road to village have been completed construction to provide more convenience for general public. 15000 km of railway under operation has been built additionally, road traffic and communication infrastructure have been strengthened remarkably. Capability of flood control and disaster mitigation has been improved, and hazard-free treatment capability for domestic garbage has increased by 120000 t/d.	Implementation of the project will further enhance infrastructure development and improve water supply, drainage and environmental health engineering facility.	Compliance

(2) Provincial level planning

The provincial level planning involved in the project includes Shaanxi Urban System Planning and Shaanxi Overall Planning for Development of Touristic Town Tourism, and detailed compliance analysis is seen in Table 2.1-3.

Table 2.1-3 Analysis of Compliance between Proposed Project and Provincial Level Planning

Analysis Basis	Concrete Requirement	Planning Project	Analysis Basis

Shaanxi Urban System Planning (2006-2020）	To coordinate Shaanxi urban and regional development, it is required to boost urbanization actively and prudently, promote proper utilization and protection of provincial spatial resource and achieve sustainable development among urban population, economy, resource and environment. In addition, it is required to reconstruct and upgrade the traditional industry, improve infrastructure and ecological environment development, boost Shaanxi's urbanization and build Shaanxi into a economically powerful province in west region and achieve the social and economic development goal with domestic medium development level in 15 years.	The project is implement small town infrastructure construction with WB fund and advanced concept, and plays a demonstrative and promotion role in enhancing the economic strength in the economic zone, accelerating integration between urban and rural area and building the urban system in the economic zone.	Compliance
Shaanxi Overall Planning for Development of Touristic Town Tourism (2011-2020)	a series of famous touristic town with unique theme, convenient traffic condition, supported service, beautiful environment, attractive and popularity that integrates leisure sightseeing, vacation and cultural experience will be built in Shaanxi through promotion of developing the touristic town so as to better protect, explore and utilize Shaanxi unique national culture, local historical culture and beautiful environment, finally, Shaanxi will be developed into a domestic and international influential tourist destination that integrates harmonious development between tourism and town development.	The Chenlu Ancient Town in Yintai District and Wugong Town in Wugong County in the project have been proclaimed as famous historical and cultural town and implementation of the project will further accelerate development of famous touristic and cultural town.	Compliance

(3) County level planning

The county level planning involved in the project includes the 12th Five-Year Planning for Xi'an Yanliang District, Chengcheng Overall Urban Planning, Wugong County Overall Urban Planning, Xianyang Chunhua County Runzhen Town Overall Planning, Xianyang Xunyi County Overall Planning, Xunyi County Zhitian Town Overall Planning, Control Detailed Planning for Baoji Chencang District, Tongchuan Yintai Beicheng Development Overall Planning, Tongchuan Chenlu Town Overall Planning, Shaanxi Tongchuan Yintai District Chenlu Ancient Town Tourism Development Overall Planning, Shaanxi Hanyin County Overall Urban Planning and Hanzhong Puzhen Town Control Detailed Planning, and detailed compliance analysis is seen in Table 2.1-4.

Table 2.1-4 Analysis of Compliance between Proposed Project and County Level Planning

Analysis Basis	Concrete Requirement	Planning Project	Analysis Basis
12th Five-Year Planning for Xi'an Yanliang District	Comply with urban development planning, overall planning for land utilization to revise Guanshan Town Small Town Development Planning and Wutun Small	Construction of the project will be capable of enhancing the economic strength of Guanshan and Wutun town,	Compliance

	Town Development Planning, determine the small town development scale properly and further optimize the urban structure and industrial structure, and build famous towns in Guanzhong that is beautiful in environment, excellent in industry and unique in feature. Incorporate the small town development into regional integrated urban-rural development planning to implement Guanshan and Wutong small town infrastructure development, and harden as well as reconstruct the major road in an planned way. Accelerate urban water supply, drainage, lighting, communication and cultural and recreational facility development, build the township road and square and improve social and life service.	and accelerate urban infrastructure development of the whole district.	
Chengcheng Overall Urban Planning(2011-2030)	The overall spatial structure consisting of one center, two-wing, one axis and three-part will be formed in Chengcheng County in the future. Chengguan Town, as the central urban development area of the overall spatial structure, is positioned as the primary central town of Chengcheng County, a developing town. The planned Chengcheng County Chengguan Town is comprised of old town, new downtown and industrial park with old downtown at west of Guhui Street and township northwest area at north of Bongbei Road. The new town is located at northeast township at east of Guhui Street and north of Gongbei Road. The industrial park is located at south township at south of Gongbei Road. The main town will expand toward east, industrial park east and south. When the main town is closely connected with the industrial park zone, the overall planning structure is featured by one town two-area, one ring two centers and three-axis connected internally and externally.	Construction of the project will boost urban development of Chenguan Town efficiently, accelerate integration between urban and rural area, and indirectly influence the neighboring towns and promote local urbanization.	Compliance
Wugong County Overall Urban Planning (2010-2020)	Wugong Town is positioned as the sub-central town of Wugong County based on its current economic development situation and industrial structure feature, and its planned development is positioned as a Guanzhong famous cultural and touristic town integrating historical tourism, trade and cultural leisure. Wugong Town will take historical cultural tourism as breakthrough for development, following the small but unique pattern. However, currently the backward infrastructure has affected the urban development.	Construction of the project will boost urban development of Wugong Town effectively, accelerate urban-rural integration and promote development process of Guanzhong famous historical and cultural touristic town.	Compliance

Xianyang Chunhua County Runzhen Town Overall Planning (2009-2020)	The overall planning takes Runzhen township as integrated service center, and G211 and Runbu Road as main and secondary axis for town regional development, which also connects township key area and G211 surrounding development zone. Ruanzhen Town industrial park zone road skeleton is comprised of one ring road and other mutually crossed roads. The ring road connects the industrial partitions in the park zone, and east-west trunk road of the skeleton connects the living and industrial zones.	Construction of the project will boost urban development of Runzhen Town effectively, accelerate urban-rural integration and promote development of Chunhua County Runzhen Town industrial park.	Compliance
Xianyang Xunyi County Overall Planning (2012-2020)	By relying on the external traffic development such as national highway, provincial highway, Binxian-Xunyi Road and Xunyi-Yaozhou Road, the county region internal traffic network is to improve its internal road network pattern, actively construct the secondary road that connects the towns and central villages. The road network to be constructed recently mainly includes Yonghe Road and Yinghui Road, etc. In addition, the infrastructure such as water supply and drainage, power supply and telecommunication, gas and heating pipe network will be constructed synchronously in a scientific way.	The major roads to be built in Chengtuan Town east area are the major contents in Xianyang Xunyi County Overall Planning (2012-2020). Therefore, the project complies with the planning.	Compliance
Xunyi County Zhitian Town Overall Planning (2009-2020)	The fast convenient traffic link will be built among the major function areas in Zhitian Township and the road traffic facility will be improved. The existing road will be fully utilized to give play to its potential through required reconstruction. The planning is aimed at constructing the main trunk road skeleton including Zhitian Street, New Zhitian Street, Nanxin Street transversely and Zhongxin Street, Xisan Road, Donger Road longitudinally. The recent planning is mainly to improve the old town and form the central area, and construction is mainly carried out in the surrounding area of east-west avenue in front of town government. The key works to be implemented recently includes strengthening infrastructure development in the town, improvement of investment environment, arrange construction item and construction timing in a proper and scientific way by referring to the county standard in order to improve the infrastructure level as soon as possible.	The project is mainly to improve the main trunk road in the township, the infrastrucrure development in the township, and forms an important integral part of Xunyi County Zhitian Town Overall Planning (2009-2020).	Compliance
Control Detailed Planning for Baoji Chencang District (2013-2030)	The second key task in planning is to accelerate urban infrastructure development. The first one assignment is to start improvement of Chencang District North	The project is mainly to improve the infrastructure and forms an important integral part of Control	Compliance

	Ring Road, east extension of South Ring Road, East Ring Road, North Auxiliary Road, Beixin Road, Jianguo Road, Weihe River North Bank, Guozhen-Caijiapo Main Trunk Road, and construction of Station Weihe River Bridge, Yangtian Weihe River Bridge to from the complete traffic road network in the main town area. The second one is to focus on Shitouhe River water source diversion works with total investment of 316 million Yuan, and complete reconstruction of old town pipe network and construction of water plant automatic control system, and the third one is to accelerate development of district technological industrial park phase II sewage pipe network reconstruction project and Yucai Industrial Park sewage treatment plant, the town and village industrial park sewage treatment plant.	Detailed Planning for Baoji Chencang District (2013-2030).	
Tongchuan Yintai Beicheng Development Overall Planning (2012-2020)	Traffic facility: coordinate with construction of regional provincial highway relocation, development of Guanzhong-Tianshui Economic Zone and Tongchuan Regional Central City, boost construction of external link of Beicheng, and achieve efficient connection of external traffic such as Beicheng and urban rapid trunk road, Baotou-Maoming Expressway, and second Baotou-Maoming Expressway, and improve the image of entering or exiting Yintai Beicheng, and actively establish the slow traffic system in the new town. Municipal facilities: focus on construction of water supply and drainage, power supply, telecommunication, gas and heating pipe network in a scientific way that is underground works first and then the ground works by combining the major traffic facility development. Ecological environment: fully start Qishuihe River ecological landscape control, form Xincheng water supply pipe network and greening network, discharge of waste water, gas and solid waste shall be acceptable. The unique and beautiful living environment will be created in Xincheng.	The project is to mainly construct East Binhe Road and West Binhe Road, both are the external road connecting Beicheng, Weiyi-Weiliu Road as the Yintai Beicheng branch road. In addition to function as partial traffic, the project is to mainly serve as an integral part of Xincheng slow traffic system and complement the urban traffic skeleton. Therefore, construction of the project complies with Tongchuan Yintai Beicheng Development Overall Planning (2012-2020), and is the key construction content in the recent planned traffic facility.	Compliance
Tongchuan Chenlu Town Overall Planning (2009-2020)	Through strengthening the perfect preservation of ancient cultural relics protection unit, overall style and traditional cultural pattern, Chenlu Town is planned to arrange the current trade, administrative function in town area, expand the town skeleton, and establish the county region central town pattern to form the urban layout in which the new and old towns are separated with one center and more	Construction of the project is to further improve the Chenlu Town through highway and is an important integral part of Tongchuan Chenlu Town Overall Planning (2009-2020).	Compliance

	partition. In which, the infrastructure such as road, water supply and drainage in the old town area will be reconstructed and improved, the middle school and hospital will relocated in the new town area. The land occupied by the existing hospital will be reconstructed, the tourism service center will be formed along the central square. In the future, the town government will be relocated in the new town area, Make and Beigou villages will be incorporated into the scope of town area construction project. By relying on the ancient tourism, two big tourism service groups will be developed on south and north sides. The environment, landscape and tourism service facility in old town area will be improved. Meanwhile, the Lidipo and Shangdian villages at east of old town area will be included in the scope of construction to form two characteristic tourism groups and create ceramic cultural tourist attraction.		
Shaanxi Tongchuan Yintai District Chenlu Ancient Town Tourism Development Overall Planning	Period from 2011-2015 is for infrastructure during which the concrete action plan will be worked out while achieving overall development planning. The recent construction project is to mainly develop the traffic facility, service facility, pipe network infrastructure, landscape structure and other necessary facilities. The detailed project includes development of Chenlu ancient town road traffic facility, pipe network and tourism service facility.	Construction of the project is to further improve the Chenlu Town through highway and is an important integral part of Chenlu Ancient Town Tourism Development Overall Planning, complying with planning requirement.	Compliance
Shaanxi Hanyin County Overall Urban Planning (2011-2020)	The urban system with two-wing will be built along Yuehechuandao in Chengguan Town of Hanyin County to provide the scientific basis for accelerating urban development of Hanying County. East-west axial development function belt along Yuehe River in Hanyin Chengguan Town has been determined in the planning, five connected functional groups will be built along Yuehe River belt. Three-transverse and seven-longitial	The project after completion will provide the better public service for the general public, on the other hand, it will provide the guarantee and foundation for local industrial development and population, and boost economic and cultural development of the whole county.	Compliance
Hanzhong Puzhen Town Control Detailed Planning	The spatial structure in the town area is featured by one axis, one center, two-belt and three partitions. The construction includes enhancing small town infrastructure development and boost economy development of Puzhen Town.	Implementation of the project in Puzhen Town is inevitable under the new economic development situation, the better hardware environment is the base for sustainable development of Puzhen and the important task for boosting urbanization. The purpose of implementation of the project is to foster the new	Compliance

		economic growth point for Puzhen Town, optimize the industrial pattern, transfer a great number of surplus rural labors in a large scale, accelerate the industrial cluster and population aggregation and boost town area sustainable economic development.	

2.1.4 Project overview

2.1.4.1 Project construction target

Shaanxi small town infrastructure construction project with WB loan is scheduled to be implemented in 9 counties of 7 cities of Shaanxi Province, and detailed construction target of subprojects is seen in Table 2.1-5.

Table 2.1-5 Summary of Project Area

No.	Name of Subproject	Name of Item	Unit	Quantities	Remarks
1	Yanliang District subproject	Road works	m	12447.954	Including road pavement, drainage, greening and lighting, etc.
		Water supply works	m	19950	Including water supply pipe and sluice valve well, etc.
		Sewage pipe	m	8503.71	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	3639.1	Including laying of rainwater pipe and manhole, etc.
2	Chencang District Guozhen Town Subproject	Road works	m	9138	Including laying of road, water supply and drainage, greening, lighting and traffic facilities, etc.
		Water supply works	m	8523	Including laying of sewage pipe and manhole, etc.
		Sewage pipe	m	8918	Including laying of rainwater pipe and manhole, etc.
		rainwater pipe	m	9784	Including laying of rainwater pipe and manhole, etc.
3	Wugong County Wugong Town Subproject	Road works	m	10004	Including laying of road, water supply and drainage, greening, lighting and traffic facilities, etc.
		Water supply works	m	20784	Including the water plant, water well and water supply pipe, etc.
		Sewage pipe	m	19452	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	2879	Including laying of rainwater pipe and manhole, etc.
4	Xunyi County Subproject	Road works	m	7672	Including the road pavement, greening and lighting, etc.
		Water supply works	m	4265	Including the water supply pipe and sluice valve well.

No.	Name of Subproject	Name of Item	Unit	Quantities	Remarks
		Sewage pipe	m	5235	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	5622	Including laying of rainwater pipe and manhole, etc.
5	Chunhua County Runzhen Town Subproject	Road works	m	12090	Including the road pavement, greening and lighting, etc.
		Water supply works	m	13942	Including the water supply pipe and sluice valve well
		Sewage pipe	m	24102	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	10175	Including laying of rainwater pipe and manhole, etc
6	Chengcheng County Chengguan Town Subproject	Road works	m	8213	Including the road pavement and lighting, etc.
		Drainage works	m	14174	Including laying of rainwater and sewage drainage pipe and manhole, etc.
7	Yintai District Subproject	Road works	m	14216	Including laying of road, water supply and drainage, greening, lighting and traffic facilities, etc.
		Sewage pipe	m	7280	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	7320	Including laying of rainwater pipe and manhole, etc.
8	Hantai District Puzhen Town Subproject	Road works	m	7107	Including laying of road, water supply and drainage, greening, lighting and traffic facilities, etc.
		Sewage pipe	m	7360	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	9953	Including laying of rainwater pipe and manhole, etc.
9	Hanyin County Chengguan Town Subproject	Road works	m	3757	Including laying of road, water supply and drainage, greening, lighting and traffic facilities, etc.
		Water supply works	m	6550	Including the water supply pipe, sluice valve well and reservoir, etc.
		Sewage pipe	m	4341	Including laying of sewage pipe and manhole, etc.
		rainwater pipe	m	2572	Including laying of rainwater pipe and manhole, etc.

2.1.4.2 Construction content

The detailed construction content of the project is seen in Table 2.1-6

Table 2.1-6 Project Construction Content Composition

No.	Project County/District	Project Construction Content		
		Water supply and Sewage Project	**New Road works**	**Drainage and Road Reconstruction Works**
1	**Xi'an** Yanliang District	① Shuibei Water Plant to Wutong and Guanshan Water Transmission Project with length of 13300m; ② Chengdong water distribution plant to Wutun water supply project with pipe of 3300m long.	North Guangyang Street construction works: L=808.224m, W=12m; water supply pipe: 780m, rainwater pipe: 772.84m,and sewage pipe: 750m. One for city by road grade level III.	① L=1245m,W=30m,water supply pipe:1250m,rainwater pipe:1230m,sewage pipe:1245m. ②West Ring Road, L=2413m,W=30m; water supply pipe:1320m,sewage pipe:2413.71m,rainwater pipe:1369.1m. ③South Guangyang Street, L=1045m,W=9m; water supply pipe:1000m,sewage pipe:1045m,rainwater pipe:1040m. ④ Hongyao Road, L=10293m,W=18m,water supply pipe:10293m; sewage pipe:3525m. ⑤Guangsan Road, L=1346.505m,W=12m,water supply pipe:1346m,rainwater pipe:259.86m,sewage pipe:275m.
2	**Baoji** Chencang District		① Beikai Road, L=755m,W=24m ; sewage pipe:734m,rainwater pipe:705m,water supply pipe:755m. One for city by road grade level III. ② North Longhai Road, L=3494m,W=24m, sewage pipe:3816m,rainwater pipe: 3770m,water supply pipe: 3490m. One for city by road grade level III. ③ Heping Road, L=1313m, W=24m,rainwater pipe:1203m. One for city by road grade level III.	①West Shuilian Road, L=843m,W=15m,sewage pipe:888m,rainwater pipe:853m,water supply pipe:840m. ② South Gate Road of Brewery,L=923m,W=18m ; sewage pipe:955m,rainwater pipe:938m,water supply pipe:920m. ③ Dazhong Road, L=900m,W=24m ; sewage pipe:880m,rainwater pipe: 860m,water supply pipe:900m. ④ Middle Chencang Road, L=1601m,water supply pipe:1601m. ⑤ Dongxin Road, L=910m,W=18m ; sewage pipe:1645m,rainwater pipe:1635m.
3	**Xianyang** Wugong County	① A new water supply plant, three water wells(2 for operation and one for standby)		① Renyi Avenue, L=2063m, 463m of it W=20m,1600m of it with width of 8m. closed

	Wugong Town	with design water output of 3000m3/d. ②Sewage treatment project: the sewage will be treated in the stabilized pond that occupies an area of 10000m2. It is expected that the sewage treatment project after completion will have treatment capacity of , 450000m3/y.		conduit for rainwater 880m,sewage pipe:880m, existing bridge: 40m. ②East Street, L=667m, W=15m,open channel to be reconstructed into closed conduit ,sewage pipe:1116m. ③South Street, L=944m, 489mof it is 15m wide and 455m is 20m wide. A new rainwater pipe:490m, sewage pipe:980m. ④ Existing North Xibao Road L=1445m,W=12m,open channel to be reconstructed into closed conduit ,sewage pipe:1295m ⑤Subtotal of lane reconstruction project: 25 lanes with L=4885m, W: 2-8m,open channel to be reconstructed into closed conduit ,sewage pipe:13181m, shall be connected into all the households of residents..
4	**Xianyang** Xunyi County			①North Street, L=268m,W=24m,water supply pipe:373m,rainwater pipe:260m,sewage pipe:258m. ②South Street, L=370m,W=24m,water supply pipe:644m,rainwater pipe:380m,sewage pipe:384m. ③ Taita Road, L=463m,W=24m,water supply pipe:552m,rainwater pipe:432m,sewage pipe:432m. ④ East Hedi Road, L=725m,W=6m,sewage pipe:675m. ⑤ Songjiagou West Hedi Road, L=460m,W=6m,sewage pipe:438m. ⑥ Nanzigou West Hedi Road, L=470m,W=12m,sewage pipe:444m. ⑦ Yangguan Avenue, L=2800m,W=26m,rainwater pipe:2248m. ⑧ Zhitian Street, L=1359m,W=26m,water

				supply pipe:1606m,rainwater pipe:1366m,sewage pipe:1359m. ⑨New Zhitian Street, L=1220m,W=24m,water supply pipe:1090m,rainwater pipe:936m,sewage pipe:1245m.
5	**Xianyang** Chunhua County Runzhen Town	Runzhen-County seat sewage trunk pipe: L=11982m		① Chuangxin Road, L=1149m,W=12m,water supply pipe:1740m,rainwater pipe:550m,sewage pipe:615m. ② North Chuangye Road, L=1385m,W=12m,water supply pipe:1637m,rainwater pipe:1286m,sewage pipe:1359m. ③Huimin Road, L=730m,W=12m,water supply pipe:804m,rainwater pipe:1172m,sewage pipe:1168m. ④ Chuangye Avenue, L=1388m,W=22m,water supply pipe:1680m,rainwater pipe:753m,sewage pipe:1412m. ⑤Runwu Road, L=1383m,W=18m,water supply pipe:1564m,rainwater pipe:1396m,sewage pipe:1480m. ⑥Runbu Road, L=1497m,W=22m,water supply pipe:1619m,rainwater pipe:1490m,sewage pipe:1528m. ⑦ Zhenxing Avenue, L=2040m,W=30m,water supply pipe:2380m,rainwater pipe:1010m,sewage pipe:2040m. ⑧ Lanes, L=2518m,W=5m,water supply pipe:2518m,rainwater pipe:2518m,sewage pipe:2518m.
6	**Weinan** Chengcheng County	Reconstruction of Changning Street drainage: sewage pipe: 2920m.	① Huifu Street, L=3210m,W=27m；draiange connecting pipe: 0.61km, Road level for the urban arterial road level III； ② Dongba Road, L=405m,W=25m,drainage pipe:1110m,	① Dongliu Road, L=665m,W=22m,drainage pipe:1744m. ②Qingzheng Street, L=2206m,W=26m；sewage pipe:2808m.

			One for city by road grade level III; ③ Yangguang Road, L=1727m,W=30m,drainage pipe:4982m, One for city by road grade level III.	
7	**Tongchuan** Yintai District		①North section of West Binhe Road, L=3002m,W=15m, rainwater pipe channel 3000m,sewage pipe:2960m, Road level for the urban arterial road level III; ②East Binhe Road ,L=3366m,W=14m, rainwater pipe channel: 3360m,sewage pipe:3360m, For slow road road level; ③ Weiyi Road ～ Weiliu Road, L=1202m,W=12m,rainwater pipe:960m,sewage pipe:960m;（Weiyi, Weier, Weisi, Weiwu and Weiliu Road have 40m long bridge）For the branch road level. ④Improvement of South Shunjin Road traffic safety management facility	①Local reconstruction of Napo-Chenlu Road, L=4466m,W=3m, mainly including adding passing lane and local widening of curve; ② Local reconstruction of Ceramic plant –Chenlu Road, L=2180m,W=3m, mainly including adding passing lane and local widening of curve
8	**Hanzhong** Hantai District		① North Section of Lianfeng Road, L=817m,W=16m ; rainwater pipe:1650m,sewage pipe:999m, Road level for the urban arterial road level III; ② Lianhua Road, L=2364m,W=32m,rainwater pipe:4663m,sewage pipe:2804m; ③Beier Road, L=2867m, W=12m. One for city by road grade Ⅱ level.	① East Street, L=699m,W=6.5m,rainwater pipe:830m,sewage pipe:787m; ② West Street, L=360m,W=6.5m ; rainwater pipe:454m,sewage pipe:426m. ③Lanes, new sewage pipe for 2344m:, new rainwater pipe for 286m, reconstruction of rainwater closed conduit for 2070m and road pavement for 8700 ㎡; ④Traffic safety facility: New South Streetand Puhan Road will be paved with new marking for 577.8 ㎡,43sets of road lamps,9 flashing lights,112m vibration marking, buried traffic light pipeline for 64m.

9	**Ankang** Hanyin County	G316 roadside main water supply pipe, L=6550m, serving 60000 people.	① Nanqu Road,L=2357m,W=20/28/23m,rainwater pipe:1468m,sewage pipe:2361m；bridge 1=25m, bridge 2=100m, One for city by road grade level III. ②West Extension of South Binhe Road, L=1400m,W=19m,rainwater pipe:1104m,sewage pipe:1980m；bridge is 10m, For the branch road level.	

2.1.5 Earthwork quantity

According to the project feasibility study, the earthwork quality of district or county project is seen in Table 2.1-7:

Table 2.1-7 Earthwork and stonework balance sheet of Project (m^3)

No.	Project Site	Excavation	Filling	Borrowing	Discard
1	Yanliang District	344571.3	326100.5	——	18470.8
2	Chencang District	158605	98976.7	——	29628.3
3	Wugong County Wugong Town	169131.38	148641.4	——	20489.98
4	Xunyi County	101000	85800	——	15200
5	Chunhua County Runzhen Town	265200	230600	——	34600
6	Chengcheng County	163737.9	169053.2	5315.3	——
7	Yintai District	50694.13	79590.54	28896.41	——
8	Hantai District Puzhen Town	72831.48	74740.49	1908.01	——
9	Hanyin County	88340	289900	201560	——

The earthwork and stonework of subproject have been balanced between excavation and fill. In addition, Chengcheng County, Yintai District, Hantai District and Hanyin County Subproject have huge quantity of full, thus requiring the borrow material and the earth purchased externally. Yanliang District, Chencang District, Wugong Town, Xunyi County and Chunhua County Runzhen Town have a certain small quantities of spoil. According to local disposal practice, the spoil generated in the subproject will be buried in the waste valley on which the soil is covered for greening.

2.1.6 Investment estimate and fund raising

(1) Investment estimate

The total investment of the project is RMB 1,445,270,400, including RMB1,003,217,200 of project cost, RMB18.39 million of technical assistance and capacity building, RMB 228,836,800 of miscellaneous of project construction, RMB 149,584,700 of reserves and RMB 45,421,600 of interest incurred during construction and front-end fee.

(2) Fund raising

The proposed project loan applied for WB is USD 150 million that is equivalent to RMB 919.5 million, accounting for about 63.62% of total investment. RMB 525,770,400 will be financed locally, accounting for about 36.38% of total investment.

2.2 Analysis of Project

2.2.1 Analysis of project in construction period

The major works in construction period of the project includes construction of road and water well, and laying of the pipe network, featured by single small-size works scattered in different county (or city) project area. Construction of the project will disturb the environment, but will have no large excavation or piling up of the stone and earth, so the impact is slight in magnitude, small in scope and short in period.

1. Analysis of ambient air impact

The air pollution during construction of the project is mainly the dust and asphalt smoke pollutant.

A lot of dust will be spread in surrounding air during transport, loading and unloading and mixing of the road building materials, and the dust pollutant will be generated as a result of wind during piling up of the road building materials.

This project adopts the asphalt concrete road pavement structure, asphalt in the melting, mixing, paving would produce a certain amount of asphalt smoke and dust, can cause certain pollution to the environment air, can also cause certain harm to the health of construction personnel. Influence a bigger stage for road paving asphalt gas phase.

2. Analysis of waste water environmental impact

The sewage produced during construction of the project mainly includes the muddy water during construction of foundation, waste water for washing the building material, production sewage after washing the vehicle, domestic sewage produced by construction workers and sewage with higher silt content produced as result of construction site run-off in rainy days. The production sewage is mainly comprised of the silt and petrol pollutant while the domestic sewage the COD, SS, ammonia nitrogen and animal and vegetable oil pollutant.

The existing bridge on Renyi Avenue of Wugong County Wugong Town of the project is 40m long and 20m wide, which crosses over Qishuihe River in which the water quality is category III. There is the bridge (40m long and 12m wide) crossing over the Qishuihe River on Weier, Weisi, Weiwu and Weiliu Road of Yintai Beicheng of Tongchuan, and the water quality in Qishuihe River is category III. There are 2 bridges on Nanqu Road at Chengguan Town of Hanyin County, Ankang, the first bridge is 25m long and the second one 100m long with width of 30m. The bridge on west extension of South Binhe Road, 10m long and 22m wide, crosses over Yuehe River in which the water quality is category III.

Pollution on surface water during construction of bridge mainly comes from the production sewage produced in construction and domestic sewage produced by the construction workers. The bridges involved in the project are small bridges without large pier or pollution on river water due to boring slurry.

In addition, the construction waste oil may pollute the water body. The formwork and mechanical oil are required during placing the bridge superstructure, if the leakage of mechanical oil occurs or the waste oil after using is drained into the water body directly, the water quality indicator such as petrol in water environment will increase, leading to deteriorate of water body quality.

3. Analysis of noise environmental impact

The noise during construction of the project mainly comes from construction machinery such as bulldozer, road roller, loading machine, excavator and mixing machine, etc. these

equipments can produce the noise of 90～98dB(A) at 5m from the sound source during operation. The sudden unstable noise source will produce the negative impact on construction workers and surrounding residents.

4. Analysis of solid waste environmental impact

The solid waste discarded during construction mainly includes the building waste produced in construction, domestic garbage in resettlement and removal of building and from the construction workers. A certain quantity of domestic garbage to be produced everyday is mainly the organic garbage. Discarding the garbage randomly will lead to rot which may pollute the water body environment. Meanwhile, it will result in the flies during fermentation and produce the reek to pollute the environment. The solid waste in case of random stacking will occupy land, and may pollute the soil and water body in case of rain. In the dry windy season, it may produce the dust pollution.

5. Analysis of ecological environmental impact

Filling or excavation of subgrade will destroy the roadside vegetation and partially encroach the farmland. Exposure of the temporary borrow site and spoil ground will change local ecological structure along the road. The exposed surface if being scoured by rainwater will result in water and soil erosion in local scope, affecting the stability of terrestrial ecological system.

6. Impact of social environmental impact

The major impact factor of social environment includes land acquisition, demolition and trip safety, inevitably affecting local residents' life, and its impact will last long and can't be reversible. Transportation of construction and material may affect the trip safety of roadside residents, and such impact will be in short period and can be reversible.

The proposed project site is involved in three cultural relics and religious activity arenas, they are the Wugong County Wugong Town God's Temple, Xunyi County Chengguan Taita and Hanzhong Haitai District Puzhen Town Lianfeng Village Mosque. Construction of the project will inevitable impact the cultural relics and religious activity. It is recommended during EIA that construction period shall avoid the significant activity and not affect the activity in these areas via arranging the passageway and guiding marking.

2.2.2 Analysis of project in operation period

The impact generated during operation of the project mainly includes the vehicle exhaust and road traffic noise. For the project is mainly the municipal road or town road with lower running speed, the environmental impact will be slight in small scope.

1. Analysis of air environmental impact

The vehicle exhaust is mainly the pollution source of ambient air during operation of the project. The vehicles, as a moving source when it runs on the road, can produce the exhaust that mainly includes CO, NOx, THC and TSP.

2. Analysis of acoustic environmental impact

The noise source of motored vehicle running on the highway is unstable, the vehicle's engine, cooling system and transmission system will produce noise when the project is put into operation. In addition, the airflow turbulence, exhaust system, friction between the tire and road surface during running of vehicle will produce the noise as well.

The running vehicle may produce mechanical noise as a result of smoothness of the road

pavement.

3. Analysis of water environmental impact

As the municipal infrastructure construction project, the non-production activity and the project itself will not produce waste water. However, construction of drainage works will change the original water use habit and mode, the collection and discharge mode of rainwater and sewage, improvement of convenience for using water may result in increase of water consumption, and increase of volume of domestic sewage generated. Construction of the rainwater and sewage collection pipe network will improve the collection rate of sewage and volume of regional domestic sewage as well.

(1) Impact on rainwater discharge

For the rainwater with a lot of silt and floating object flows into the rainwater conduit after collecting on the pavement, and may pollute the surface water, wash off the land and vegetation, even deteriorate landscape if it discharges directly, the simple sediment and removal of floating object shall be carried out, and then the treated water can drain to minimize the impact remarkably.

(2) Impact on sewage discharge

The sewage produced in the project will be treated in the regional sewage treatment plant and then discharge. the environmental impact may be controlled effectively and be minimized.

4. Impact of ecological environmental impact

(1) Analysis of impact of project area on land utilization

The project will occupy the land permanently, and most lands are occupied by the subgrade. There is mainly the farmland and residential area in the proposed road area. Land to be occupied by the project will change the land utilization mode of the area, and will be changed into that permanently available for transportation, resulting in resettlement of some residents.

(2) I0mpact of road on the plants in the project area

The land permanently occupied by the project will change its function of the assessed area, reduce the greening area of ecological system and vegetation coverage, as a result, the spatial scale of biocenosis will be shortened, which may deteriorate the integrated productivity of system and biomass and destroy the structure and function of ecological system, however, such negative impact is only limited within the scope of road.

The total quantity of vegetation destroyed due to proposed road is limited, and negative impact will be caused on the regional ecological environment. The required ecological compensation measures will be adopted to compensate the negative impact on the ecological environment after completion of the road, for example, the trees will be planted on both sides of the road.

5. Risk impact

The risk accident during transportation on the highway mainly affects the roadside water body, leakage of dangerous chemical and its flow into the water will pollute the water boy and agricultural irrigation system seriously. The hazardous article, if being scattered on the land, will affect the normal use function of land and destroy the ecological environment on the land.

For there is no sensitive water boy along the proposed road, no threat exists on the safety of water body. However, the measures for management of vehicle for hazardous article and accident prevention measures will be prepared. In addition to the hazardous article

transportation accident, the common transport accident will pollute the water body. Though it has slight pollution magnitude, the rate of common accident is certainly higher than such data, so the preventive management shall not be ignored.

3 Project Area Current Environmental Situation Survey

3.1 Overview of Shaanxi Province Condition

Located in hinderland of northwest China, Shaanxi remains an important province in northwest region. It borders on Shanxi and Henan in east, Ningxia and Gansu in west, Sichuan, Chongqing and Hubei in south and Inner Mongolia in north, covering an area of 205800 km^2. Shaanxi has 10 cities, one technological demonstration area, 107 counties (or district) (including 80 counties, 3 county-level cities and 24 districts), 1581 towns and a population of 37530000 persons (18770000 of urban population and 18760000 of rural population). The project area involves in 7 cities (Xi'an, Baoji, Xianyang, Weinan, Tongchuan, Hanzhong and Ankang), 9 counties (districts) (including 5 counties and 4 districts) and 14 towns with total affected population of 480000 persons.

In general, Shaanxi is long from south to north and complex in geomorphology. Shaanxi can be divided into Northern Shaanxi loess plateau, Guanzhong Plain and Southern Shaanxi Qinba mountainous area from north to south. Shaanxi stretches across three climatic zone in which Southern Shaanxi has northern subtropical region, Guanzhong and most of Northern Shaanxi the warm temperate zone, and north part of Northern Shaanxi along the Great Wall the temperate climate. Climate in south and north of Shaanxi is different remarkably with great difference in temperature and uneven rainfall distribution. There are many rivers in Shaanxi. With Qinling Mountain as boundary, north of Qinling Mountain has the Yellow River system, while the south the Yangtze River system. The proposed project is distributed on the loess plateau, Guanzhong plain and Southern Qinba mountainous area, having warm temperate zone and north subtropical climate and involving in Weihe River of the Yellow River system, Luohe River system and Yantze and Hanjiang River. With Qinling Mountain as boundary, the northern Weihe River and Luohe River are depleted in water resources while the southern Hanjiang River with plenty of water source.

The complex terrain and variable climate contribute richful biodiversity. Investigation of Shaanxi condition data shows that Shaanxi boasts 604 species of terrestrial vertebrates, including 28 amphibians, accounting for 12.7% of 220 in China; 49 species of reptiles, accounting for 12.9% of 380 in China; 380 species of birds, accounting for 32% of 1189 in China; 147 species of animals, accounting for 28.9% of total 509 in China; 171 families of spermatophyte, 1143 genera and 3754 species, including 9 species of national first grade wide plant under key protection (3 of then are artificially planted), 23 second grade and 58 kinds of Shaanxi wild plant under Shaanxi provincial special protection. In addition, Shaanxi has a total of wet land area of 292895 ha, accounting for 1.45 of total area in China, in which the higher plants are 193 species, birds 95, fish resources 135, reptile 22 and amphibian 28. The animal and plant species in the proposed project area are not distributed evenly. Taking Qinling Mountain as boundary, there are rare animal and plant species and small coverage of natural vegetation in north part of Shaanxi such as Yanliang, Chencang, Wugong, Xunyi, Chunhua, Chengcheng and Yintai, etc.). While in south part of Shaanxi such as Hantai and Hanyin, for the project is located in the completed urban area where the plants and animals are planted or raised artificially, the project will not affect the previous animal or plant species.

3.2 Current Situation of Natural Environment in Project Area

3.2.1 Geographic location

The proposed project sites are located in Shaanxi Xi'an Yanliang District (Wutun Town and Guanshan Town), Baoji Chencang District (Guozhen Town and Qianwei Subdistrict Office), Xianyang Wugong County (Wugong Town), Xianyang Xunyi County (Chenguan Town and Zhitian Town), Xianyang Chunhua County (Runzhen Town), Weinan Chengcheng County Chengguan Town, Tongchuan Yintai District (Yintai Beicheng and Chenlu Town), Hanzhong Hantai District (Puzhen Town) and Ankang Hanyin County (Chengguan Town) respectively. The project area geographic location is seen in Fig. 3.2-1.

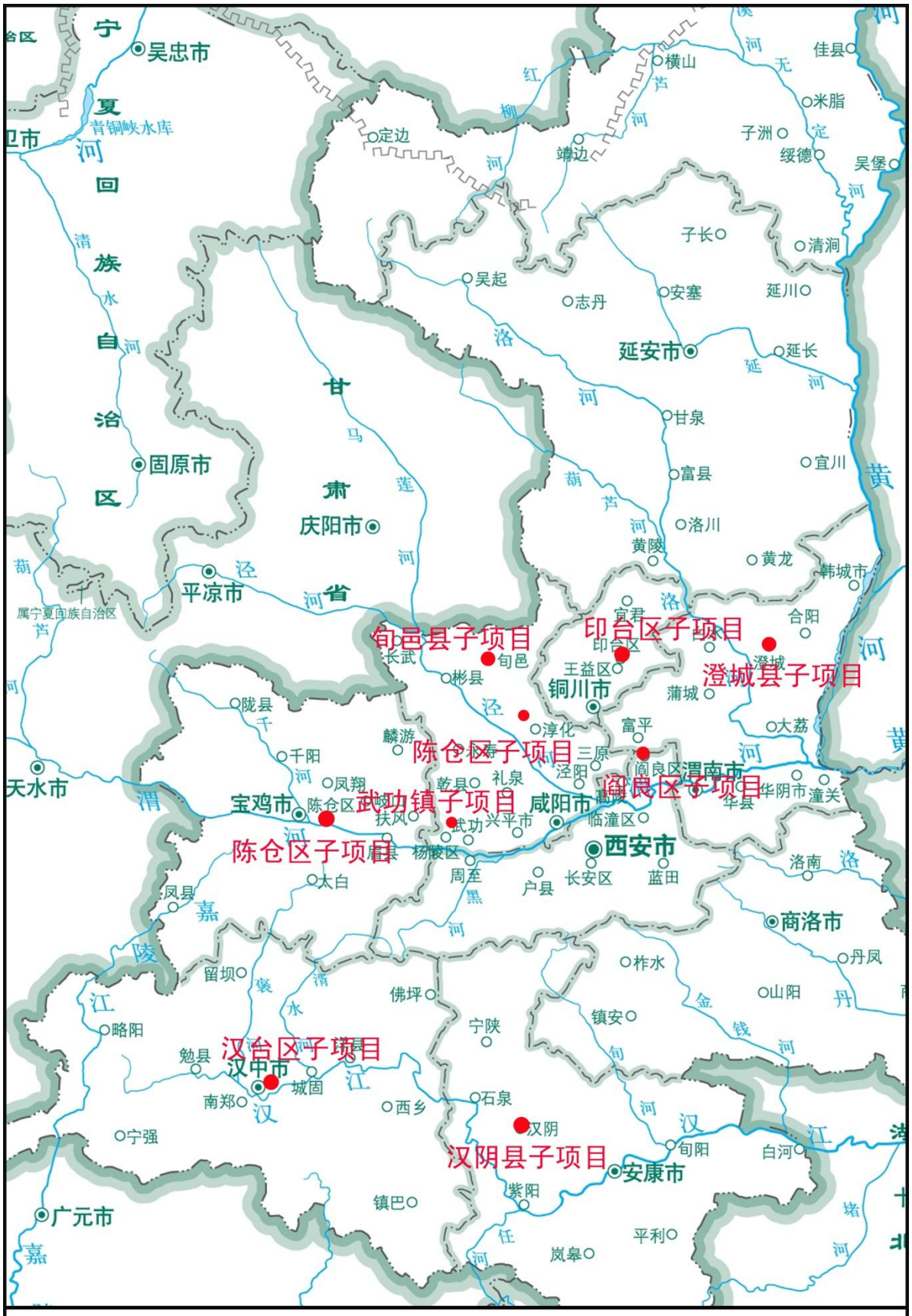
3.2.2 Geographic structure and earthquake

Shaanxi geographic condition data survey shows that the proposed project site are distributed on six tectonic units such as Weihe River fault depression plate, Longxian - Beikuanping tectonic plate, Longxian - Hancheng fault upheaval plate, Erdos late Paleozoic-Mesozoic overlapping basin plate, Hanzhong-Micang Mountain anteklise plate, Fengxian-Xunyang epicontinental sea plate and six fault zones such as Kouzhen-Guanshan fault zone, Badu-Guozhen-Tieluzi- Sanyao fault zone, Baoji-Xianyang-Weinan fault zone, Weihe River basin north edge fault zone, Mianxian-Yangxian fault zone and Yuehe River fault zone. According to China Ground Motion Peak Acceleration Zoning Plan (1:4,000,000) (GB18306-2001), the basic seismic parameters of proposed project site is seen in Table 3.2-1.

Table 3.2-1 Proposed Project Site Geographic Structure and Earthquake

Proposed Subproject Site	Tectonic Unit	Fault Zone	Ground Motion Peak Acceleration (g)	Basic Intensity of Earthquake	Characteristic Period of Seismic Response Spectrum (S)
Xi'an Yanliang District	Weihe River fault depression plate	Kouzhen-Guanshan fault zone	≥0.15	Ⅶ	0.35
Baoji Chencang District	Longxian-Beikuanping tectonic plate	Badu-Guozhen-Tieluzi-Sanyao fault zone	≥0.15	Ⅶ	0.40
XianyangWugong County	Weihe River fault depression plate	Baoji-Xianyang-Weinan fault zone Weihe River basin north edge fault zone	≥0.15	Ⅶ	0.40
Xianyang Xunyi County	Erdos late Paleozoic-Mesozoic overlapping basin plate	Weihe River basin north edge fault zone	≥0.05	Ⅵ	0.45
Xianyang Chunhua County	Longxian-Hancheng fault upheaval plate	Weihe River basin north edge fault zone	≥0.05	Ⅵ	0.45
Weinan Chengcheng County	Longxian-Hancheng fault upheaval plate	Weihe River basin north edge fault zone	≥0.20	Ⅷ	0.40
Tongchuan Yintai District	Longxian-Hancheng fault upheaval plate	Weihe River basin north edge fault zone	≥0.05	Ⅵ	0.45
Hanzhong Hantai District	Hanzhong-Micang Mountain anteklise plate	Mianxian-Yangxian fault zone	≥0.10	Ⅶ	0.45

Ankang Hanyin County	Fengxian-Xunyang epicotinental sea plate	Yuehe River fault zone	≥0.05	Ⅵ	0.45



Proposed Project Site Geographic Location Map

3.2.3 Geomorphology

The proposed project sites are mainly the river valley plain, river lower terrace, loess terrace like plain, residual loess tableland, etc. The geographic type and feature of the proposed project sites are seen in Table 3.2-2.

Table 3.2-2 Geographic Type and Feature of the Proposed Project Sites

Proposed Subproject Site	Geographic Type	Geographic Feature
Xi'an Yanliang District	plain（Shichuanhe River valley）	This area is high in north and low in south in scalariform form without large difference. The maximum altitude is 483.2m and the minimum one 351.7m with biggest height difference of 131.5m. The strike of Schichuanhe River valley plain is northwest-southeast and stretches 27.8km in this project area where it is fertile in soil, flat in terrain and the surface has more sediment and a plenty of cobbles.
Baoji Chencang District	River	This area is comprised of the mountain, stream and plain with complex structure. It is surrounded in south, north and west, and is lower in center. This it is high in west and low in east. The rivers and streams are distributed on both banks of Weihe River and Qianhe River, covering an area of 241.4km^2 with altitude of 507-600m. With flat terrain, the content of organic matter in the soil is higher than 1%, they are a plenty of surface water and groundwater distributed in many larger first grade land.
Xianyang Wugong County	Qishuihe River（River valley deluvial terrace）	This county is mainly the river valley alluvial terrace, loess terrace plain and piedmont diluvial fan front edge low-laying area. Qishuihe River valley alluvial terrace is distributed in discontinuous and scattered way in Y-shaped long irregular river valley. Both sides of the river valley are the loess terrace like plain that is high in northwest and low in southeast with slope of 2.5-5%. Being cut by Qishuihe River, West Wugong Plain is formed that is wide and flat with deep soil layer where the beam and slot can be seen. The plain surface is covered with 10-20m loess under which lies the alluvial sediment.
Xianyang Xunyi County	Condition of the whole county	Located in the loess plateau, the project area is low in southwest and high in northeast with half mountain and half plain and the height difference is not obvious. Sanshuihe River crosses the whole project area from northeast to southwest. The altitude in northeast is 1300-1855m, accounting for 54% of total area of the whole country. The loess plateau is located in southwest of the county, accounting for 46% of total area of the county.
	Loess plateau（Zhanghong-Zhitian Yuan）	Covering an area of 138.6km^2, the plain is 10km in max. width and 3km in minimum width and 35km in length with altitude of 1000-1400m. The plain surface inclines toward southwest from northeast with grade of 0.5-1%. The mild slope with grade of 3% on the plain surface stretches toward Jinghe River. The bed rock is the tertiary system on which the deep loess is covered, and the plain topsoil is eroded seriously.
	Sanshuihe River plain（Chengguan Town）	Sanshuihe River flows through earth-stone mountainous area and loess plain with narrow river valley and different size of flood plain on the flat deposit bank on which the secondary loess is covered and under which the alluvial sandy gravel and sand layer are covered, most of them are the farmland.
Xianyang Chunhua County	Loess plain（Runzhen Plain）	Located on south edge of Weihe River north loess plateau, the county is high in north and low in south with altitude of 630-1808.9m. The north of county is the Ziganling south extension mountainous area, the center is the loess plateau in slot shape. Jinghe River flows

		through southwest boundary, Zhiyuhe flows from north to south and then to southeast, mainly forming the mountainous area, loess hill, loess plateau and river valley terrace, etc. Runzhen Town plain is the loess ridge of the loess plateau formed due to parallel comb water system with altitude of 950-1300m in long narrow belt that is more than 20km between south and north, and the width between east and west varies. The plain surface is flat with longitudinal slope of approximately 2° and transverse 1°. The plain surface has shallow gully and dissected valley. The plain connects with hill on north and its south end is broken and eroded. The plain surface is divided into several small ridges.
Weinan Chengcheng County	Loess plain	As part of Weihe River north loess terrace like plain, the county is mainly the loess plateau. Huanglong Mountain lies across northern boundary. Luohe River flows through southwestward, it is high in north and low in south with altitude of 470-1285m, it is mainly the low and medium mountain, piedmont alluvial skirt, loess plateau and river valley. The loess plateau surface is flat, inclines toward south with dip of 1-2° and altitude of 470-1100m, connecting with piedmont skit via low-lying area. Due to control of basement rift, the terrace feature of original terrain is obvious, mainly the loess underlying bedrock, on which middle Pleistocene series loess in tens meters' thick is covered, and its thickness increases from north to south under which the middle and Paleozoic erathem sand shale lies.
Tongchuan Yintai District	Residual loess gully	Located in north of Weihe River Beishan mountain and southeast of Qiaoshan Mountain, Yintai District stretches from northeast to southwest with altitude of 900-1250m where many river valleys exists, the surface is broken, it is the residual loess plateau and ridge hill. Proportion between plain ridge and gully area is 6:4, and relative cutting depth of cleugh is 100-200m. The proposed project iste is in Qishuihe River valley plain with width of 1.5-1.8km. Both banks sides are the tree-step terrace, mainly the eroded loess river valley with relative cutting depth of 50-100m. Comprised of the loess, the grade of valley slope is over 40°, even 85%.
Hanzhong Hantai District	Hanjiang river lower terrace	The proposed project site is located in Hantai District, Puzhen Town, the Hanjiang River flood plain and first grade terrace of river. The flood plain is distributed continuously on both banks, the lower flood plain is connected with the riverbed, while the higher flood plain is 2-5m higher above the riverbed. The flood plain is 3.5km wide, it is flat and comprised of the sand, pebble and silt. The first grade terrace is distributed along Hanjiang River banks, 4-15m higher than the riverbed, where it is flat, the soil is fertile consisting of the sub-clay, sandy soil and sandy gravel.
Ankang Hanyin County	Yuehe River plain	The terrain of the county is two river valleys among three mountains and rises along the valleys, including the medium high mountain, low mountain, hill and river valley. The proposed project site is located in Yuehe River valley, comprising of the Yuehe River flood plain with height of 0-4m and width of several meters to kilometers, on which there is the sand bank formed in flood period, the surface is covered with sandy soil. The terrain is flat and lower with deep soil layer. The whole area is the paddy field, the major grain producing area of Hanyin County.

3.2.4 Climate and meteorology

The climate in proposed project site mainly involves the south warm temperate zone, north warm temperate zone, north subtropical climatic region. The climatic feature and

meteorological factor of the proposed project sites are seen in Table 3.2-3:

Table 3.2-3 Climatic Feature and Meteorological Factor of the Proposed Project Sites

County or District	Climatic Feature	Meteorological parameters					
		Annual Average Temperature (℃)	Main Wind Direction	Average Wind Speed for Years (m/s)	Annual Average Precipitation (mm)	Frost Free Season (D)	Max. Depth of Permafrost (cm)
Yanliang	War, temperate zone continental monsoon climate, dry and cold in winter, hot and humid in summer, windy in spring and rainy in autumn.	13.6	NE	2.4	537.5	215	-
Chencang		12.9	E	2.2	700	210	10
Wugong		12.9	NW	1.8	608.25	227	-
Xunyi		9.1	NW	2.3	612.9	180	59
Chunhua		10	E	2.8	610.8	183	56
Chengcheng		12.1	NEE	2.7	514.9	202	52
Yintai		8.9	NE	2.2	589.2	228	30
Hanyin	North subtropical regional humid climate, monsoon, four distinctive seasons, spring is short and windy, summer is hot and longer, autumn is short and rainy and winter is long and cold.	15.1	SE	1.7	847.3	258	15
Hantai		14.3	ENE	1.0	905.3	234	8

3.2.5 River system

The project to be implemented in Guanzhong and Southern Shaanxi, having Weihe River, Luohe and Hanjiang River system, the rivers involved include Shichuanhe River, Qingyuhe River, Qianhe River, Weihe River, Qishuihe River in Wugong County, Sanshuihe River, Tongshenhe River, Dayuhe River, Qishuihe River in Tongchuan, Hanjiang River and Yuehe River, the river system distributed surrounding the project site is seen in Fig. 3.2-2-3.2-8. Overview of major rivers is as follows:

(1) Shichuanhe River: the first tributary of Weihe River, originates from Jiaoping Beishan Mountain of Tongchuan and Yaoqu Beishan Mountain in Yaozhou District, the upstream is Qishuihe River and Zuhe River, both rivers flows southward to Fuping County Hongshui Town for confluence, it is also called Shichuanhe River. Shichuanhe River flows from southwest of Fuping County to Duanyuan Village of Yanliang District, and then from northwest to southeast to Naweizihe River, in Fanjia Village, after that, the river flows from Naqingyuhe River in Xiaosu Village of Wutun Town, and outside Yanliang District, finally to Weihe River through Lintong County Yingren Village. The river flows Yanliang, Xinxing, Kangqiao and Wutong towns with total length of 144km. The river flowing in project area is 30km with slope of river bed of 4.4‰, and drainage area of 4585km^2 (188km^2 in project area). The annual mean runoff is 215 million cubic meter with small flow, even depleted in dry season.

(2) Qingyuhe River: the biggest tributary of Shichuanhe river, originates from Yehugou

at northwest of Zhaojin in Yaoxian County, flows through Yaoxian, Chunhua, Sanyuan, Yanliang and Lintong. It flows from Muzheng Village, Zhenxing Town at southwest of Yanliang District to southeastward through Zhenxing, Beitun and Wutun town and out Yanliang District to Shichuanhe River in Xiaosu Village of Wutun Town. The river is 153.8km long, 28km flows through Yanliang District with total drainage area of 1863km^2. The river control drainage area in Yanliang is about 180km^2. Both banks of the river are fully of abrupt cliff with narrow riverbed, the average width of river valley is 170m, the river has a lot of sediment and reeds growing on both banks.

(3) Qianhe River: the first tributary of Weihe River, originates from Tangnanlu Shimiaoliang, Zhangjiachuan Hui Autonomous County of Gansu Province, flows from northwest to southeast through Longxian, Qianyang and Fengxiang County to Weihe at Didian in Chencang District with total length of 152.6 km and drainage area of 3493.9km^2. The average river slope is 0.58%, and mean runoff of years is 393 million cubic meters, mean flow of years 15.4m^3/s, minimum flow and maximum flow 0.17m^3/s and 3840m^3/s respectively. The mean average sediment of years is 10.97kg/m^3.

(4) Weihe River: the first tributary at middle Yellow River, originates from Niaoshushan Mountain of Weiyuan County, Gansu Province, flows into the Yellow River in Tongguan, Shaanxi Province. Weihe River flows into Chencang District from Chencang District Fenglingge Town Jianhe Village, and out Chencang District in Yangping Jiangma Village. The river in Chencang District is 157.6km, accounting for 19.3% of total length. The width of river before Linjia Village (Baoji gorge sluice) is 50-200m and the river bed slope is 1.5-2%, that after Linjia Village is 500-3000m and 0.15-0.2% respectively. The mean runoff of years is 2530 million cubic meters, mean flow of years 81.4m^3/s. The peak discharge in flood season is 5032m^3/s and that in dry season is 3.7m^3/s. The river water has a lot of sediment.

(5) Qishuihe in Wugong County: the secondary tributary of Weihe River, originates from Ningligou, Zhaoxian Town, Linyou County, flows through Yongshou, Qianxian and Youfeng to Wugong County, collects Weishuihe River, Moyuhe River and Qingshuihe River, and then flows into Weihe River in Gaozhai Village. Qishuihe is 250km long, and 24km in Wugong County with drainage area of 157.2km^2. The annual mean flow is 4.32m^3/s, and annual runoff is 136236000m^3. The flow varies greatly, and becomes the dry valley in dry season for the upstream is intercepted for irrigation.

(6) Sanshuihe River: the first tributary of Jinghe River, originates from northern Nanlan mountainous area, flows from the head to southeast, into Binxian County in Zhangbasi Town Caijiahe River, collecting Shidizi stream, Yangjiadianzi stream, Youfanggou stream, Yuzigou stream, Dijiahe River, Mayigou stream and Cangergou stream. The river is 128.6km, and 113.5km in Xunyi County with drainage area of 1323.3km^2 (1279.84km^2 in Xunyi County). The river bed slope is 5.5%, average width of river valley is 10.86m. The river has average flow of 2.91m^3/s, mean runoff of years 92 million cubic meters, mean modulus of runoff of years 71900 m^3/km^2. The river has average content of 32.4kg/m^3.

(7) Tongshengou stream (Runzhen Gully): the first tributary of Jinghe River, originates from east Yaoxian, Chunhua County, flows from north to south and into Jinghe River in Zuili Village, Majia Town. The stream is 30.7km with drainage area of 99.2km^2, the river bed slope is 29.1%, the average width of river valley is 10m. Flow in downstream is 0.55m^3/s and the mean runoff of years is 4650000 m^3.

(8) Dayuhe River: the first tributary of Luohe River, originates from Chengcheng County and Heyang County, flows into Luohe River in Quli Village of Yongfeng Town. 37.75km flows through Chengcheng County, the river bed slope is 1.45‰ and the runoff is 6241600 m^3. There is the depleted, ample flow and frost period for the river that has a lot of sediment. The

sediment flow in Chengcheng County is 780000 t/y, and the characteristic ratio of river sediment is over 4, the coefficient of variation is over 0.3 and 0.65 maximally.

(9) Qishuihe River in Tongchuan: originates from Yaoxiankliang at east of Fenghuangshan Mountain, flows 14km southeastward, and converges in north Jinsuoguan with Tangnihe River, and then flows southward to collect the Magou Stream, Leijiagou Stream, Shijiahe River, and westward to collect the Xiaohegou Stream, Wangjiahe River, southward to collect Xinchuangou Stream to Huangbao Town and collect Hongyangou Steam (Xiaohegou Stream), and then flows southward for 2.5km to Huangliang Cement Plant at Yaoxian County boundary, and converges with Zuhe River at south of Yaoxian County. The river is 62.4km long with drainage area of 773.5km^2, the slope of river is 8.8%, the average flow and annual runoff is 0.54m^3/s and 39520000 m^3.

(10) Hanjiang River: the first tributary of Yangtze River, originates from Hanwang Mountain, Da'an Town of Ningqiang County, flows southeastward through Shaanxi Hanzhong and Ankang, and then to northwest Hubei Province, after collecting Danjiang River, it flows southeastwa rd through Xiangyang and Tianmen to the Yangtze River in Wuhan. The project is involved in Hanjiang River Hanzhong Hantai District reach, the scope of reach is from Gushan Village to Taohuadian Village. 27.4km flows through Hanzhong. The river bed slope is 0.89‰, Lianhe stream and Lengshui stream converge on the south bank, while Nabaohe River, Xiajiagou Stream, Sigou Stream, Ganhe River, Wangjiahe River and Jingbanghe River. The drainage area before Hanjiang River bridge is 9329km^2, the average width of river is 500m, annual mean runoff is 3.476 billion m3 and average runoff 90.5m^3/s.

(11) Yuehe River: the first tributary of Hanjiang River, originates from north mountain, Tiewadian, t he main peak of Fenghuang Mountain, flows from east to west of Hanyin County, through Pingliang, Chengguan and Puxi, and then southward to collect 9 streams and northward 14 streams, and into Ankang at Shuangru Town Huanglongdong. 49.5km flows through Hanyin County with catchment area of 851.4km^2, flow of 8.815m^3/s and river bed slope of 6.3‰.

Relation between project and river location is seen in Table 3.2-4.

Table 3.2-4 Proposed Project Site River System

Proposed Subproject Site	River system	River	Relation with Project	Location Relationship
Yanliang District (Wutun Town)	Weihe River	Shichuanhe River	Sewage produced in the project drains after treatment in sewage treatment plant.	2.2km from east of proposed project site (downstream)
		Qingyuhe River	No drain	3.4km from south of proposed project site (downstream)
Chencang District (Guozhen Town and Qianwei Subdistrict Office)		Qianhe River	No drain	3.2km km from west of proposed project site (upstream)
		Weihe River	Sewage produced in the project drains after treatment in sewage treatment plant.	1.6km from south of proposed project site (downstream)
Wugong County(Wugong Town)		Qishuihe River (Wugong)	Sewage produced in the project drains after treatment.	0.6km from east of proposed project site (downstream)

Xunyi County (Chengguan Town and Zhitian Town)		Sanshuihe River	Sewage produced in the project drains after treatment in sewage treatment plant.	in the proposed project site
Chunhua County(Runzhen Town)		Tongshengou stream	No drain	6.2km from west of proposed project site (upstream)
Yintai District (Yintai Beicheng and Chenlu Town)		Qishuihe River (Tongchuan)	Sewage produced in the project drains after treatment in sewage treatment plant.	in the proposed project site
Chengcheng County(Chengguan Town)	Luohe River	Dayuhe River	Sewage produced in the project drains after treatment in sewage treatment plant.	8.2km from east of proposed project site (downstream)
Hantai District(Puzhen Town)	Hanjiang River	Hanjiang River (Hantai Section)	Sewage produced in the project drains after treatment in sewage treatment plant.	3.1km from proposed project site (downstream)
Hanyin County(Chengguan Town)		Yuehe River	Sewage produced in the project drains after treatment in sewage treatment plant.	in the proposed project site

3.2.6 Hydrogeology

The groundwater at proposed project site is mainly the loose rock pore water and fissure water, and the hydrogeological condition of the proposed project site is seen in Table 3.2-5.

Table 3.2-5 Hydrogeology at Proposed Project Site

Proposed Subproject Site	Groundwater Type	Hydrogeological Feature
Yanliang District	loose rock pore water	The area is covered with Pleistocene series alluvial aeolain layer with thickness of 160～200m, the water storage capacity varies greatly and watery is poor, the groundwater is scattered, it is different in exploiting difficulty.
Chencang District		Watery, the acquifer is mainly the quartneray loess and neogene sand layer and gravel pebble bed, the first and second terrace of river valley and high flood plain has groundwater 5-10m under the surface. Confined water aquifer is the Pliocene coarse gravel with burial depth of p ressure head of 8-44m.
Wugong County		The acquifer is buried 10-40m under ground, the thin sand bed gravel aquifer with thickness of 10-20m distributed unstably. The waterlevel is 7-20m under ground, watery.
Xunyi County	loose rock fissure water (Chengguan Town)	Chenguan section river valley aquifer is the alluvial gravel, sandy pebble, loose lock and strong water permeability, continuous distribution, which is favorable for permeating of rainfall and river water. The water level is 5-8m under ground with plenty of groundwater.
	Loess layer pore water (Zhitian Town)	The aquifer middle Pleistocene series silt layer, loess, ancient soil layer and Pleistocene loess, relative water resisting layer is the tertiary red soil and lower Pleistocene series wucheng loess. The water level is 21.8～39.2 under ground. The aquifer becomes thin from center of plain to surrounding area, and the burial depth of groundwater becomes larger, the watery becomes worse.

Chunhua County	fissure water	The Triassic system sandshale and Ordovician limestone shale is the stone mountainous area of bed rock. Affected by regional geological structure, the thick limestone fissure is developed to be favorable for seepage of natural rainfall, and the shale forms the water-resisting layer, even the karst in local section, the fissure water belt.
Chengcheng County	Pore and fissure water	The aquifer group is mainly the pore fissure water with aquifer thickness of tens to hundres meters. The water level is 40-hundres meters under ground with poor watery, and the groundwater runs off smoothly and recycle fast. The deep groundwater runs off southwestward and seep. The rainfall irrigation is the replenishment source.
Yintai District	Karst fissure water	The water level is 200-500m underground, the aquifer group is mainly the karst developed carbonatite water soluable aquifer group and the watery section is near the gully.
Hantai District	loose rock pore water	Hanjiang River flood plain first terrance is the watery area with water level of 1-7m underground, and the aquifer is 10-70m thick, watery.
Hanyin County		The aquifer is the alluvial, deluvial, gravel, silty clay and clay sand that are watery.

3.2.7 Soil and vegetation

The soil in proposed project site mainly includes grey soil, moisture soil, swampy soil, paddy soil, sediment, secondary loess, loessal soil, red clay and white clay, and the vegetation is mainly planted artificially. The natural vegetation is widely spread in Xunyi and Chunhua County. The major soil and vegetation are seen in Table 3.2-6.

Table 3.2-6 Type of Soil and Vegetation at Proposed Project Site

Proposed Subproject Site	Soil	Vegetation
Yanliang District	Grey soil（the ancient farming soil with largest area in district with thickness of 173cm, thick soil layer, more organic matters, high nutrient content and strong soil moisture conservation capability）, river sediment (distributed on（Shichuanhe River bank with more sediment, mixing of soil and stone, vulnerable to dry and flood, better permeability）	Mainly the artificial vegetation (artificial economic forest, crops and timber materials)（capsella bursa-pastoris, green bristlegrass, corydalis bungeana, wild oats, art emisia, cogon, and commelina and diffusa, etc with small quantity of vegetation）
Chencang District	Moisture soil（distributed in Weihe River old beach with thin soil mass, sandy, less fertile and suitable permeability）, sediment (distributed in Weihe River and Qianhe River bank new beach or mountain foot, poor production performance of soil and lower fertile), swampy soil (distributed in Weihe River first terrace low-lying area, old channel closed section and valley bottom soaking area. The surface is covered with a great number of dead plant), paddy soil（distributed in Weihe River old and new beach with soft pasty soil where it is suitable for growing rice）	The major vegetation includes artificial vegetation (crops, yam, bean, cotton, oil and vegetable crops, aspen, ailanthus altissima, tung tree and Chinese scholar tree that are planted, and pasture, medicinal plant and flowers) and natural vegetation that includes Pinus armandii, populus davidiana, white birch, oriental arborvitae and oak, etc.)
Wugong County	The sediment, white sediment clay, moisture soil and secondary loess are distributed on Qishuihe River valley terrace, the valley slope is distributed with white clay and color soil)	ailanthus, aper mulberry, chinese scholar tree, jujube tree, apple tree, pear tree, cypress, willow, aspen and artificial forest on Qishuihe River bank forestry and agricultural vegetation, etc.

Xunyi County	Zhitian plain is mainly distributed with black soil (thick loess parent material, loose with pores,lower groundwater level) , loessal soil(mainly the farming soil with poor degree of development, less organic matter, deep loess layer and poor water retaining capability) , red soil（short age of soil, cohesive, dense, poor permeability and easy hardening） Sanshuihe River valley new alluvial soil (a type of soil formed on the river new alluvial parent material due to alluvial) moisture soil and swampy soil with small area.	The major vegetation is the natural vegetation including Chinese pine forest, populus davidana forest, white birch forest, Liaodong oak forest, ostryopsis bush, sophora viciifolia bush, rosa hugonis bush, mountain peach bush, and walnut forest, apple orchard and pear orchard that are planted artificially.
Chunhua County	The plain surface is distributed with yellow cohesive soil and sediment white clay, and the plain slope the white clay and terrace loessal soil	The major vegetation includes Chinese pine forest, Liaodong oak forest, populus davidana forest, birch forest, sophora viciifolia bush, rosa hugonis bush, sea-buckthorn bush and wild jujube bush, etc.
Chengcheng County	Grey soil and loess	Mainly the artificial vegetation including the crops, economic forest etc., the natural vegetation mainly includes the bush and herbaceous plant with a few oriental arborvitae, elm and aspen distributed sporadically.
Yintai District	River valley is distributed with new alluvial soil, and ridge plain the white clay and red soil	Loess hill bush vegetation, mainly includes vitex negundo bush, wild jujube bush, etc, and a few oaks. The artificial vegetation is the major vegetation.
Hantai District	Paddy soil, moisture soil and sediment	The natural vegetation has been replaced by artificially planted vegetation, mainly including the agricultural vegetation (paddy rice, wheat, oilseed rape, vegetation, feed and flower), forest vegetation (mainly including protection forest, citrus, tea, white mulberry, populus tomentosa, toona sinensis, willow, elm, metasequoia, Chinese catalpa, Chinese ilex and oriental arborvitae- the subtropical vegetation)
Hanyin County	Paddy soil and moisture soil	Agricultural vegetation (food crops), oil crops, economic crops, vegetables and flowers etc.), forest vegetation (timber forest, fuelwood forest, economic forest, fruit forest, bush and bamboo forest) and natural vegetation (rattan vegetation, Chinese herbal medicine and aquatic plant)

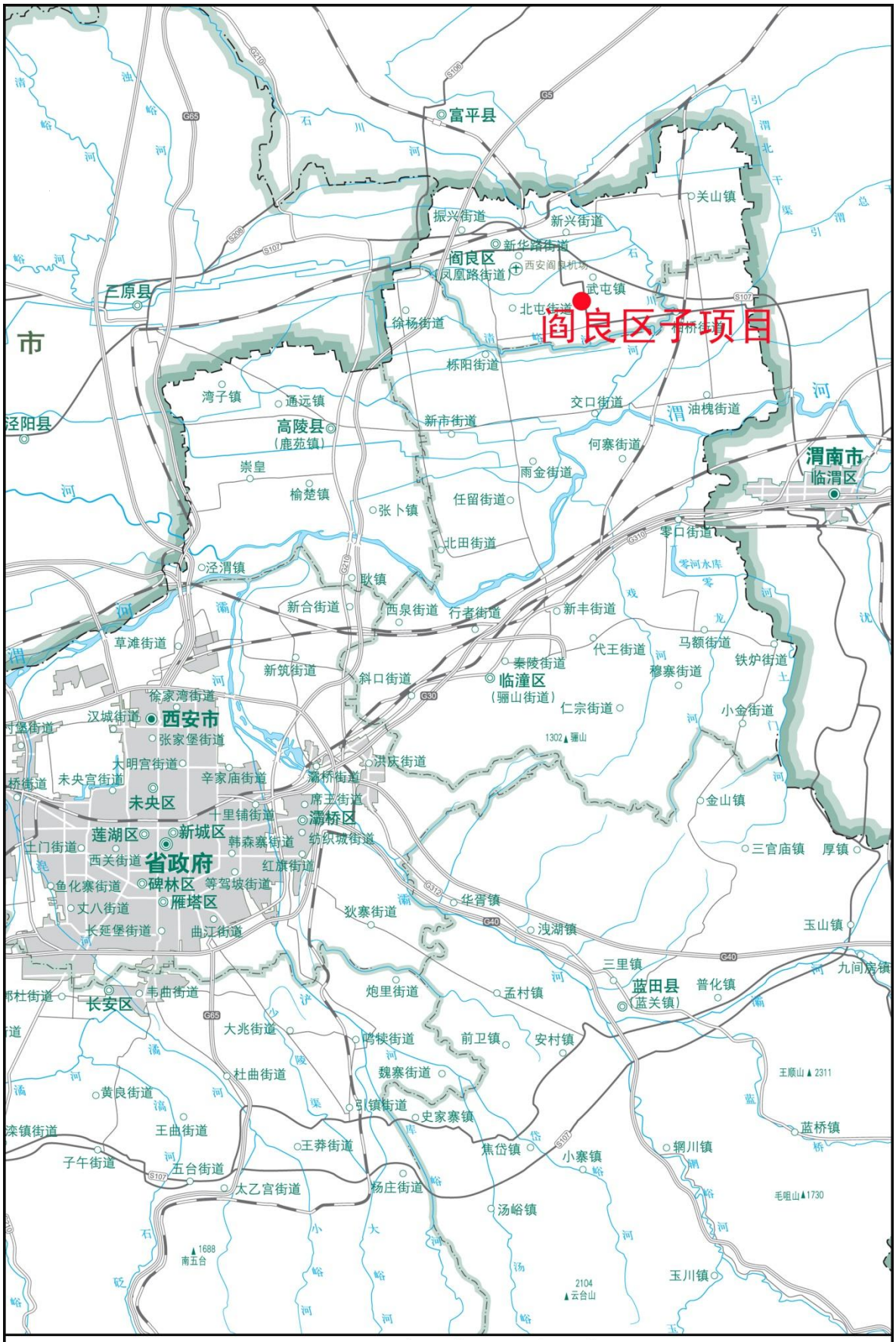


Fig. 3.2-2 Yanliang District Water System Map

Fig. 3.2-3 Chencang District Water System Map


好
畤
河
(属永寿县)
仪井镇
乾陵水库
泔
店头镇
羊毛湾水库
乾县
(城关镇)
渠
干
湾
羊
毛
S107
渠
干
阳
新阳镇
临平镇
漆
宝
鸡
峡
大北沟水库
河
周城镇
梁村镇
引
渭
总
干
渠
水
苏坊镇
姜村镇
游凤镇
王村镇
峡
鸡
宝
河
武功镇
贞元镇
后
河
武功镇子项目
五泉镇
S104
长宁镇
大寨镇
杨陵区
武功县
(普集镇)
揉谷镇
渭
惠
渠
李台街道
大庄镇
小村镇
清
水
河
渭
汤
G310

图3.2-4 武功县水系图

Fig. 3.2-4 Wugong County Water System Map

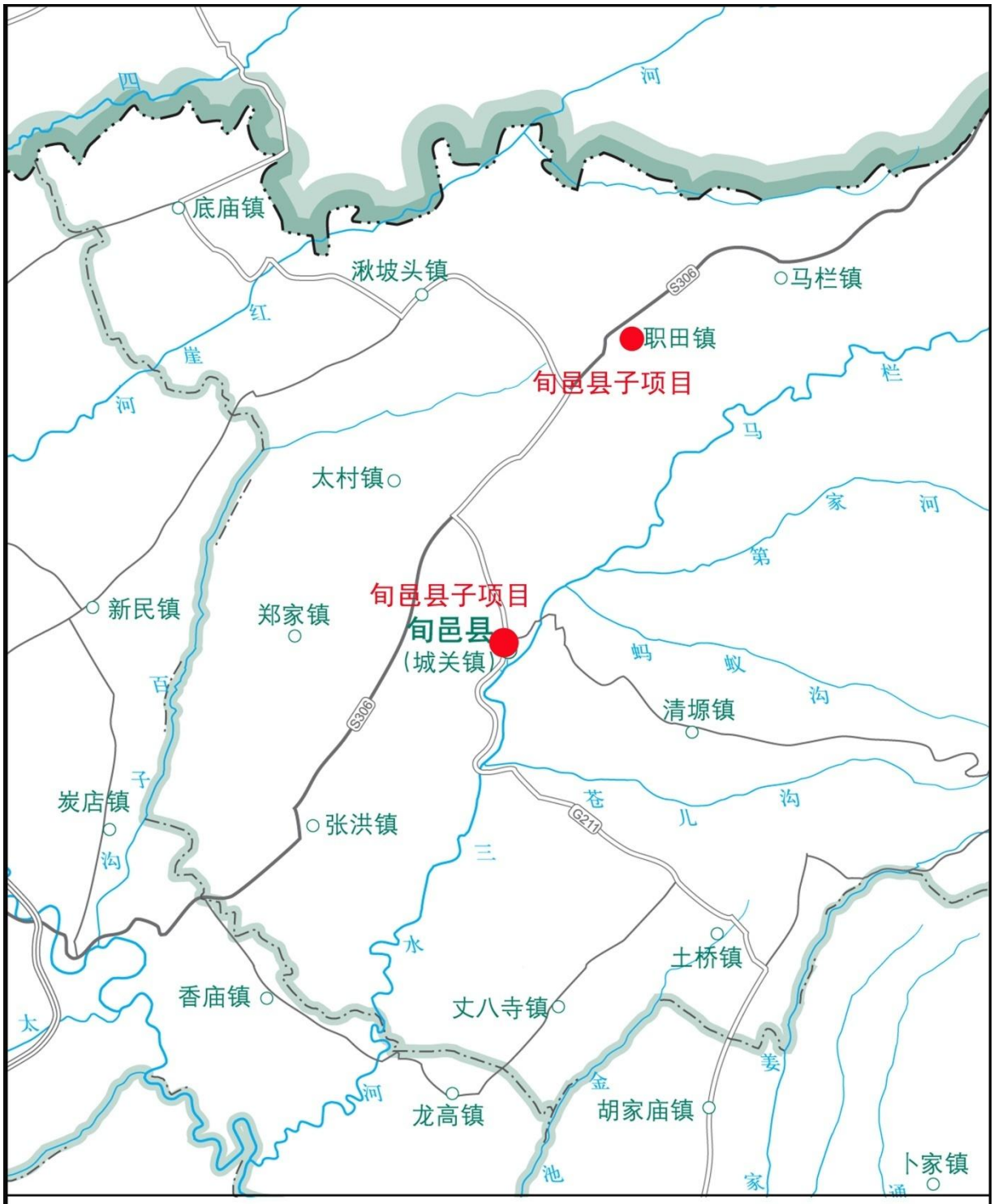


Fig. 3.2-5 Xunyi County Water System Map

Fig. 3.2-6 Chunhua County Water System Map

Fig. 3.2-7 Chengcheng County Water System Map

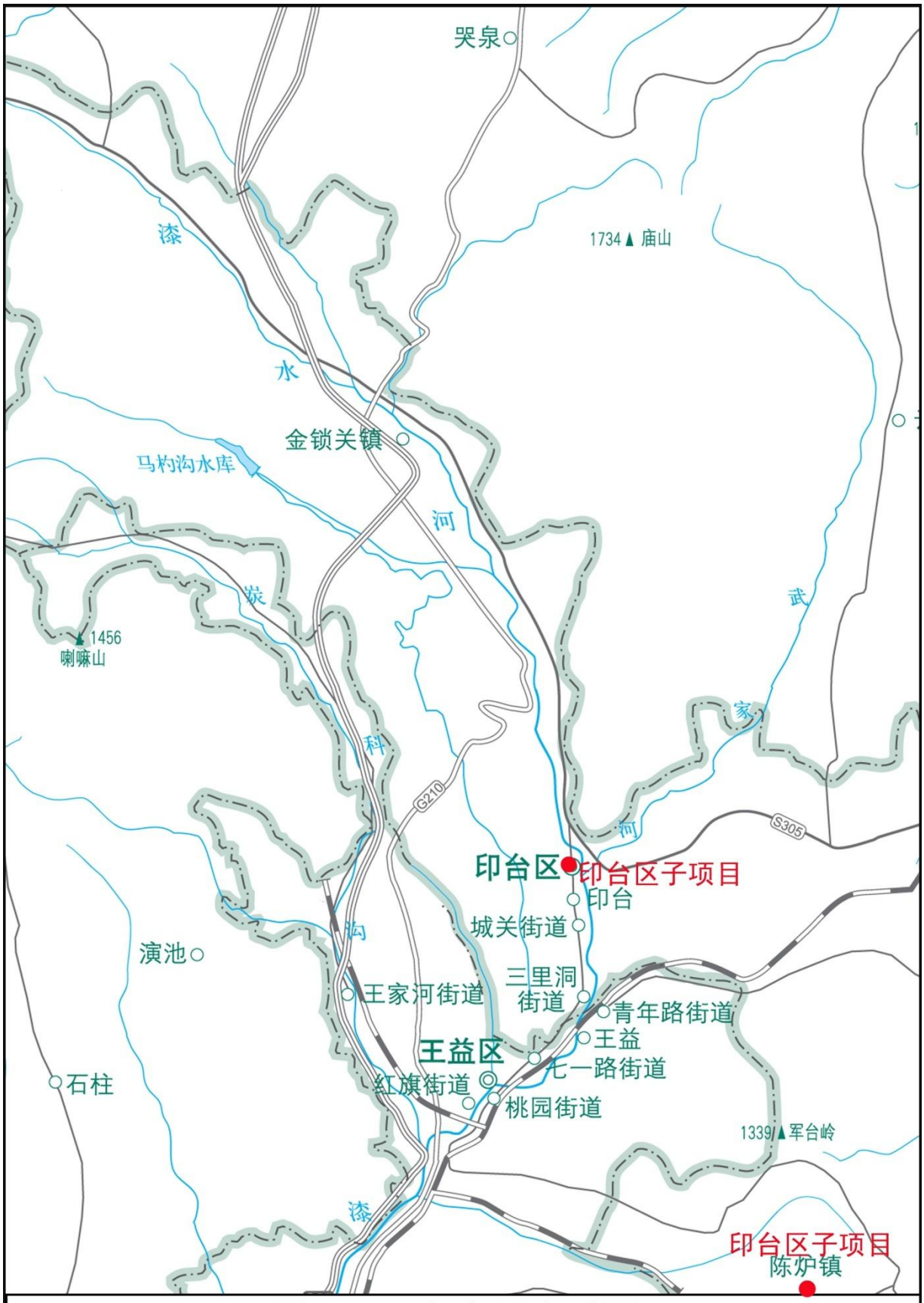


Fig. 3.2-8 Yintai District Water System Map

Fig. 3.2-9 Hantai District Water System Map

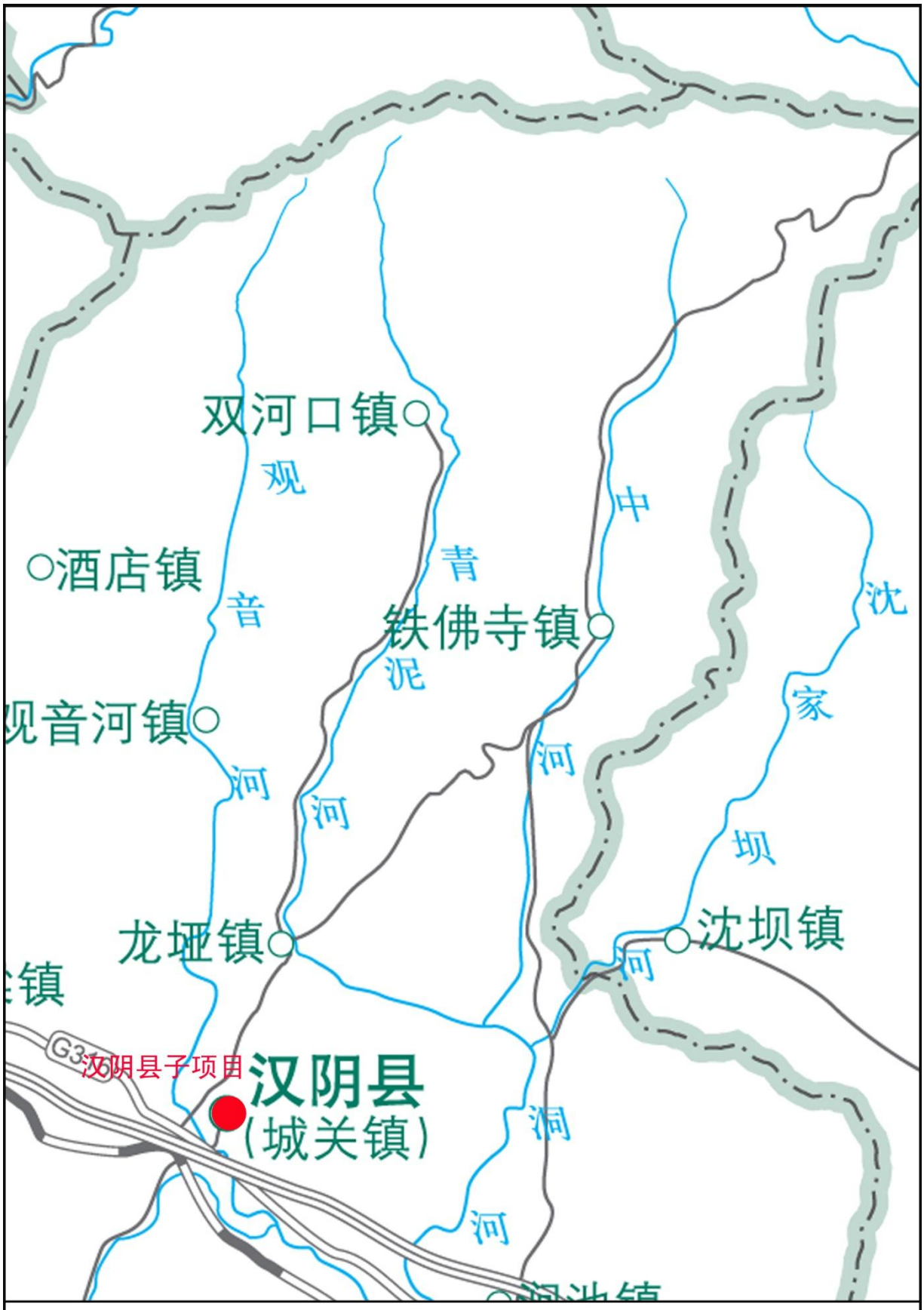


Fig. 3.2-10 Hanyin County Water System Map

3.3 Ecological resource overview

The complex terrain and variable climate contribute to richful biodiversity. Shaanxi's geographic information survey indicates that Shaanxi boasts 604 species of terrestrial vertebrate, including 28 species of amphibian, accounting for 12.7% of total 220; 49 species of reptile, accounting for 12.9 of total 380; 380 species of bird, accounting for 32% of total 1189; 147 species of animals, accounting for 28.9% of total 509; 171families, 1143 genus and 3754 species of spermatophytes, among which 9 of them are the national primary wild plant under special protection (3 of them are planted artificially), 23 the national second wild plant under special protection, and 58 provincial wild plants under special protection. In addition, Shaanxi has a total area of wet land of 292898 ha, accounting for 1.4% of total area in Shaanxi Province, including 193 species of wet land higher plant, 95 species of bird, 135 species of fish, 22 species of reptiles and 28 species of amphibian. The animal and plant species in the project area are not distributed evenly. Taking Qinling Mountain as boundary, the north area such as Yanliang District, Chencang District, Wugong County, Xunyi County, Chunhua County, Chengcheng County and Yintai District, etc have rare animal and plant species, and small quantity of natural vegetation, while the south area such as Hantai District and Hanyin County mainly have the artificially-breed animal and animals where the proposed project area is located in the completed urban area, not involving in rare animal or plant species.

3.4 Project Area Social Environment Survey

3.4.1 Overview of regional social and economic situation

The proposed project sites are located in Xi'an Yanliang District（Wutun Town、Guanshan Town）, Baoji Chencang District（Guozhen Town、Qianwei Subdistrict Office）, XianyangWugong County（Wugong Town）, Xianyang Xunyi County（Chengguan Town、Zhitian Town）and Xianyang Chunhua County（Runzhen Town）, Weinan Chengcheng County Chengguan Town、Tongchuan Yintai District（Beicheng and Chenlu Town）, Hanzhong Hantai District（Puzhen Town）、Ankang Hanyin County（Chengguan Town）,the proposed site social environment profile is seen in Table 3.4-1.

Table 3.4-1 Social Environment Profile of the Proposed Project Site

Proposed Subproject Site	Administrative Division and Population	Economic Profile	Traffic	Total Area (km^2)
Xi'an Yanliang District Wutun Town	15 village committees with population of 35000 persons	The pillar industry mainly includes plantation, breeding, dairy product processing, and main crops include wheat and maize, and the economic crops includes melon and vegetables.	National highway 108 and provincial highway 107 interconnect here and Xi'an-Yanliang Expressway is connected with Xi'an	53.3
Baoji Chencang District Guozhen Town	5 administrative villages, 35 village teams with population of 51000 persons, and 37000 persons live in town area	The pillar industry includes trade and real estate, the main crops include wheat and maize and major economic crops include vegetables. The per capita income is 13000 Yuan.	Xi'an-Baoji Expressway, Lianyungang-Lanzhou Railway and provincial highway 210 run through Chencang District. The major traffic road in town area includes Chencang Avenue, Middle Chencang Road, Guopan Road, South Ring Road and West Ring Road, etc.	14
Baoji Chencang District Qianwei Subdistrict Office	5 administrative villages, 7 community committees with population of 61000 persons, and 52000 persons live in town area	The pillar industry includes automobile trade and spares and commercial logistics. The main crops include maize and wheat, major economic crops include vegetables. The per capita income is 12000 Yuan.		14
Wugong County 武功镇	22 administrative villages with population of 42100 persons, and 5000 persons live in town area	The pillar industry includes agriculture,The main crops include wheat and maize,major economic crops include fruit. The per capita income is 7315Yuan.	Lianyungang-Lanzhou Railway、Xi'an-Baoji Expressway, Xi'an-Baoji Highway, Xi'an-Baoji North Highway and provincial highway 107 run through Wugong Town.	46.7
Xunyi County Chengguan Town	14 administrative villages and one community committee with population of 12000 persons	The pillar industry includes apples, vegetables, agriculture and animal husbandry. The per capita income is 7286Yuan.	national highway211and national highway 306 runs through the town area	4.04
Xunyi County Zhitian Town	16 administrative villages with population of 29000 persons and 9738 persons live in town area	The pillar industry includes animal husbandry, agriculture and medical materials. The main crops include wheat and maize major economic crops apple and cured tobacco. The per capita income is 6890Yuan.	national highway211and national highway 306runs through the town area	86.1
Chunhua County Runzhen Town	14 administrative villages with population of 16000 persons	The pillar industry includes fruit industry and animal husbandry. The major economic crops are apple. The main crops include wheat and maize. The per capita income is 7 629Yuan.	The national highway211 and Xianyang-Xunyi Expressway run through the town area	47.5

Weinan Chengcheng County Chengguan Town	11 5 administrative villages, 62 village teams and 5 communities with population of 82600 persons, and 55000 persons live in town area	The pillar industry includes tertiary industry. The main crops include wheat and major economic crops are maize and walnut, etc. The per capita income is 6069Yuan.	Beijing-Kunming Expressway, national highway108, Xi'an-Houma, Xi'an-Baotou and Xi'an-Yan'an Railway run through Weinan. The national highway 108, provincial highway 202 and 106 interconnect here	49.8
Tongchuan Yintai District Chenlu Town	18 administrative villages with population of 19800 persons, and 3900 persons live in town area	The pillar industry includes ceramic, coal and clay. The main crops include wheat and maize,major economic crops include dry fruit. The per capita income is 7599Yuan.	The major traffic includes napo-Chenlu village road, Ceramic-Chenlu village road.	99.7
Tongchuan Yintai District Beicheng	3 administrative villages with population of 3716 persons	The main crops include wheat and maize, the major economic crops are apples, and the pillar industry is the tertiary industry. The per capita income is 10000 Yuan.	Xi'an-Tongchuan, Tongchuan-Huangling Expressway, national highway 210 and Provincial highway 305 run through Tongchuan	0.78
Hantai District Puzhen Town	2 community committees and 36 village committees with population of 54500 persons and 29800 persons live in town area	The main crops include paddy rice, wheat, oilseed rape, etc. the economic crops are vegetables, medicinal materials and fruit trees. T he peasant's income is 9710Yuan.	Yangpingguan-Ankang Railway, national highway108 and Xi'an-Hanzhong Expressway run through Hantai district.	42
Hanyin County Chengguan Town	24 administrative villages and 4 communities with population of 78000 persons	The main crops include paddy rice, and the economic crops are oilseed rapes. The crop farming is the pillar industry. The per capita income is 5938 Yuan.	Yangpingguan-Ankang Railway, Shiyan-Tianshui Expressway and national highway316 run thro ugh Hanyin County	133.41

3.4.2 The general situation of the material and cultural heritage area

Shaanxi boasts time-honored history, profound cultural deposites and many cultural relics and historic sites as well as scenic spots, including Terracotta Warriors and Horses of Qin Shihuang Mausoleum, Huashan Mountain, Lishan Mountain, Tiantaishan Mountain, Huang Di Mausoleum, Hukou Waterfalls and Famen Temple. There are a lot of cultural relics and historic sites in the project area, mainly involving in Wugong County Wugong Town God's Temple and Xunyi County Chengguan Town Taita.

3.5 Investigation of Current Situation of Project Area Infrastructure and Environmental Sanitation

The field investigation indicates that current situation of the water supply, road drainage and sewage treatment in the proposed project site is seen in Table 3.5-1. The current situation and photo of proposed project environmental sanitation are seen in Table 3.5-2.

Table 3.5-1 Water Supply and Drainage and Sewage Treatment Current Situation in the Proposed Project Site

County or District		Current Situation of Water Supply	Current Situation of Road Drainage	Current Situation of Sewage Treatment
Yanliang District		Shuibei has the water plant with 10 wells, two impounding reservoirs with capacity of 2000m^3 for 10000t/d. It is planned that the water plant will supply water to Guanshan and Wutun Town, but the water supply pipe network has not be laid. Qujia water source has 10 wells, a reservoir of 6000 m^3 with maximum water supply capacity of 5000t/d,	Hongyao Road, Zhenguan Road, West Ring Road, Guangsan Road, North Guangyang Street rainwater and sewage flow together, permeate underground and evaporate.	The domestic sewage is treated in Yanliang District sewage treatment plant with process of DE oxidation ditch, and then drains into Shichuanhe River after treatment.
Chencang District		Chencang District Water Supply Company has water supply of groundwater, 6 water supply wells with capacity of 29500 m^3/d. The enterprise and public institutions have their own water source with 78 water wells and capacity of 60000 m^3/d.	Dazhong Road, West Shuilian Road, South Peijiu Road and Dongxin Road rainwater and sewage flow together, drain in the open channel that is often blocked by garbage, and the water quality is poor. The sewage flows on Chencang Avenue and will be treated in the sewage treatment plant.	The domestic sewage is Baoji Chencang District Guozhen Townsewage treatment plant with process of improved SBR secondary biological method, and then drains into Weihe River after treatment.
Wugong County		The water source is the groundwater. 6 water wells are available, where it is aged in water supply pipe, disordered in pipe network and unacceptable in water quality.	Renyi Avenue, East Street, South Nanguan Street, existing Xi'an-Baoji north road river system has not been improved and the sewage drains into Qishuihe River.	The domestic sewage without treatment drains into the street open channel through Yangling Road drainage network, finally into Qishuihe River.
Xunyi County	Chengguan Town	Built in 1980s, the water supply plant has actual output of 1300 m^3/d. The water source is 4 wells in south bank of Pahe River. Cuihe Village water supply plant, established in 2007, has supply capacity of 4500m^3/d, and its source is from the water in irrigation hydro-junction in Zhifang village at upstream of	South Street, North Street, Taita Road and Yangguan Avenue rainwater and sewage flow together, the channel is blocked seriously, and discharge is not smooth. The sewage, when it discharges	The domestic sewage is treated in Xunyi Countysewage treatment plant that has treatment capacity of 6000 m^3/d. T he sewage treatment plant is proposed for expansion. Now the sewage discharges into the sewage treatment

		Pahe River at east of county seat, some villages have the well in their yard.	into the sewage plant, is stored temporarily in the storage pool.	plant for storage without treatment.
	Zhitian Town	Zhitian Town is supplied by Zhitian water supply project with maximum output of 6545m^3/d.	Zhitian Street and New Zhitian Street rainwater and sewage flow together and drains into the side ditch, and finally into the ditch on the plain.	Zhitian TownThe domestic sewage without treatment drains into the ditch on the plain directly.
Chunhua County		Runzhen Town is supplied by Becun village water supply project with source of groundwater. 7 water wells supply water of 2640m^3/d. The water supply pipe network has not covered some self-contained water wells.	Chuangxin Road, North Chuangye Road, Huimin Road, Chuanye Avenue and Runbu Road have no drainage.	The domestic sewage without treatment drains into the ditch.
Chengcheng County		Chengbei water plant and 2nd water plant supply water with actual output of 10000m^3/d. The tap water coverage is 58.8% but it doesn't cover some self-contained well.	Qingzheng Street, Dongliu Road and Changning Street rainwater and sewage flow together. The drainage is not improved and the sewage flows into the sewage treatment plant.	The domestic sewage is treated in Chengcheng County sewage treatment plant with water inflow of 10000 m^3/d and treatment process of CASS. The treated sewage drains into Dayuhe River.
Yintai District	Yintai Beicheng	The water is supplied from Tongchuan Water Plant with source of surface water in Qishuihe River.	Weier and Weiliu Road have no sound drainage, and no drain pipe network.	The domestic sewage is treated in Tongchuan sewage treatment plant with treatment capacity of 35000 m^3/d and SBR biochemical process. The acceptable treated sewage drains into Qishuihe River.
	Chenlu Town	The water is supplied from Rural Safe Drinking Water Project and can be guaranteed.	The sewage drains in to the road channel, and most branches does not have drainage, and the rainwater flows along the road.	The sewage without treatment drains along the road, permeates underground or evaporates.
Hantai District		Puzhen Town is supplied from Hanzhong Water Supply Plant and Puzhen Town Water Supply Plant with water source from Hanjiang River. Both water plants have output of 20000 and 10000 m^3/d respectively. The water supply pipe network has been laid.	East Street, West Street, New South Street, Lianfeng Road, Lianhua Road, Puhan Road and old town lane does no t have sound drainage, the sewage here drains into the ditches in the town area, and finally into Hanjiang River.	The domestic sewage without treatment drains into the ditch in the town, finally into Hanjiang River. The industrial waste water after being treated acceptable by enterprise drains.
Hanyin County		North Hanyin is supplied from Guanyinxia Water Plant with capacity of 5000 m^3/d and water	East extension of Fenghuang Avenue and Nanqu Road does	The domestic sewage is treated in Hanyin County sewage

	source of Guanyinhe River reservoir. South Hanyin is supplied from Lvyuan Water Supply Company with capacity of 000 m^3/d and water source of Yujiahe River, Damu Dam in Fenghuang Mountain. Yuehe River water plant has the self-contained water supply with capacity of 2000m^3/d and the source of Yuehe River.	not have sound drainage, and the rainwater and sewage drain into Yuehe River.	treatment plant with treatment capacity of 10000m^3/d and process of CAST. Without the drainage network, the domestic sewage drains into Yuehe River tributary.

Table 3.5-2 Current Situation and Photo of Proposed Project Main Environmental Sanitation

<table>
<tr><th>County or District</th><th>Main Environmental Condition</th><th colspan="2">Photo</th></tr>
<tr><td>Yanliang District</td><td>Currently, West Section of Hongyao Road is the asphalt road 40m wide and the east section has not been hardened. North Guangyang Street is the country road without hardening or drainage.</td><td> 
Current situation of east section of Hongyao Road</td><td> 
Current situation of North Guangyang Street</td></tr>
<tr><td rowspan="2">Chencang District</td><td rowspan="2">Currently, Dazhong Road is 8m wide with serious broken pavement and incomplete drainage, the waterlogging can be seen on the pavement. West Shuilian Road is 7m wide (including 3m open channel with cover plate), the open channel is often blocked. South Gate Road of Brewery is 5m wide (including 2m wide open channel), the drainage channel is often blocked by garbage seriously. The rainwater and sewage flows together on Dongxin Road.</td><td> 
Current situation of Dazhong Road</td><td> 
Current situation of West Shuilian Road open channel</td></tr>
<tr><td> 
Current situation of South Gate Road of Brewery open channel</td><td> 
Current situation of Dongxin Road drainage</td></tr>
</table>

<table>
<tr><td>Wugong County</td><td>The pavement of Nanguan Street and East Street has been broken seriously and the drainage is incomplete.</td><td> 
Current situation of Nanguan Street pavement</td><td> 
Current situation of East Street pavement</td></tr>
<tr><td>Xunyi County</td><td>Chengguan Town South and North Street, Taita Road, Zhitian Town Zhitian Street, New Zhitian Street have incomplete drainage, and the south section of New Zhitian Street has not been hardened.</td><td> 
Current situation of South Street drainage</td><td> 
Current situation of New Zhitian Street south section</td></tr>
<tr><td rowspan="2">Chunhua County</td><td rowspan="2">The lanes of major road such as Chuangxin Road, North Chuanye Road, Huimin Road and Chuanye Avenue have not been hardened, and are muddy.</td><td> 
Current situation of Chuangxin Road</td><td> 
Current situation of North Chuanye Road</td></tr>
<tr><td> 
Current situation of Huimin Road</td><td> 
Current situation of Chuanye Avenue branch road</td></tr>
<tr><td>Chengcheng County</td><td>The rainwater and sewage flow together on Qingzheng Street, Dongliu Road and Changning Street. Partial Huifu Street, Yangguang Street and Dongba Road have not been hardened.</td><td> 
Qingzheng Street combined rainwater and sewage</td><td> 
Current situation of Huifu Street pavement</td></tr>
</table>

		 Current situation of Yangguang Road Pavement	 Current situation of Dongba Road
Yintai District	Currently Weier-Weisi Road have pavement of 3m wide without hardening. No East Binhe Road exists, where it is the one-storey residence.	 Current situation of Weier Road	 Current situation of residence on East Binhe Road
Hantai District	East Street, West Street and old town lanes have incomplete drainage. Currently, north section of Lianfeng Road is 3m wide without hardening. No road exists in Lianhua Road and Beier Road, where it is the farmland now.	 Current situation of West Street	 Current situation of Lianfeng Road
Hanyin County	The pavement of is 3m wide without hardening, and east extension of Fenghuang Avenue has incomplete drainage.	 Current situation of Nanqu Road	 Current situation of East Extension of Fenghuang Avenue

3.6 That is associated with the project engineering overview of the survey

Along the road of this project, water supply and drainage facilities will be laid out; the main related works mainly include those related to water supply and drainage. For the description of the works, see Table 3.6-1.

Table 3.6-1: Table of Works Related to Water Supply and Drainage

Subproject area	Description of the works in the project	Related works		Correlation of the works
		Water supply works	Water drainage works	
Yanliang District	Hongyao Road extension works, Wutun Town road project, Zhenguan Road and Xihuan Road reconstruction project and the construction of the supporting water supply and drainage pipe network, trunk water transfer project from Shuibei Water Plant to Guangshan and Wutun	Water supply works of Shuibei Water Distribution Plant: the water supply plant has 10 water source wells, 2 water reservoirs of volume 2000m^3, with water supply capacity of 10000 m^3/d.	Yanliang Sewage Treatment Plant: adopting DE oxidation ditch treatment process with processing capacity of 25000 m^3/d; the current actual treatment scale is 15000 m^3/d, having been put into use.	Shuibei Water Plant can fulfill the water supply needs due to water consumption increase of the project. The Sewage Treatment Plant can hold the amount of the wastewater increased due to the project.
Chencang District	New construction of Longhai North Road, Beikai Road, and Heping Road; reconstruction of Dazhong Road, Shuilian West Road, Pijiu Nanmen Road, Dongxin Road, and Central Chencang Road, as well as construction of the supporting	Shitou River Water supply project for short term: water supply capacity: 20000 m^3/d, for which the interface has been reserved on Central Chencang Road of Guo Town.	Chencang Guo Town Sewage Treatment Plant of Baoji City: adopting the modified SBR II biochemical wastewater treatment process, with design capacity up to 50000 m^3/d and actual treatment capacity 30000	This project increases water demand for 8000 m^3/d, which can be fulfilled by Shitou River Water Supply Project.

		pipelines, and water supply and drainage lines.		m^3/d.	Due to this project, wastewater amount increases by 6000 m^3/d, which can be held by the Sewage Treatment Plant.
Wugong County		Reconstruction of the main roads, streets, lanes etc of the old town section; construction of the supporting water supply & drainage pipe works and 1 water supply plant.	Construction of this project	Wugong Town Sewage Treatment Plant: to be constructed by applying for the national construction fund; adopting class II biochemical treatment process, having treatment scale 5000 m3/d, expected to put into operation by 2015.	After the Sewage Treatment Plant is completed, it can hold the wastewater generated by the overall project.
Xunyi County	Chengguan Town	Reconstruction of Beida Street, Nandajie Street, Taita Road, Donghedi Road, Songjiagou Xihedi Road, Nanzhigou Xihedi Road, and Yangguan Blvd and the supporting water supply & drainage construction.	2 water supply plants: the design water supply capacity of Central County Water Plant is 2500 m^3/d, the actual water supply capacity is 1300 m^3/d; the water source is the 4 big wells on the south bank of Linpa River; the design water supply capacity of Cuihe Village Water Plant is 4500m^3/d, sourced from Pahe River.	Xunyi County Sewage Treatment Plant: of treatment scale 6000m^3/d; the actual holding capacity is 1650m3/d. Now it's proposed for reconstruction, the reconstructed work will adopt CASS+UV disinfection process of processing scale 12000 m^3/d.	Water need increase due to this project is 1956m^3/d; the present water supply plant can fulfill the demand. Wastewater increase due to this project is 1564m^3/d, After the Sewage Treatment Plant has been reconstructed, it can hold the

					volume of wastewater increased.
	Zhitian Town	Road reconstruction for Zhitian Street and Zhitian New Street as well as the construction of the supporting water supply and drainage facilities.	Zhitian water supply project: the max daily water supply scale is 6545m^3/d, sourced from Pahe River; the main roads have been laid with the main water supply pipelines.	Raise fund otherwise to construct WSZ-AO small-scale buried wastewater treatment facilities to treat the domestic sewage, with treatment capacity of 80m^3/h.	The max water consumption volume of the town area is 2390m^3/d, which can be fulfilled by Zhitian Water Supply Project.
					Wastewater increase due to this project is 1440m^3/d, which can be held by small-scale wastewater treatment facilities.
Chunhua County	Runzhen Town	Road reconstruction including Chuangxin Road, Chuangye North Road, Huimin Road, Chuangye Blvd, street lanes, Runwu Road, Runbu Road, and Zhenxing Blvd and construction of the supporting water supply & drainage facilities;	2 sets of water supply sources: Beichun Water Supply Station, having 7 wells with water supply capacity up to 2640 m^3/d. It's planned to construct Tongshengou Water Supply	Chunhua County Sewage Treatment Plant adopts CASS+ air floatation process, with design processing scale up to 8000 m^3/d and actual discharge capacity up to 3000m^3/d; the max water discharge capacity is	Water supply increase due to this project is 1000 m^3/d, which can be fulfilled by the water supply project.

		construction of the trunk wastewater pipe from Runzhen Town to the county city.	Project sourced from Tongshengou, with water supply capacity up to 9120m^3/d.	6000 m^3/d.	Wastewater increase due to this project is 800 m^3/d, which can be held by the Sewage Treatment Plant.
Chengcheng County	Chengguan Town	New construction of Huifu Street, Yangguang Road, and Dongba Road; reconstruction of Qingzheng Street, Dongliu Road, and Changning Street and the supporting water discharge pipe network	Not applicable for this project	Chengcheng County Sewage Treatment Plant adopts CASS treatment process, with design capacity up to 20000 m^3/d; with actual water inlet capacity up to 12000 m^3/d.	Wastewater increase due to this project is 6000 m^3/d, which can be held by the Sewage Treatment Plant.
Yintai District		New construction of the north section of Binhe West Road, Binhe East Road, Weiyi Road-Weiliu Road and the supporting water supply & drainage facilities; reconstruction of Napo – Chenlu Highway and Ceramics Factory – Chenlu Highway	Not applicable	Tongchuan Sewage Treatment Plant, adopting SBR biochemical method of scale 35000 m^3/d; with actual water inlet capacity about 18000 m^3/d.	Wastewater increase due to this project is 1683m^3/d, which can be held by the Sewage Treatment Plant.
Puzhen Town Hantai District		Reconstruction of the north section of Lianfeng Road, Lianhua Road, Bei'er Road and the street lanes of the old town sections; as well as the supporting water supply & drainage facilities.	Not applicable	Construct one Sewage Treatment Plant in the new area in the east of the city, with treatment capacity up to 200,000 m^3/d of 3 years of construction term, having been commenced.	After the Sewage Treatment Plant has been completed, the domestic sewage of the overall Puzhen Town will be discharged to it.

Chengguan Town of Hanyin County	Construction of Nanqu Road, the west extension section of Binhe South Road, and the east extension section of Fenghuang Blvd and the supporting water supply & drainage facilities; construction of the water supply pipes from Beicheng Street to Yuehe Logistic Park.	The north section of the town is supplied with water from Guanyinxia Water Plant at a capacity of 5000m^3/d, sourced from Guanyinhe Reservoir. The south section of the town is supplied from Luyuan Water Supply Company at a capacity of 3000 m^3/d, sourced from Damuba Yujia River of Fenghuang Mountain. Yuehe Water Plant is used as a backup water source, of water supply scale up to 2000 m^3/d, sourced from Yuehe River.	Hanyin County Sewage Treatment Plant, adopting CAST process, of design scale up to 20000 m^3/d; the actual water inlet capacity is 10000 m^3/d.	The present water need is about 7100m^3/d, which can be fulfilled. The planned water consumption for 2015 is 17000 m^3/d, which cannot be fulled, thus the capacity of the water supply project needs to be expanded.
				Wastewater increase due to this project is 6300 m^3/d, which can be held by the Sewage Treatment Plant.

3.7 Survey of the Present Environment Quality of the Project Area

The environmental quality of the project has three main sources of information: 1, local environmental quality routine monitoring data; 2, the relevant local environmental quality monitoring project status information, 3, the project commissioned environmental monitoring data.

3.7.1 Present Conditions of Air Environment Quality

The items to be surveyed for the present air quality conditions of the project include SO_2, NO_2, PM_{10} etc. For the data source, see Table 3.7-1; Table 3.7-2 gives the statistical result.

Table 3.7-1: Data Source of Present Conditions of the Environment Air Quality

Data name	Source	Time
The data on the present air environment conditions of Yanliang District	The environment assessment monitoring of Kingdeer Project in Yanliang District	2013.5.20-2013.5.26
The data on the present air environment conditions of Chencang District	The environment assessment of Lingyun storage battery project	2012.6.19-2012.6.26
The data on the present air environment conditions of Wugong County	The environment assessment monitoring of gas storage peak-shaving pipe project on Guangzhou Ring Road	2011.4.24-2011.4.30
The data on the present air environment conditions of Xunyi County	The environment assessment of Xunyi County – Malanchuan Class II Tourist Highway Project	2012.7.11-2012.7.17
The data on the present air environment conditions of Chunhua County	The environment air quality bulletin of Chunhua County	Oct. 2013
The data on the present air environment conditions of Chengcheng County	The environment air quality bulletin of Chengcheng County downtown section	The fourth quarter of 2012
The data on the present air environment conditions of Yintai District	The environment quality bulletin of Tongchuan City	2011
The data on the present air environment conditions of Hantai District	The environment quality bulletin of Hanzhong City	2012
The data on the present air environment conditions of Hanyin County	Monitoring of the present conditions of the regional environment quality	Jul. 2013

Table 3.7-2: Statistical Results of the Survey of the Environment Air Quality Present Conditions (mg/m^3)

Proposed place for the subproject	SO_2		NO_2		PM_{10}
	Hour value	Daily average	Hour value	Daily average	Daily average
Yanliang District	0.014-0.065	0.031-0.045	0.019-0.064	0.025-0.049	0.082-0.195
Chencang District	0.022-0.030	0.017-0.027	0.016-0.024	0.017-0.022	0.076-0.087
Wugong County	0.022-0.029	0.024-0.026	0.026-0.035	0.027-0.034	0.087-0.137

Xunyi County	0.008-0.039	0.020-0.031	0.006-0.037	0.012-0.025	0.106-0.146
Chunhua County	/	0.018-0.033	/	0.013-0.028	0.04-0.125
Chengcheng County	/	0.116-0.148	/	0.029-0.042	0.058-0.150
Yintai District	/	0.001-0.222	/	0.003-0.136	0.005-0.685
Hantai District	/	0.016-0.03	/	0.036-0.074	0.050-0.224
Hanyin County	-	0.015-0.019	-	0.017-0.021	0.040-0.048
Class II standard value	≤0.5	≤0.15	≤0.24	≤0.12	≤0.15

From Table 3.7-2, we can see that, for the air quality indexes of the proposed place for this project, except the PM10 value in Yanliang District and Yintai District exceeds the grade II standard of Environment Air Quality Standard (GB3095-1996), the other indexes all meet the grade II standard of Environment Air Quality Standard (GB3095-1996). The reason for the exceeding may be related to the regional climate and the loess landform characteristics.

3.7.2 Present Conditions of Surface Water Environment Quality

Items to be surveyed for the present conditions of surface water environment quality include PH value, COD, and ammonia nitrogen etc. For the data source, see Table 3.7-3; see Table 3.7-4 for the results.

Table 3.7-3: Data Source for Surface Water Environment Quality

Data name	Source	Time
Present water quality conditions of Shichuan River	The environment assessment monitoring of gas storage peak-shaving pipe project on Guangzhou Ring Road	2011.6.4-2011.6.5
Present water quality conditions of Chencang Section of Weihe River	The environment air quality bulletin of Baoji City	2011
Present water quality conditions of Qishui River (Wugong)	The environment assessment monitoring of gas storage peak-shaving pipe project on Guangzhou Ring Road	2011.4.26-2011.4.27
Present water quality conditions of Sanshui River (Xunyi)	The environment assessment monitoring of Xunyi County - Zaochi Highway	2012.7.15-2012.7.17
Present water quality conditions of Dayu River (Chengcheng)	Environment quality profile of the water source area for Chengcheng County	2012
Present water quality conditions of Qishui River (Tongchuan)	Environment quality bulletin of Tongchuan City	2011
Present water quality conditions of Puzhen Town Section of Hanjiang River	Environment quality bulletin of Hanzhong City	2012
Present water quality conditions of Yuehe River	Monitoring of the present regional environment quality conditions	Jul. 2013

Table 3.7-4: Statistical Result of the Survey of the Present Surface Water Environment Quality Conditions (except mg/L, PH)

River section surveyed	PH	COD	Ammonia nitrogen
Yanliang Section of Shichuan River	7.53-7.58	28.4-43.0	2.156-3.097
Chencang Section of Weihe River	7.66-7.72	13-23	0.209-0.842
Qishui River (Wugong)	7.65-7.84	40	1.344-1.355
Sanshui River (Xunyi)	8.06-8.07	6.2-8.0	0.129-0.134
Dayu River (Chengcheng Section)	8.19-8.72	5.0	0.225
Qishui River (Tongchuan)	6-9	>15	>0.5
Hanjiang River (Puzhen Section)	6-9	≤15	≤0.55
Yuehe River	7.25	3.4	0.466
Class III Standard	6-9	≤20	≤1.0
Class I Standard	6-9	≤15	≤0.15
For Qishui River (Tongchuan), class I standard for water is executed; class III standard for water is executed for other river sections.			

From Table 3.7-4, it can be seen that for the indexes for the Survey of the Present Surface Water Environment Quality Conditions, the PH value of each river section meet the standard; river sections of exceeded COD value include the Chencang Section of Shichuan River and Weihe River, Qishui River (Wugong) and Qishui River (Tongchuan); those of exceeded ammonia nitrogen value include Shichuan River, Qishui River (Wugong), and Qishui River (Tongchuan) etc; the rest river sections all meet the applicable standards; therefore, the water quality of Shichuan River, Qishui River (Wugong), Qishui River (Tongchuan), and Chencang Section of Weihe River does not meet the water quality requirements.

3.7.3 Present Sound Environment Conditions

The sound environment quality is monitored by Luonan County Monitoring Station in Nov. 2013. See Attachment 4 for the monitoring report.

(1) Distribution of the monitoring points

In the assessment, it is proposed to select representative areas around the project to set up sound environment monitoring points to monitor the present sound environment conditions. See Table 3.7-5 for the monitoring points distributed.

Table 3.7-5: Present Sound Environment Monitoring Points Distribution List

S/N	Subproject area	Monitoring point place	Distance to the project (m)	Remark
1#	Yanliang District, Xi'an City	Beitun Middle School	30 south of Hongyao Road	Villages on the north and south sides of Hongyao Road
2#		Beitun Central Primary School	30 north of Hongyao Road	
3#		Beitun Kindergarten	30 north of Hongyao Road	
4#		Sanzhang Village	8 south of Hongyao Road	

5#		Liqiao Village	8 south and north of Hongyao Road respectively	
6#		Donglai Village	8 north of Hongyao Road	
7#		Xinfeng Village	8 south of Hongyao Road	
8#		Gengxi Village	8 south and north of Hongyao Road respectively	
9#		Gengdong Village	8 south and north of Hongyao Road respectively	
10#		Xinmin Village	8 north of Hongyao Road	
11#		Guangyang Village	8 south and north of Guangyang Central Street respectively	Village on the north and south sides of Guangyang Central Street
12#	Chencang District, Baoji City	Shuilianzai Village	5 south and north of Shuilian West Road respectively	Village on the east and west sides of Shuilian West Road
13#		Dazhong Village	8 east and west of Dazhong Road respectively	Village on the east and west sides of Dazhong Road
14#		Gaojialeng Village	10 north of Longhai North Road	Village on the north side of Longhai North Road
15#	Wugong Town, Wugong County, Xianyang City	Daxuejie Primary School	50 north of Dongjie Street	School on the north side of Dongjie Street
16#	Chengguan Town, Xunyi County, Xianyang City	Taita Neighborhood for Low-income Families	30 north of Taita Road	Residential area on the north side of Taita Road
17#	Runzhen Town, Chunhua County, Xianyang City	Runzhen Town Middle School	8 south of Chuangye Blvd	School on the south side of Chuangye Blvd
18#		Runzhen Town Primary School	8 south of Chuangye Blvd	School on the south side of Chuangye Blvd
19#		Runzhen Town Kindergarten	8 north of Chuangye Blvd	School on the north side Chuangye Blvd
20#	Chengguan Town, Chengcheng County, Weinan City	Chenghe Mining Bureau Middle School	8 north of Dongliu Road	School on the north side of Dongliu Road
21#		Chenghe Mining Bureau Primary School	8 north of Dongliu Road	
22#		Chenghe Mining Bureau Kindergarten	8 north of Dongliu Road	
23#		Yangjiazhuang Village	8 east and west of Huifu Street respectively	Villages gone through by Huifu Street
24#		Zengjia Village	8 east and west of Huifu Street respectively	
25#	Yintai North Town, Yintai District, Tongchuan City	Shunhe Village	50 west of Binhe West Road	Village on the west side of Binhe West Road
26#	Puzhen Town, Hantai District, Hanzhong City	Mosque on Lianfeng Road	15 east of Lianfeng Road	Religious activity places on Lianfeng Road

27#		Lianfeng Village	8 east of Lianfeng Road	Residential area on the east and west sides of Lianfeng Road
28#		Xinxiang Estate	8 west of Lianfeng Road	
29#	Chengguan Town, Hanyin County, Ankang City	Zhongyan Village	15 west of Nanqu Road	Village on the west side of Nanqu Road
30#		Huaba Village	50 east of Nanqu Road	Village on the east side of Nanqu Road
31#		Jiefang Village	15 east of Nanqu Road	Village on the east side of Nanqu Road

(2) Sound environment quality monitoring results

For the sound environment quality monitoring results of the project, see Table 3.7-6.

Table 3.7-6: Sound Environment Monitoring Results List (dB(A))

S/N	Day time		Night time		Standard value	
	11.5	11.6	11.5	11.6	Day time	Night time
1#	46.2	45.3	37.1	36.9	60	50
2#	46.5	44.9	36.2	36.0		
3#	45.7	46.1	37.1	36.5		
4#	42.4	46.7	39.0	38.7		
5#	46.1	47.0	38.2	39.4		
6#	47.3	47.4	40.1	39.7		
7#	46.9	46.8	39.0	39.4		
8#	47.2	45.9	38.5	39.1		
9#	46.5	47.1	40.2	40.3		
10#	47.0	46.7	41.0	39.5		
11#	45.6	44.8	36.1	35.2		
12#	44.9	45.5	35.5	36.7		
13#	45.8	44.9	39.2	39.6		
14#	46.8	47.6	40.1	38.4		
15#	47.1	46.9	39.7	39.2		
16#	45.3	45.2	34.7	34.5		
17#	42.6	44.1	35.2	34.9		
18#	46.8	48.1	42.7	42.3		
19#	43.5	45.2	35.9	36.1		
20#	44.6	45.4	36.5	35.8		
21#	44.1	44.8	35.2	36.4		
22#	46.3	48.0	38.7	39.2		

23#	45.9	46.1	40.1	41.0		
24#	46.0	47.8	39.0	39.6		
25#	45.9	46.3	37.1	36.5		
26#	46.4	47.0	36.8	35.7		
27#	46.3	45.9	35.3	36.6		
28#	47.0	48.1	36.5	37.4		
29#	45.5	46.6	40.2	38.5		
30#	46.3	45.8	41.7	40.8		
31#	43.9	44.0	39.3	41.1		

Table 3.7-6 shows that the sound environment quality of the assessment area meets the standard for class 2 area of Sound Environment Quality Standard.

3.8 Environment Object Concerned

3.8.1 Environment Protection Object for Surface Water

The water environment protection object involved with the project mainly refers to the final accepting river of the water discharge of the project, see Table 3.8-1.

Table 3.8-1: Statistical Form of the Water Environment Protection Object Involved with the Project

Subproject place			Protection object	Location relations with the subproject areas	Water quality object
Xi'an City	Yanliang District	Wutun Town	Shichuan River	2.2km east of the project area	III
Baoji City	Chencang District	Guo Town, Qianwei Subdistrict Office	Weihe River	1.6km south of the project area	III
Xianyang City	Wugong County	Wugong Town	Qishui River	0.6km east of the project area	III
	Xunyi County	Chengguan Town, Zhitian Town	Sanshui River	Within the project area	III
Weinan City	Chengcheng County	Chengguan Town	Dayu River	8.2km east of the project area	III
Tongchuan City	Yintai District	Yintai North Town	Qishui River	Within the project area	I
Hanzhong City	Hantai District	Puzhen Town	Hanjiang River	3.1km south of the project area	III
Ankang City	Hanyin County	Chengguan Town	Yuehe River	Within the project area	III

3.8.2 Other Environment Object Concerned

Other environment objects concerned for the project mainly include the objects concerned for project sound environment and social environment, such as sensitive objects as schools etc, villages, and key cultural relics protection unit etc; see Table 3.8-2.

Table 3.8-2: Statistical Form of the Sound Environment Protection Object Involved with the Project

Subproject place			Protection object	Location relations with the subproject areas	Water quality object
Xi'an City	Yanliang District	Wutun Town	Beitun Central Primary School	30m north of Hongyao Road	Sound environment protection object
			Beitun Middle School	30m south of Hongyao Road	
			Beitun Kindergarten	30m north of Hongyao Road	
			Beitun Subdistrict Office	8m to the south and north sides of Hongyao Road respectively	Sound environment, Social environment Object concerned
			Sanhe Village	8m to the south and north sides of Hongyao Road respectively	
			Xixiang Village	8m to the north side of Hongyao Road	
			Hongfeng Village	8m to the south side of Hongyao Road	
Baoji City	Chencang District	Qianwei Subdistrict Office	Shuilianzai Village	5m to the east and west sides of Shuilian West Road respectively	
			Dazhong Village	8 m to the east and west sides of Dazhong Road respectively	
			Gaojialeng Village	10m to the north side of Longhai North Road	
Xianyang City	Wugong County	Wugong Town	Daxuejie Primary School	50m to the north side of Dongjie Street	Sound environment protection object
			Cheng Huang Temple	8m to the north side of Dongjie Street	Provincial cultural relics
			residents on both sides of Nanguan Central Street	15m to the east and west sides of Nanguan Central Street respectively	Sound environment, Social environment Object concerned
	Xunyi County	Chengguan Town	Taita Neighborhood for Low-income Families	30m to the north side of Taita Road	
			Taita	100m to the north side of Taita Road	National cultural relics
	Chunhua County	Runzhen Town	Runzhen Town Primary School	8m to the south side of Chuangye Blvd	Sound environment protection object
			Runzhen Town Middle School	8m to the south side of Chuangye Blvd	
			Runzhen Town Kindergarten	8m to the north side of Chuangye Blvd	
Weinan City	Chengcheng County	Chengguan Town	Chenghe Mining Bureau Middle School	8m to the north side of Dongliu Road	
			Chenghe Mining Bureau Primary School	8m to the north side of Dongliu Road	
			Chenghe Mining Bureau Kindergarten	8m to the north side of Dongliu Road	

			Yangjiazhuang Village	Huifu Street goes through the village, the min distance is 8m	Sound environment, Social environment Object concerned
			Zengjia Village	Huifu Street goes through the village, the min distance is 8m	
Tongchuan City	Yintai District	Yintai North Town	Shunhe Village	50m to the west side of Binhe West Road	
Hanzhong City	Hantai District	Puzhen Town	Mosque on Lianfeng Road	15m to the east side of Lianfeng Road	
			Lianfeng Village	8m to the east side of Lianfeng Road	
			Xinxiang Estate	8m to the west side of Lianfeng Road	
Hanzhong City	Hanyin County	Chengguan Town	Zhongyan Village	15m to the west side of Nanqu Road	
			Huaba Village	30m to the east side Nanqu Road	
			Jiefang Village	15m to the east side of Nanqu Road	
			Taiping Village	10m to the west side of the west extension section of Binhe South Road	
			Lianfeng Village Mosque	15m to the east side of Lianfeng Road	Religious activity place

For the pictures of the main cultural relics and religious activity places involved with the proposed project place, see Table 3.8-3:

Table 3.8-3: Pictures of the Cultural Relics Sites and Religious Activity Places around the Project

Name	Pictures	
Wugong Town Cheng Huang Temple		
	Wugong Cheng Huang Temple – Temple Fair	**Wugong Cheng Huang Temple – Culture Relics Identity Tablet**

Xunyi County Taita Tower		
	Xunyi Taita Tower	**Xunyi Taita Tower – Culture Relics Identity Tablet**
Lianfeng Village Mosque		
	Lianfeng Village Mosque - Entrance	**Mosque – External View**

4. Analysis of the World Bank's Safeguard Policies

4.1 Screening of the Safeguard Policies

In this environment assessment, the correlation between the project and the World Bank's safeguard policies/procedures is analyzed, the results are as shown in Table 4.1-1.

Table 4.1-1: Correlation with the World Bank's Safeguard Policies/Procedures

S/N	Policies/procedures	Result
1	World Bank's Business Policies/Procedures "Environment Assessment" (OP/BP4.01)	Related
2	World Bank's Business Policies/Procedures "Natural Habitat" (OP/BP4.04)	Not related
3	World Bank's Business Policies/Procedures "Pest Management" (OP4.09)	Not related
4	World Bank's Business Policies/Procedures "Ethnic Minorities" (OP/BP 4.10)	Not related
5	World Bank's Business Policies/Procedures "Material Culture Resources" (OP4.11)	Related
6	World Bank's Business Policies/Procedures "Involuntary Resettlement" (OP/BP4.12)	Related
7	World Bank's Business Policies/Procedures "Forestry" (OP4.36)	Not related
8	World Bank's Business Policies/Procedures "Dam Safety" (OP/BP4.37)	Not related
9	World Bank's Business Policies/Procedures "International Watercourses" (OP7.50)	Not related
10	World Bank's Business Policies/Procedures "Projects in Dispute Areas" (OP7.60)	Not related
11	World Banks Procedure "Information Disclosure" BP 7.15	Related

4.2 Evaluation and Analysis of the Safeguard Policies

(1) Environment assessment (OP4.01)

Through analysis of the type, location, sensitivity, scale, the characteristics and size of the potential environment impact, it can be seen that the proposed project will not produce major negative environment impact. According to the requirements of the World Bank's Safeguard Policies for environment assessment (OP4.01) regarding environment screening and classification, this project is classified as Class B project.According to the requirements of the World Bank's Safeguard Policies for environment assessment (OP4.01), the environment assessment contents of this project include predictive assessment of the potential environment impact and risks, analysis of the alternatives of the project, mitigation measures for negative environment impacts and the safeguard measures for favorable environment impacts, environment management and monitoring plan etc.

(2) Nature habitat (OP4.04)

The project is mainly in township areas and rural areas; the vegetation of the surrounding areas simply belongs to artificial farmlands, forests; and areas are densely populated, with frequent human activities and less wild animals. For the road sections and bridges goes over watercourses, the construction wastewater shall be recycled to the most; the small amount of wastewater discharged may cause impact to the water quality of local river sections. After the project is completed, the impact to the river water quality is less. Therefore, the change of water quality caused by engineering construction and operation has minor impact to the related fishes and to the aquatic ecosystem. Therefore, the World Bank's "Natural Habitat" policy is not applicable to this project.

(3) Pest management (OP 4.09)

Implementation of the project is not involved with use of synthetic chemical pesticides and agricultural chemicals. Therefore, the World Bank's "Pest Management" police is not applicable to this project.

(4) Ethnic minorities (OP/BP 4.10)

According to the survey, the proposed project place does not belong to the accumulation area of ethnic minorities. Therefore, the World Bank's "Ethnic Minorities" police is not applicable to this project.

(5) Material culture resources (OP/BP 4.11)

According to the cultural relic distribution data of the project counties and districts and as verified through the field survey jointly carried out with the related personnel of the cultural relic protection department of the related counties (cities), Although not involved in a variety of material and cultural resources within the Bank's policy referred to the scope of the project area, but the project is surrounded by a number of material and cultural resources distribution. In this case, the World Bank's "Cultural Relic Resource" policy is applicable to this project.

Considering the possibility of existence of underground cultural relics, the assessment requires that in the construction phase of the project, the construction must be stopped immediately once any underground cultural relic is discovered, so as to protect the site and timely and report to the competent cultural relic departments. The construction shall be restored after authentication and treatment of the cultural relic department. In the environment management plan, the corresponding savage and protection measures shall be proposed according to the national cultural relic protection laws and regulations as well as the advice of the cultural relic protection department.

(6) Involuntary resettlement (OP4.12)

Total land area to be acquired and occupied for construction of this project is 124.94 hm^2, all belonging to permanent land occupation and mainly for the subgrade. There are 9 townships and 29 villages will be affected by the land acquisition; totally 3530 people of 390 households will be affected by land acquisition resettlement, in which 2223 people of 55 households will be affected by land acquisition and 1307 people of 335 households will be affected by resettlement; the building removal area is 71527.45m^2. Therefore, the World Bank's involuntary resettlement policy (OP4.12) is applicable to this project.

Regarding the resettlement and land occupation due to this project, Shaanxi Office for Projects Utilizing Foreign Loans has entrusted Shaanxi Academy of Social Sciences to carry out social impact assessment; it has drawn up the Resettlement Action Plan (RAP) as required in Involuntary Resettlement (OP4.12), which totally restores the life of the resettled residents and has their losses sufficiently compensated, after which their living standard is improved instead of being reduced. For the specific contents, please refer to Resettlement Action Plan

for the Township Infrastructure Construction Projects of Shaanxi Province Funded by Loans of the World Bank (RAP). For this project, the related organization will supervise the execution of the Resettlement Action Plan (RAP).

(7) Forestry policy (OP/BP 4.36)

This project is not involved with any engineering contents and activities that may cause major change and deterioration of the forests and key habitats. Therefore, the World Bank's "Forestry Policy" is not applicable to this project.

(8) Dam safety (OP/BP 4.37)

This project is not involved with reservoirs and dams.

(9) International watercourse (OP/BP 7.50)

This project is not involved with international watercourses.

(10) Project in dispute areas (OP/BP 7.60)

The proposed place of this project is not in any known dispute area.

(11) World Bank's procedure Information Disclosure (BP 7.15)

During implementation of this project, it's necessary to disclose the information and carry out public consultations. Therefore, the World Bank's "Information Disclosure" procedure is applicable to this project.

Regarding the requirements of Information Disclosure (BP 7.15) by the World Bank, the assessment, by combining the requirements of Intrim Measure for Public Participation in Environment Impact Assessment (HF [2006]28), requires for the necessary information disclosure and public consultations during the assessment process, for details, please refer to "Public Participation" section of the report.

5. Environment Impact Predictive Assessment and Mitigation Measures

5.1 Impact on Water Environment

The wastewater produced in the construction period of this project mainly includes wastewater produced for construction of road and pipe network construction and domestic sewage by the construction personnel; the construction wastewater includes the mud flushing effluent by cleaning the concrete mixing plants, water by flushing the construction materials and the vehicles etc containing oil dirt produced in construction of the foundation works; the main contaminants include SS and petroleum products of concentration at 3000mg/L and 30mg/L respectively. The main pollutants for the domestic sewage mainly include BOD_5, COD, BOD_5, and COD, with concentration at 200mg/L and 400mg/L respectively. In addition, construction of the roads and pipe network may involve with crossing of some small rivers, improper construction or management may raise impact to the surface water.

5.1.1 Environment Impact and the Mitigation Measures in Construction Period

1. Environment Impact

(1) Domestic sewage

Compared with the construction camp and construction personnel distribution characteristics of urban road reconstruction projects, road reconstruction, pipe network layout and well construction projects, the construction personnel will mostly hire the residential houses along the line of the project during the construction period, for which no temporary production and living site, toilets, and work shed are needed. The domestic sewage will generally drained to the local village and towns for treatment, thus producing minor impact to the surface water environment.

A small number of small-scale camps will be designed just near some new roads to be constructed; since the domestic sewage produced by the construction personnel is less and sparsely distributed, latrine pits can be provided nearby, which shall be emptied timely to be farmyard manure. Domestic sewage shall not be drained to the outside; the impact to the water environment around the construction camp is minor.

(2) Production effluent

It's forbidden to directly drain the production effluent produced in the foundation construction period. For the mud flushing effluent by cleaning the concrete mixing plants during the foundation construction of the project, a sedimentation tank shall be provided; the deposited water can be used for spraying the road; the rest part of the deposited water will be drained to the nearby urban drainage pipe network; the water flushing the construction materials and vehicles contains pollutants mainly including SS and petroleum products with concentration at 3000mg/L and 30mg/L respectively; if no sedimentation and oil separation is carried out, the soil and water environment near the discharge port will be polluted locally.

In addition, there are totally 8 bridges are involved with the project construction, which include the existing bridge of Renyi Blvd in Wugong Town of Wugong County, 40m in length and 20m in width, striding over Qishui River (Wugong); there are also briges on Wei'er Road, Weisi Road, Weiwu Road, and Weiwu Road in Yintai North Town, Yintai District of Tongchuan City, which are 40m in length and 12 in width respectively, striding over Qishui River (Tongchuan); there are 2 bridges on Nanqu Road Chengguan Town of Hanzhong City

and Hanyin County, in which Bridge 1 in 25m in length and Bridge 2 is 100m in length, both are 30m in width. The bridge on the west extension section of Binhe South Road is 10m in length and 22m in width, striding over Yuehe River. The object of the water quality of both Qishui River and Yuehe River is Class III.

If the product effluent produced during construction of the bridges and the domestic sewage produced by the construction personnel are not collected unitarily for treatment, the surface water bodies will be affected. Since the bridges involved with this project are small ones without piers for large bridges, therefore, the water in the river will not be polluted by boring mud. In addition, waste oil produced in the construction may also pollute the water bodies. Formworks and mechanical oils will be used during the cast-in-place process of the superstructure of the bridges; leakage of the mechanical oils and direct draining of the waste oil to the water body will increase the petroleum indexes etc for the water quality of the water environment, leading to quality reduction of the water body quality.

Therefore, the wastewater produced in the construction process shall be collected collectively and treated centrally. Drainage of untreated wastewater will pose impact on the surface water bodies.

2. Mitigation Measures

According to the analysis of the proposed project, there is less wastewater produced during the construction period; in the assessment, just pertinent mitigation measures are proposed for the water environment:

(1) Domestic sewage of construction workers relying on the surrounding towns and villages existing facilities for processing.

(2) Management on production effluent shall be strengthened to minimize the production effluent during the construction (such as effluent leaked with concrete mixing, flushing water etc) and try to recycle the wastewater onsite.

(3) For the muddy water produced during the foundation construction process, a sedimentation tank shall be provided; the deposited water can be used for spraying the road; the water flushing the construction materials and vehicles contains pollutants as petroleum products, for which oil separation sedimentation pool shall be provided for treating the wastewater for recycling, the rest part of the wastewater will be drained to the drainage pipes nearby.

(4) Reconstruction of the storm water and wastewater pipeline and roads in Wugong County old town area of Xianyang City, Yintai District road construction of Weinan City, and Hanyin County rod construction of Hanzhong City will be involved with the surface water bodies such as Qishui River (Wugong), Qishui River (Tongchuan), and Yuehe River. The construction effluent shall be collected collectively and treated centrally; it’s forbidden to directly drain it to the watercourses.

(5) The construction material piles (cement, gravels etc) shall be covered properly to prevent contamination of surface water and underground water resulted from storm water scouring. After the works are completed, if no further work will be done, the piling site shall be landscaped and restored.

(6) It’s necessary to take measures to prevent earth and bulk construction materials from clogging the existing urban drainage pipelines.

(7) In the construction of the bridges on Wugong Town Renyi Blvd of Wugong County; Wei’er Road, Weisi Road, Weiwu Road, Weiwu Road, and Weiliu Road in Yintai North Town,

Yintai District of Tongchuan City; Nanqu Road in Chengguan Town of Hanyin County in Hanzhong City, and the west extension section of Binhe South Road, measures shall be taken to prevent the waste residuals, waste oils, and wastewater from entering the water body. After bridge construction is over, the construction site must be cleared up to prevent the construction wastes from flowing into the rivers along with storm water. At the same time, management shall be strengthened, construction materials such as bitumen, oils, chemicals etc shall be piled far away from river bed, provided with temporary canvas to prevent storm water scouring. In general, during the bridge construction, strengthening the field management of the construction plants and construction materials can avoid and relieve surface water environment pollution along the line due to the bridge construction.

5.1.2 Environment Impact and Mitigation Measures during Operation Period

This is a municipal infrastructure construction project without productive activities, the project itself will not produce wastewater; however, the water supply & drainage works of the project construction will change the original water consumption convention and style, collection and drainage pattern of storm water and sewage. Improvement of the water consumption convenience can increase the water consumption amount, leading to increase of domestic sewage amount. Construction of the pipe network for collecting storm water and wastewater will improve wastewater and sewage collection rate as well as the regional domestic sewage amount.

1. Environment Impact

(1) Impact by storm water discharge

Storm water is likely to form road runoff, whose water quality is mainly up to the pollution of the pavement; the various pollutants on the pavement are the most direct causes of the pollution. The type, size, and solubility of the deposits on the pavement will affect the draining process; the results of many field monitoring carried out at home and abroad show that the grain diameter of the deposited materials on the pavement also affects the drainage process; the capability of the runoff to scour and move the solid particles changes along with the grain sizes; the smaller the grain diameter is, the strongers the carrying capacity of the runoff will be. When the precipitation is less, the fine-grained materials can be removed along with the runoff; however, grains of bigger diameters are not likely to be carried away by the runoff.

Since the storm water collected from the pavement will enter storm water pipe, in which much sand and floating objects are contained; direct discharge may pollute the surface water, destroy the land and vegetation, as well as form landscape deterioration; thus, it’s necessary to simply remove the deposits and floating objects, discharge after treatment, significantly reduce the impact.

(2) Impact by sewage discharge

The sewage produced in the project will be treated in the regional sewage treatment plant and then discharge after being acceptable. The surrounding water body is category III and the sewage from the sewage treatment plant drains into the designated place, the treatment capacity of relevant project can meet the requirement of the project. The comprehensive analysis shows that the negative impact of the project can be controlled effectively, and will not produce serious impact on external environment, and the environmental impact is

acceptable.

It is noted that no sewage treatment plant has been completed in Wugong Town project point currently. However, it is told by the employer that initial work has been commenced for Wugong Town sewage treatment plant. It is recommended during assessment that the employer should consider the possibility of asynchronous construction of the sewage treatment plant and project to solve the environmental pollution problem due to improvement of water supply, waste water and sewage collection condition. The employer proposed that temporal biological oxidation pond will be used for sewage treatment before completion of the town area sewage treatment plant, and then the sewage will be treated in the town area sewage treatment plant in the future. Recommended construction units to strengthen coordination with relevant units to ensure synchronization built.

The stabilization pond, also called oxidation pond or geological pond, is the engineering facility for natural purification of sewage in algal-bacterial symbiotic system that not only remove various pollutants effectively in the sewage such as SS, BOD, COD and bacteria, but also has feature of low in investment and operation cost, simple in maintenance and repair and operation, thus is has been widely applied.

Study of sewage treatment with stabilization pond in China begins in 1950s and Chinese government encourages and supports application of stabilization pond. The National Environment Protection Administration has allocated RMB 3 million to fund Qiqihar for improvement and reconstruction of the stabilization pond. By 1990, 180 stabilization ponds have been completed with daily sewage treatment capacity of 1.9 million tons. For the stabilization pond can form composite ecological system and the sludge at bottom of pond can be used as concentrated fertilizer, the stabilization pond has been widely applied in treating the sewage produced in agriculture, animal husbandry and breeding industry, in particular application of stabilization pond in west region of China will be perspective for there is the small population.

According to the engineering practice of small town domestic waste water treatment with new stabilization pond written by Tang Wenqing and demonstration project of treating domestic sewage with stabilization pond in Xinhe Village, Xinxing Town, Yi'an County, the quality of water after treatment in the stabilization pond can meet requirement of national Sewage Integrated Discharge Standard second grade (GB8978-1996).

In addition, the EIA requires that the employer shall maintain close contact with designer to establish the proven stable design parameters and technical specification of stabilization pond according to the current environmental condition and engineering features to make sure

that quality of water discharged from the stabilization pond is stable and acceptable. The surface water body-Qishuihe River in Wugong Town project has been polluted, and the quality of water fails to comply with surface water category III requirement for water body function, the above analysis indicates shows the quality of water from the stabilization pond can meet the requirement for Standard for Farmland Irrigation Water Quality (GB5084-92) and can be available for irrigating the nearby farmland.

The completion of the project drainage network. having great significance in perfecting the local domestic sewage collection system, promoting the wastewater treatment rate, and improving the water environment conditions of the accepting rivers.

Generally, the concentration of COD in the domestic sewage is 250~500mg/L; that of BOD is 200~300mg/L; 25~40mg/L of ammonia nitrogen, and 100~200mg/L of SS (sourced from Engineering Treatment and Recycling of Wastewater (4th edition). According to the comparative survey, it's determined that the quality of the domestic sewage of this project is as shown in Table 5.1-1.

Table 5.1-1: Table of Main Pollutants in Domestic Sewage

Type	Concentration of the main pollutants (mg/L)			
	COD	BOD5	NH3-N	SS
Domestic sewage	400	260	30	180

After implementation of this project, reduction of the pollutant discharge is as shown in the following Table 5.1-2.

Table 5.1-2: Estimation of Reduction of Pollutant Discharge

Location of the subproject		Drainage works (direction)	Collected amount (m^3/d)	Reduction of pollutants (t/a)			
				COD	BOD_5	NH_3-N	SS
Xi'an City	Yanliang District	Yanliang Sewage Treatment Plant	10000	1277.5	876.0	65.7	584.0
Baoji City	Chencang District	Baoji City Chencang District Guo Town Sewage Treatment Plant	6000	766.5	525.6	39.4	350.4
Xianyang City	Wugong County Wugong Town	Stabilization pond sewage treatment facilities (new construction)	1232	157.4	107.9	8.1	71.9
	Xunyi County Chengguan Town	Xunyi County Sewage Treatment Plant	1564	199.8	137.0	10.3	91.3
	Xunyi County Zhitian Town	WSZ-AO small-size buried type wastewater treatment facilities (new construction)	2390	305.3	209.4	15.7	139.6
	Chunhua County Runzhen Town	Chunhua County Sewage Treatment Plant	800	102.2	70.1	5.3	46.7
Weinan City	Chengcheng County Chengguan Town	Chengcheng County Sewage Treatment Plant	6000	766.5	525.6	39.4	350.4

Tongchuan City	Yintai District	Tongchuan Sewage Treatment Plant	1683	245.7	159.7	18.4	110.6
Hanzhong City	Puzhen Town Hantai District	Sewage Treatment Plant in the New Area in the east of the city (new construction)	200000	25550.0	17520.0	1314.0	11680.0
Hanzhong City	Chengguan Town of Hanyin County	Hanyin County Sewage Treatment Plant	6300	804.8	551.9	41.4	367.9
Total			235969	30175.7	20683.2	1557.7	13792.8
Note: ① The concentration of the pollutants discharged from the Sewage Treatment Plant shall follow (DB61-224-2011) Integrated Wastewater Discharge Standard in Yellow River Valley Grade I requirements and (GB8978-1996) Integrated Wastewater Discharge Standard Grade I requirements. ② The sewage of Tongchuan City will not be discharged to the outside.							

From the above table, we can see that after the layout of the sewage pipelines and implementation of the drainage works of this project, the discharge of COD in the region will be reduced by 30175.7t/a; that of will be BOD_5 reduced by 20683.2t/a; NH_3-N will be reduced by 1557.7t/a; SS will be reduced by 13792.8t/a. Implementation of this project will reduce the discharge of the regional water pollutants, thus improving the regional water environment quality.

(3) Impact of water resource in Wugong Town project intaking

Safe Drinking Water Project in Wugong Town has undergone multi-program comparison and selection as well as comprehensive consideration and demonstration. First, the quality of surface water sources around Wugong Town have been poor and fail to satisfy the requirement of water quality due to the local domestic pollution sources having been poured into river without treatment in recent years, second, there is no water project having comprehensive utilization function around town and the water supply area is far away from the town, thus it can be seen that surface water sources are not suitable for serving as water source for new water plant as a result of their water quality, water quantity and distance etc. Wugong Town selects ground water as water supply, which has been approved by Wugong Water Conservancy Bureau in writing.

It is observed from analysis of water quality monitoring result of ground water well in Huashan Village (1000m away from the project site) and Shangying Village (900m away from the project site) in Wugong Town that all indicators of water quality reach the standards, the raw water, after disinfection treatment, shall come up to the existing national quality standard for drinking water and the detailed water quality report is shown in appendix.

Wugong County is in Wei River water system, water-bearing rocks of ground water are various in terms of burial type of ground water and lithological character and water storage property of water bearing stratum

① Phreatic water contains three types of water-bearing formations:

Water bearing stratum of phreatic water in alluvium of valley terrace has been distributed in gravel and pebble beds of Wei River, Qishui River and Weishui River, one to three water bearing stratums within the range of 40m in depth, thickness ranges from 4.4m to 28.0m, water level in depth ranges from 2m to 13m. mineralization of groundwater is smaller than 1 g/L，being fresh water, of which: water rich subregion with extremely high water storage is distributed on flood plain of, front edge of first and second terrace of Wei River, flood plain of Qishui River, water bearing stratum: gravel and pebble bed, 3-40m in thickness, floor depth: 42m, water level depth: 2—12m，deep in the north and shallow in the south, water yield:

4-30m3/s; water rich subregion with very high water storage is distributed on the rear edge of second terrace and third terrace of Wei River, water bearing stratum: medium and fine sand, sandy pebble, one to three water bearing stratums within the range of 40m in depth, single stratum thickness 2—21m, total thickness: 9.7—27.5m，water level depth: 8—28m，water yield: 12—19m3/h; water rich subregion with higher water storage is distributed on the terrace of Qishui River, water bearing stratum: medium and fine sand, gravel and pebble, one to three water bearing stratums within the range of 40m in depth, single stratum thickness 4—12 m, total thickness: 4.4—20.0m，water level depth: 3—8m，water yield: 7.87—10.34m3/h;

Water bearing stratum in loess terrace pore space and fissure phreatic water are distributed in Changning, Zhenyuan, Daijia, Wugong Town and watercourse etc. The lithological character of water bearing stratum is loess, mild clay, loess is characterized by miarolitic, fissure and pore space, being the main storage space for ground water in loess formation. Inhomogeneity of loess fissure development and multi-layer of fossil soil in loess formation and geologic structure of calcareous concretions make ground water of loess formation characterized by anisotropy and multilayer, with non-development of loess fissure and poor miarolitic connectivity along horizontal direction making ground water slow in horizontal movement, with development of loess fissure, favorable connectivity and fast seepage speed along vertical direction, with the increase of depth from top to bottom, the miarolitic development and permeability weaken by degrees, making water yield property of water bearing stratum of loess in the region weaken from top to bottom, the phreatic water level depth is from 50m to 85m，water yield is from 0.36 to 1.8 m3/h.

Water bearing stratum in depression pore space, fissure phreatic water in front edge of proluvial fan: medium water rich subregion is distributed in Wei Village, the lithological character of water bearing stratum is loess or mild clay, depth: 20—80m, with sporadic pebble bed, thickness: 2—5m，total thickness of water bearing stratum: 8.5—12m，water level depth: 5—17m，water yield: 7.1—8.3 m3/h. weaker water rich subregion is distributed in Sufang, water bearing stratum is loess and mild clay, thickness: 10—22m, water level depth: 12—25m，water yield: 2—5 m3/h.

② Two types of pressure bearing water bearing stratum in shallow formation

Water bearing stratum in thick sandy pebble bed with high water storage property is distributed in terraces of loess tableland and Wei River, Qishui River in Daijia, Changning, Zhenyuan, Wugong Town, rivercourse et, the water level depth 40—80m in loess terrace, 3—14m in terrace of valley; water bearing stratum roof depth: 90—120m in loess terrace, valley terrace depth: 40m below the ground, there are 2-13 water bearing stratums within the range of 180—250m in depth in loess terrace, the single stratum: 2~5m in thickness, total thickness is 30~60m, the number of water bearing stratums and the total thickness thereof are on the increase from north to south, individual well capacity: 29~57 m3/h

Water-bearing stratum with poor water storage in fine sand and argillaceous silt and pebble bed is distributed in Weicunyuan, confined water level 70~90m in depth, water bearing stratum roof: 150~160m in depth, there are 5-6 water strata within the range of depth from 160 to 250m, single stratum is from 5 to 15m in thickness, total thickness is from 45 to 55m. the thickness of water stratum from north to south is on the increase, individual well capacity: 25—45 m3/h.

③ Pressure water-bearing stratum in deep layer: it is widely distributed fine sand, mild clay in the depth ranging from 250 to 370m, in which there are 3-5 water bearing stratums, single stratum is from 2m to 5m in thickness, total thickness is from 10m to 20m , the water level is

about 60m in depth, individual well capacity: 14—16 m3/h.

Analysis of Wugong County Wugong Town Water Supply Project Water Resource Verification Report shows that the project has water output in recent period (2020) of 4500m3/d and 6000m3/d in 2030. A new water supply project will be constructed, 4 wells will be dug with depth of about 200m, and the confined groundwater will be extracted. The designed water yield per well is 80m3/h. According to existing well long period stable pumping test information of Wugong Town, the water yield per well is 75.8m3/h~83.5m3/h, and the stable drawdown of pumping is 16m~20.2m, indicating that the design water yield per well is rational.

Analysis of Wugong County Wugong Town Water Supply Project Water Resource Verification Report also shows that the annual water yield of the project is $219\times10^4m^3/a$ and the allowable exploration of regional groundwater resource is $1051\times10^4m^3/a$, the water to be exploited only accounts for 20.8% of the exploration volume, thus the project intaking has minor impact on the regional water resource.

2. Mitigation Measures

(1) The plunge pool with sediment grating function shall be mounted at rainwater discharge outlet to remove the sediment and flotage.

(2) The anti-seepage treatment shall be carried out for construction of stabilization pond for treating the sewage in Wugong Town, Wugong County, Xianyang County to avoid the groundwater being polluted.

(3) Make sure Tongchuan Sewage Treatment Plant can hold the increased wastewater increase due to this project which is 1683m3/d; the treated wastewater will be fully recycled and realize the feasibility of zero discharge.

(4) Contact with the sewage treatment plant shall be strengthened to ensure that Tongchuan sewage treatment plant receives the new sewage with quantity of $1683m^3/d$ produced in the project. The sewage after treatment can be reused and achieve zero discharge.

(5) The warning sign shall be pasted on the vehicle, and the vehicle loading coal, lime, cement and earth that may produce dust shall be covered. Overloaded vehicle is prohibited to avoid the scattering of goods on vehicle from polluting the water body.

5.2 Atmospheric Environment Impact

This is a municipal infrastructure construction project without productive activities or waste gases; however, airborne dust, construction plant exhausts, and asphalt smoke may be generated during the construction period of the project; the atmospheric pollution produced during the operation period is mainly resulted from the road works, mainly by vehicle exhaust gas and road airborne dust.

5.2.1 Environment Impact and Mitigation Measures during the Construction Period

1. Environment Impact

(1) Pollution by airborne dust due to construction

① Main pollution sources

The airborne dust of this project is mainly due to the earthwork phase of the road project, the excavation and filling during the layout of various pipelines, in which the waste earth will produce airborne dust under the action of wind, also include the dust produced by the spilled earth during loading/unloading process, that produced by the tires and running track of the construction plants going in/out of the construction site; as well as the that produced by the powder of the construction materials during loading/unloading, and piling process. In addition, during the construction process, mixing of the paving materials such as podsol, flyash etc will also produce dust, leading to airborne dust pollution to the environment.

② Airborne dust pollution analysis

During the construction period, new construction and reconstruction of roads; layout of various pipeline network, excavation, filling, and temporary piling may produce airborne dust, having major impact on the buildings close to the redlines on both sides of the road. Therefore, airborne dust pollution shall be mitigated for sections of environment-sensitive points.

(2) Exhaust gas pollution

The exhaust gas from the construction plants and vehicles contain such atmospheric pollutants such as HC particulate matter, CO, and NO_X etc, which will cause impact to the construction site to some extent.

For construction vehicles moving on the site, the exhaust gas forms point pollution source, having limited dissipation scope. The vehicles are in non-continuous driving mode and the construction will be carried out stepwise; the construction of each step is limited; therefore, the emission time and amount of the pollutant is relatively less, thus the impact to the atmospheric environment is minor. Compared with the exhaust gas emission by the vehicles during the operation period of the road, the exhaust gas emission in the construction period is quite limited.

(3) Asphalt smoke pollution

In the construction of asphalt section, impact of the asphalt mixing station to the air environment is one of the important factors impacting the air environment during the road construction period. The smoke produced by firing the fuel materials for heating the asphalt and the asphalt smoke etc produced during the mixing process will produce impact to the air environment to some extent. By now, a good solution has been adopted for the asphalt mixing plants used in road construction at home and abroad. Heating the asphalt with steam and adopting enclosed and dustproof units in the mixing process will minimize the asphalt smoke, leading to minor impact to the environment. The smoke produced by firing the fuel materials for heating the asphalt can impact the environment to some extent, but the scope is limited. According to the monitored results of Highway Office of Ministry of Communications at the asphalt mixing plant at Dayangfang of Jingjintang, with advanced asphalt and concrete mixing plant, the asphalt smoke emission concentration is 22.7mg/m^3 when the plant runs normally, meeting the requirements of Integrated Emission Standard for Atmospheric Pollutants (GB16297-1996) for asphalt smoke which is at 80-150mg/m^3. In addition, the air environment quality around the asphalt mixer measured in the same period indicates that at the location 100m in the downwind direction of the mixer, the concentration of Benzo [a] pyrene is 0.936μg/100m^3, meeting the grade II requirements of GB3095-1996 Environment Air Quality Standard which is at 0.01mg/100m^3.

Further applicable information indicate that the scope of air environment impacted by asphalt

mixing station is within 500-1500m; therefore, it is stressed in the environment protection measures and action plan that the location selected for the asphalt mixing station for construction shall be limited to be far away from human residence; the downwind direction shall be beyond the scope of 1000m, with advanced mixing plants adopted, so as to minimize the environment impact of the asphalt smoke.

2. Mitigation Measures

(1) The vehicles for transporting construction materials shall be covered properly to reduce material spilling. Materials that are likely to fly away such as cement and lime etc shall be applied with windproof actions such as cover tarpaulin etc; in addition, the site shall be timely sprayed with water.

(2) For subgrade filling, water shall be sprayed properly according to the needs for subgrade material compaction. The contractor shall also often spray water after the materials are compacted to avoid secondary dust generation.

(3) In order to avoid negative impact to the environment sensitive points and crops by the airborne dust due to materials such as soil-cement mixing and pavement operations under windy weather conditions, soil-cement mixing shall be carried out in a unitarily fixed location, with temporary fence 3m in height provided to be around the mixer, preventing dust diffusion. The mixing site is recommended in the downwind direction of construction site, without environment-sensitive points around it. The mixed material shall be transported to the related road section for pavement to reduce airborne dust. The mixed materials shall be paved and compressed along with the transportation.

(4) The transportation vehicles and construction plants shall keep good operation status, with intact rate required to be over 90%, selecting high-quality fuel; in addition, exhaust gas purifier shall be installed to effectively reduce emission of the polluting exhaust gas.

(5) The employer shall collectively and integratedly consider road construction and reconstruction, the layout of infrastructures such as drainage and storm water pipelines, reasonably arrange the schedule of each facility; the first item to be constructed shall be the underground facilities such as drainage facilities etc; then the road works; it's required to avoid repeated excavation to minimize the environment impact.

5.2.2 Environment Impact and Mitigation Measures during Operation Period

1. Environment Impact

The air environment impact during the operation period is mainly due to the road works. The main air pollutants are vehicle exhaust gases and airborne dust on the road.

The exhaust gases from vehicles on the newly constructed roads is the mainly pollution source to the air environment during the operation period; the emission scale of pollutants is proportional to the traffic volume as well as related to the vehicle type and operation conditions. The work contents for the road reconstruction of this project mainly involve with the roadside landscaping, lighting, and pipe network; after some alterations traffic will increase, but not so steep, so the ambient air will have some adverse impact, but taking into account the road conditions improve, for road dust mitigation has a certain positive significance, two-phase offset its environmental impact will remain at the original level.

The impact of the new road on the air environment is analyzed and assessed with comparable ways, for the information of the comparable roads, see Table 5.2-1.

Table 5.2-1: Road Air Environment Impact Analysis Table

Case	Name of road	Monitored by	Time	Description
I	Lantian-Xiaoshangyuan Class II Highway	Shangzhou Environment Monitoring Station	2004.9	The factors to be monitored including NO_2 and TSP; the monitoring points are set up at locations 0m, 20m, and 50m to the road respectively. The monitoring results are compared with the Grade II standard in Environment Air Quality Standard (GB3095-1996): ① The one-hour concentration of nitrogen dioxide is 0.027~0.090mg/m^3; the daily mean of concentration is 0.039~0.072 mg/m^3, both meeting the Grade II standard. ② The daily mean of concentration of total suspended particles is 0.114~0.343mg/m^3; Grade II standard can be reached at locations 20m from the road.
II	Xi'an - Tongchuan 4-lane Expressway	Xi'an Environment Monitoring Station	2008.9	The factors to be monitored including NO_2 and TSP; the monitoring points are set up at locations 24m, 30m, and 58m to the road respectively. The monitoring results are compared with the Grade II standard in Environment Air Quality Standard (GB3095-1996): ① The one-hour concentration of nitrogen dioxide is 0.068~0.139mg/m^3; the daily mean of concentration is 0.040~0.088 mg/m^3, both meeting the Grade II standard. ② The daily mean of concentration of total suspended particles is 0.482~0.889g/m^3; the suspension substance index is beyond the limit.
III	Xi'an - Tongguan 4-lane Expressway	Chang'an University Environment Engineering Research Institute	2008.9	For the existing Tongguan-Xi'an Expressway, two profiles are selected in Lintong and Chishui for monitoring; the factors to be monitored including NO_2. the monitoring points are set up at locations 50m, 100m, and 150m to the road respectively. The monitoring results are compared with the Grade II standard in Environment Air Quality Standard (GB3095-1996): the one-hour concentration of nitrogen dioxide is 0.028~0.086mg/m^3; the daily mean of concentration is 0.032~0.075mg/m^3, meeting the Grade II standard.
IV	Literatures	-	-	The concentration of PM10 at locations 1m to the similar road is 0.36mg/m^3. The concentration of PM_{10} goes down obviously as the distance to the road increases. At locations 40m to the road, the concentration of PM_{10} decrease to 76% of that 1m to the road, and at locations 60m to the road, this concentration value is reduced to 48.78% of that 1m to the road to 0.17 mg/m^3. However, it's still beyond the Grade II standard of Environment Air Quality Standard.

In general of the analysis, the traffic volume of this project is less than that of the above three cases and the air environment along the project line is of good conditions; the environment capacity is high. In the operation period of this project, NO_2 of the vehicle exhaust has minor

impact on the environment and air quality along the line, not exceeding grade II standard as specified in Environment Air Quality Standard (GB3095-1996). TSP and PM_{10} have certain impact on the environment and air quality, but it can be acceptable after taking such measures as landscaping on both sides of the road, strengthening road cleaning, and regular water spraying.

Except the vehicle exhaust gas pollution due to the increase of the above traffic volume resulted from the road reconstruction, the pollution by airborne dust resulted from poor pavement conditions can be mitigated to some extent as the pavement quality improves.

2. Mitigation Measures

During the operation period, the impact on the air environment by the proposed road for the project is mainly from the exhaust gases and airborne dust etc produced by the running vehicles. Aiming at the features of the pollution source, the following mitigation measures are proposed in the assessment:

(1) Landscaping by planting trees on road side: it's recommended to plant the local arbors and shrubs on both sides of the roads, especially in sensitive points, according to the local climate and soil features; strengthen the maintenance of the landscapes along the road line and maintain the pollution-reliving functions of the landscape, which is not only good for absorbing the airborne dust on the road, protecting the environment and air quality along the line, but also for beautifying the environment and improving the landscape along the road line.

(2) Strengthen the operation management of the road; strictly implement the vehicle management system and the national motor vehicle emission limit standard, as well as restrict vehicles of over exhaust gas emission and carrying bulk materials without covering measures to go on the public roads.

(3) Strengthen pavement maintenance and cleaning; keep the road in good operation conditions, and reduce airborne dust and vehicle exhaust gas pollution.

(4) For vehicles transporting products that are likely to cause airborne dust (such as lime and coal etc), the management shall be strengthened; it shall be provided with tarpaulin cover, with constant speed kept during the driving process; avoid sudden braking to minimize material spilling.

(5) Provide with tank car to regularly spray water and clean the pavement, so as to reduce the pollution by airborne dust.

5.3 Impact on Sound Environment

The noise of this project is mainly from the transport vehicles and plants for the construction period and the traffic of the operation period. Construction noise is short-term and temporary; road traffic noise belongs to permanent impact.

5.3.1 Noise Impact in Construction Period and the Mitigation Measures

1. Impact Analysis

In the construction period of this project, the noise is mainly sourced from the construction plants and the transport vehicles.

(1) Analysis on the noise sources from different construction phases in the construction period

According to the construction characteristics of this road construction for this project, the main work contents include road construction and reconstruction as well as pipe network layout, the involved construction process mainly includes two phases, namely foundation construction and pavement construction. The following sections introduce the construction processes and plants for these two phases.

① **Foundation construction:** this phase is most time-consuming, using the most construction plants, and having the highest noise; the works mainly include foundation treatment, subgrade leveling, earthwork excavation and fill, and compression pavement layer by layer etc. This process is also accompanied with transportation of a lot of materials in and out of the construction site. The construction plants to be used for this phase also included loading machine, vibrating tyre roller, bulldozer, land leveller, and excavator etc.

② **Pavement construction:** this process is carried out after the completion of subgrade construction; the mainly work is paving asphalt along the overall line. The main construction plants include massive asphalt pavers. According to the domestic monitoring results of the noise for the construction period of expressway projects, the construction noise of this road is relatively less compared with the subgrade construction, the impact on the sensitive points 50m beyond the road is minor.

In general, the construction period of this project has the highest noise impact. From this point, we can see that the noise impact by the construction period of the new road of this project is high. In addition, during the process of foundation construction, radiation noise will be produced by the vehicles transporting the construction materials; during the transportation process, some existing roads near the sensitive points will be selected inevitably, the radiation noise resulted herefrom will cause certain impact on the noise-sensitive points along the line.

(2) Noise source distribution, predication mode and source intensity during the construction period

① Noise source distribution:

According to the construction characteristics of the road project, the noise source distribution is described as follows:

a. Road construction plants such as road roller, bulldozer, land leveler are mainly distributed within the land use scope of the main road line;

b. Loading machines etc are mainly concentrated in sections where earthworks are to be transferred and recycled and with high volume of earthworks;

c. Mixers are mainly concentrated at mixing stations;

d. Excavators and loading machines are mainly concentrated in excavation sections.

e. Dump trucks are mainly driven between excavation and fill sections, the mixing station and the construction accesses along the line, as well as the existing roads around the link roads.

② Predication mode:

Construction plant noise can be treated as point noise source. According to the noise attenuation mode of point noise source, estimate the noise values at locations of different distances to the noise source; the predication mode is as follows:

$$L_i = L_0 - 20\lg\left(\frac{r_i}{r_0}\right) \qquad \text{(formula 5-3-1)}$$

Where: L_i: the estimated value of the construction noise at location of distance ri m to the noise source, dB(A);

L_0: reference value of the noise at location of distance r0 m to the noise source, dB(A).

For more construction plants, sound level superposition shall be performed for understanding the impact to certain prediction point:

$$L = 10\lg \sum 10^{0.1L_i} \qquad \text{(formula 5-3-1)}$$

(3) Noise source intensity:

According to the predication mode of 5-3-1, the noise values at locations of different distance to the construction plant are listed in Table 5.3-1. The impact scope of the noise by the main construction plants is indicated in Table 5.3-2.

Table 5.3-1: Noise Level of the Main Construction Plants at Different Distance (dB (A))

Name of plant	5m	10m	20m	40m	60m	80m	100m	150m	200m	280m	300m
Loading machine	90	84	78	72	68.5	66	64	60.5	58	55.	54.5
Vibrating tyre roller	86	80	74	68	64.5	62	60	56.5	54	51	50.5
Bulldozer	86	80	74	68	64.5	62	60	56.5	54	51	50.5
Land leveller	90	84	78	72	68.5	66	64	60.5	58	55	54.5
Excavator	84	78	72	66	62.5	60	58	54.5	52	49	48.5
Paver	87	81	75	69	65.5	63	61	57.5	55	52	51.5
Mixer	87	81	75	69	65.5	63	61	57.5	55	52	51.5

Note: the noise levels at 5m distance are actually measured values.

According to the regulations in Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011), the daytime noise limit on the construction site is 75dB (A); the night-time limit is 55dB(A). The results in Table 5.3-1 indicate that the radiation noise of unit construction plant in daytime at location 40m beyond the construction site can reach the standard limit. In night time, the noise limit can be basically reached at locations 280m beyond the noise source. However, typically there are many construction plants working on the construction site simultaneously; therefore, the construction site noise is the mixed radiation noises by different construction plants and by the vehicles in and out of the site; the distance for meeting the noise standard is far more over 40m in daytime and 280m in night time; while there are villages and schools distributed on both sides of the roads to be constructed and reconstructed, the construction noise in day time will have different level of impact on the surrounding noise-sensitive points. Construction at night will cause interference to the resting residents within the assessment scope along the line, especially to the sensitive points such as kindergartens and schools which are near the road; such impacts will be more outstanding.

The road construction is normally carried out by sections, the noise impact of each section is temporary and it disappears after the construction is over, which can be understood by the general residents. However, in order to protect the residents along the line to have normal life and rest, the construction contractor shall take necessary noise control measures to minimize the noise impact to the environment.

2. Mitigation Measures

(1) Reasonable layout of the construction site: reasonably and scientifically laying the construction site out is the main path for reducing the construction noise, such as centralizing the fixed vibration sources of the construction site to minimize the interference scope; the plants that can be fixed include air compressors and generators, which can be installed in the rooms onsite, with sound insulation board provided in the rooms to reduce the noise. The construction material site and material fabrication site shall be kept far away from the environment protection objects as possible as it can be.

(2) Reasonable arrangement of the work time for construction: road construction plant noise is featured with burstiness, irregularity, discontinuity, and high intensity etc. According to the surveys, the noise from the construction site may exceed Class 4 noise standard for some times, which can be generally mitigated with changeable construction methods. Under precondition that the schedule is assured, the work time for construction shall be arranged reasonably and try to arrange construction works of intensive noise emission between the time period 7: 00~12: 00 in the morning and 14: 00~22: 00 in the afternoon, with construction of strong vibration prohibited at night.

(3) Reasonable arrangement of route and direction of the transport vehicles: construction transport vehicles, especially massive vehicles for transportation shall have reasonably defined transportation route and time as specified by the related department. The main transport route selected shall be away from the sensitive points such as villages and residential areas etc as far as possible. For sensitive points that cannot be avoided, NO HORN sign shall be set up; no transportation of construction materials is allowed on the accesses within the scope 50m to the residential areas. For accesses on which construction material transportation has to be carried out, NO HORN sign and speed limitation signs must be set up and the speed of the passing vehicles at night shall be less than 30km/h.

(4) Reasonable selection of construction plants: during the construction process, the construction contractor must select the construction machineries and transportation vehicles according to the applicable national standard; try to select the construction plants of low noise and vibration, provide them with silencing devices and accessories; pay attention to the servicing and correct use, so as to keep the best work status and the lowest sound level; avoid using more than one high-noise plants on the same site at the same time.

(5) Performing propaganda well and advocating scientific management and civilized construction: as restricted by the technical conditions and the objective field environment, certain impact by the construction noise and vibration can still be caused to the surrounding environment even the corresponding control measures and actions are taken; therefore, it's necessary to disclose the related information and explain to the affected residents and the related organizations impacted by the project. The tasks to be performed include strengthening the site management scientifically, promoting the environment protection awareness of the construction personnel, vigorously advocating the self-consciousness for civilized construction and try to avoid construction noise deterioration resulted from human factors.

(6) Strengthening environment management, accepting supervision by the environment protection department: in order to effectively control the impact of the construction noise to the environment along the line, it's necessary to strengthen environment management in addition to the applicable control measures. According to the applicable national and local laws, statutes, regulations and rules, the construction contractor shall actively accept the supervision, management, and inspection of the environment protection department.

(7) The construction contractor shall carry out the various construction management systems and it shall ensure that the construction noise meets the requirements specified in

Limit Values for the Noise from Construction Sites (GB12523-2011); earnestly carry out the applicable national and local regulations as Environmental Noise Pollution Prevention Law of the PRC etc

(8) Perform sound environment monitoring during the construction period; take the corresponding noise control measures according to the monitoring results.

5.3.2 Noise Impact and the Mitigation Measures in the Operation Period

5.3.2.1 Impact Predication

The traffic volume will almost not change after the road reconstruction of this project, thus there is almost no change to the impact on the sound environment; besides, as the pavement conditions improves, the sound environment around will also be mitigated and improved. After the new road is put into operation, the impact to the sound environment is mainly from the traffic noise from the road. Some of the sensitive points along the project line are close to the road, which will be impacted to some extent by the noise radiation of the vehicles during the operation period; therefore, it's necessary to predict and assess the general noise level for the short term, middle term, and long term after the road is completed as well as the noise impact to the sensitive points within the assessment scope, so as to draw up reasonable noise reduction measures according to the actual noise impact situations and the local conditions, and provide the related planning along the project line with scientific basis.

(1) Road Traffic Noise Prediction Mode

① Predication mode of the equivalent sound level of Class i vehicles

Vehicles driven on the road can be considered as continuous linear sound source. According to Technical Guideline for Environment Impact Assessment - Sound Environment, the noise prediction mode is as follows:

$$L_{eq}(h)_i = (\overline{L_{0E}})_i + 10\lg(\frac{N_i}{V_i T}) + 10\lg(\frac{7.5}{r}) + 10\lg(\frac{\psi_1 + \psi_2}{\pi}) + \Delta L - 16 \qquad (5.3\text{-}3)$$

Where:

$L_{eq}(h)_i$: the hour equivalent sound level of class i vehicles, dB(A);

$(\overline{L_{0E}})_i$: the average energy sound level A when the speed of class i vehicle is km/h and the horizontal distance is 7.5m, dB(A);

N_i : the average hourly traffic flow of Class i vehicles passing certain prediction points in day time and night time, nos/h;

r : The distance m from the road center line to the prediction point, applicable to the noise prediction of the prediction points with >7.5m.

V_i : the average speed of Class i vehicles, km/h;

T : time for calculating equivalent sound level, 1h;

ψ_1, ψ_2 : opening angle and radian from the prediction point to the both ends of the road of limited length;

ΔL : correction resulted from other factors, dB(A), which can be calculated as follows:

$$\Delta L = \Delta L_1 - \Delta L_2 + \Delta L_3 \qquad (5.3\text{-}4)$$

$$\Delta L_1 = \Delta L_{坡度} + \Delta L_{路面}$$

$$\Delta L_2 = A_{atm} + A_{gr} + A_{bar} + A_{misc}$$

Where:

ΔL_1: correction resulted from factors of the line, dB(A);

$\Delta L_{坡度}$: correction of road longitudinal grade, dB(A);

$\Delta L_{路面}$: correction resulted from road pavement materials, dB(A);

ΔL_2: attenuation resulted in the sound wave transmission way, dB(A);

ΔL_3: correction resulted from reflection, dB(A).

② equivalent sound level prediction mode for the traffic sound at the observation point

The total traffic equivalent sound level:

$$L_{eq}(T) = 10\lg(10^{0.1L_{eq}(h)_{大}} + 10^{0.1L_{eq}(h)_{中}} + 10^{0.1L_{eq}(h)_{小}}) \qquad (5.3\text{-}5)$$

③ Environment noise prediction mode

$$L_{eq})_{环} = 10\lg(10^{0.1(L_{eq})_{交}} + 10^{0.1(L_{eq})_{背}}) \qquad (5.3\text{-}6)$$

Where: $L_{eq})_{环}$: environment noise value at the prediction point, dB(A);

$L_{eq})_{交}$: traffic noise value at the prediction point, dB(A);

$L_{eq})_{背}$: background noise value at the prediction point, dB(A);

(2) Parameter Determination for the Prediction Mode

① hourly traffic volume (Ni)

As predicted with the feasibility study report of the project, the 16-hour traffic volume of the project in day time accounts for 80% daily traffic volume; the 8-hour traffic volume at night accounts for 20% daily traffic volume. According to the traffic volume prediction value for the operation period of this project provided with the project analysis, the hourly traffic volume in day and at night for each assessment year is predicted as shown in Table 5.3-4.

Table 5.3-4: Prediction Value of Hourly Traffic Volume for the Assessment Year of the Project, Veh/h

Area	Section	Vehicle size	2017		2032		2037	
			Day time	Night time	Day time	Night time	Day time	Night time
Yanliang District	Hongyao Road	Oversize vehicle	118	30	148	37	178	44
		mid-size vehicle	237	59	296	74	355	89
		small-size vehicle	355	89	444	111	533	133
	North Guangyang Street	Oversize vehicle	74	19	93	23	111	28
		mid-size vehicle	148	37	185	46	222	56
		small-size vehicle	222	56	278	69	333	83
	Guangsan Road	Oversize vehicle	74	19	93	23	111	28
		mid-size vehicle	149	37	186	46	223	56

		small-size vehicle	223	56	278	70	334	84
Chencang District	Longhai North Road	Oversize vehicle	29	7	81	20	97	24
		mid-size vehicle	59	15	163	41	195	49
		small-size vehicle	88	22	244	61	292	73
	Beikai Road	Oversize vehicle	38	10	88	22	106	26
		mid-size vehicle	77	19	175	44	211	53
		small-size vehicle	115	29	263	66	317	79
	Heping Road	Oversize vehicle	56	14	112	28	145	36
		mid-size vehicle	112	28	223	56	289	72
		small-size vehicle	168	42	335	84	434	108
Chengcheng County	Huifu Street	Oversize vehicle	178	44	246	62	271	68
		mid-size vehicle	355	89	492	123	542	136
		small-size vehicle	533	133	738	185	813	203
	Yangguang Road	Oversize vehicle	116	29	182	45	209	52
		mid-size vehicle	232	58	363	91	418	104
		small-size vehicle	348	87	545	136	627	157
	Dongba Road	Oversize vehicle	246	61	354	88	391	98
		mid-size vehicle	491	123	707	177	782	196
		small-size vehicle	736	184	1060	265	1173	293
Yintai District	The north section of Binhe West Road	Oversize vehicle	83	21	106	27	124	31
		mid-size vehicle	166	42	212	53	249	62
		small-size vehicle	250	62	318	80	373	93
	Binhe East Road	Oversize vehicle	35	9	64	16	86	22
		mid-size vehicle	70	18	129	32	172	43
		small-size vehicle	105	26	193	48	258	65
	(Weiyi Road—Weiliu Road)	Oversize vehicle	18	5	29	7	50	13
		mid-size vehicle	37	9	59	15	100	25
		small-size vehicle	55	14	88	22	150	38
Hantai District	the north section of Lianfeng Road	Oversize vehicle	451	113	530	132	569	142
		mid-size vehicle	901	225	1059	265	1138	284
		small-size vehicle	1352	338	1589	397	1707	427
	Lianhua Road	Oversize vehicle	544	136	609	152	663	166
		mid-size vehicle	1088	272	1218	304	1325	331

		small-size vehicle	1632	408	1827	457	1988	497
	Bei'er Road	Oversize vehicle	407	102	515	129	561	140
		mid-size vehicle	814	203	1029	257	1121	280
		small-size vehicle	1221	305	1544	386	1681	420
Hanyin County	Nanqu Road	Oversize vehicle	138	35	194	48	236	59
		mid-size vehicle	276	69	387	97	471	118
		small-size vehicle	414	104	581	145	707	177
	the west extension section of Binhe South Road	Oversize vehicle	259	65	298	75	354	88
		mid-size vehicle	518	130	597	149	708	177
		small-size vehicle	778	194	895	224	1062	265

② Vehicle speed (Vi)

According to Code for Environment Impact Assessment of Highway Construction Projects (JTG B03-2006), the following formula is applicable to the single vehicle speed prediction of the vehicle types as stated in the section of road traffic noise prediction (Annex C):

$$v_i = \left[k_1 \cdot u_i + k_2 + \frac{1}{k_3 \cdot u_i + k_4} \right] \times \frac{v}{120} \qquad (5.3\text{-}7)$$

$$u_i = N_{\text{单车道小时}} \cdot \left[\eta_i + m \cdot (1 - \eta_i) \right]$$

Where: v_i: the predicted speed of type i vehicle, km/h; when the design speed is less than 120km/h, the predicted speed of this vehicle type is reduced proportionally;

k_1, k_2, k_3, k_4: regression coefficient, with value taken according to Table 3.2-15;

u_i: equivalent speed of the vehicle type;

$N_{\text{单车道小时}}$: hourly traffic volume on a single lane;

η_i: proportion of the vehicle type;

m: weighting coefficient of other vehicle types;

v: Designed speed

According to the above formula, the speed of the small, medium and oversize vehicles for the operation period of the proposed road is calculated in Table 3.2-16.

③ Single vehicle radiation sound level ($(\overline{L_{0E}})_i$)

The average radiation noise level (dB) $(\overline{L_{0E}})_i$ of type i vehicles at the reference point (7.5m) shall be calculated as follows:

$$\text{Small-size vehicle} \quad (\overline{L_{0E}})_{\text{小}} = 12.6 + 34.73 \lg V_{\text{小}} + \Delta L_{\text{路面}}$$

$$\text{Mid-size vehicle} \quad (\overline{L_{0E}})_{\text{中}} = 8.8 + 40.48 \lg V_{\text{中}} + \Delta L_{\text{纵坡}} \qquad (5.3\text{-}8)$$

$$\text{Oversize vehicle} \quad (\overline{L_{0E}})_{\text{大}} = 22.0 + 36.32 \lg V_{\text{大}} + \Delta L_{\text{纵坡}}$$

Where: V_i : average running speed of the vehicle type

The prediction results of the average single vehicle radiation sound level calculated according to the above formula for the operation period of the proposed road are as shown in Table 3.2-17.

④ Correction resulted from the factors of the line (ΔL_1)

A. The road longitudinal slope correction $\Delta L_{坡度}$ can be calculated with the following formula:

$$\text{Oversize vehicle: } \Delta L_{坡度} = 98 \times \beta \quad \text{dB(A)} \qquad (5.3\text{-}9)$$

$$\text{mid-size vehicle: } \Delta L_{坡度} = 73 \times \beta \quad \text{dB(A)}$$

$$\text{small-size vehicle: } \Delta L_{坡度} = 50 \times \beta \quad \text{dB(A)}$$

Where: β : road longitudinal grade, %

B. for the noise correction of different pavement, see Table 5.3-5

Table 5.3-5: Noise Correction of Common Pavement, dB (A)

Pavement type	Correction at different driving speed, km/h		
	30	40	50
Asphalt concrete	0	0	0
Cement concrete	1.0	1.5	2.0
Note: the corrections in the table are the corrections of the results measured with $(\overline{L_{0E}})_i$ on asphalt concrete pavement.			

⑤ Attenuation resulted from sound wave transmission path (ΔL_2)

A. attenuation by obstacles (A_{bar})

a. calculation of attenuation by sound barrier (A_{bar})

The sound barrier of infinite length can be calculated with the following formula:

$$A_{bar} = \begin{cases} 10\lg\left[\dfrac{3\pi\sqrt{(1-t^2)}}{4arctg\sqrt{\dfrac{(1-t)}{(1+t)}}}\right], & t = \dfrac{40f\delta}{3c} \le 1 \quad dB \\ 10\lg\left[\dfrac{3\pi\sqrt{(t^2-1)}}{2\ln(t+\sqrt{(t^2-1)})}\right], & t = \dfrac{40f\delta}{3c} > 1 \quad dB \end{cases} \qquad (5.3\text{-}10)$$

Where:

f: sound wave frequency, Hz;

δ : path difference, m;

c : sound velocity, m/s

In the assessment for highway construction project, sound wave of 500Hz frequency can be used to calculate the attenuation by sound barrier, which is to be used as level A attenuation appropriately.

Calculation of sound barrier or finite length:

A_{bar} shall still be calculated with formula 4.2-10, then corrected according to Fig. A.3 in HJ 2.4-2009. The corrected A_{bar} is up to blind angle β / θ.

b. calculation of the sound shadow attenuation on both sides of high embankment or low cutting.

The sound shadow attenuation on both sides of high embankment or low cutting refers to the additional attenuation of the prediction point resulted in the sound shadow zone of high embankment or low cutting.

When the prediction point is located in sound direct zone, A_{bar}=0;

When the prediction point is located in sound shadow zone, A_{bar} will decide path difference δ.

As calculated with Fig. 4-2, δ =a+b-c; and acquire A_{bar} with Fig. A.4 according to HJ 2.4-2009.

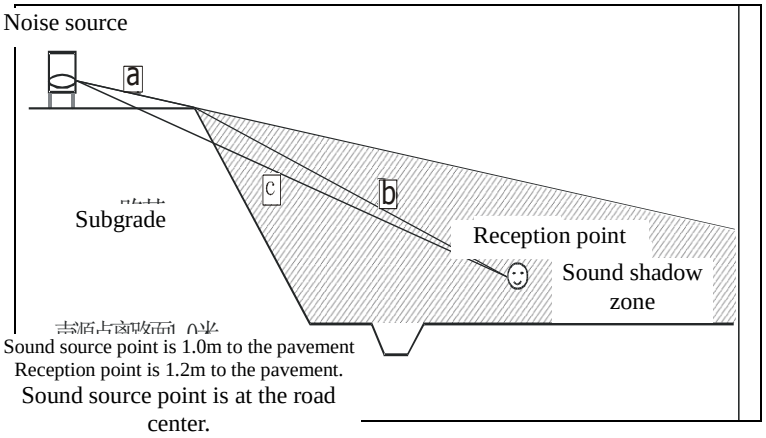


Fig. 5.3-1: Sketch for Calculation of Path Difference δ

c. calculation of additional attenuation for rural houses

The additional noise attenuation of rural houses shall be calculated according to Table 5.3-6.

Table 5.3-6: Table for Calculation of Noise Attenuation of Rural Houses

Row of the house	Land occupation area of the house	Noise attenuation (dB)
Row one	40~60%	3
	70~90%	5
The rest rows	Each row increase	Increasing by 1.5
	Continue to increase the rows	Taking 10 maximally

B. Ground effect attenuation (ΔAgr)

When the sound wave is transmitted by going through loose ground, or when most of the loose ground is composed of mixed ground, if just sound level A is just calculated for the prediction point, the attenuation of octave frequency band resulted from ground effect can be calculated with the following formula:

$$A_{gr} = 4.8 - (\frac{2h_m}{r})\left[17 + \frac{300}{r}\right] \qquad (5.3\text{-}11)$$

Where:

r: distance between the sound source and the prediction point, m;

h_m: the average height to the floor of the transmission path in meter, which can be calculated with Fig. 4-4; h_m= F/r; F: area, m2; r, m;

If the calculated A_{gr} is negative, then A_{gr} can be replaced with "0".

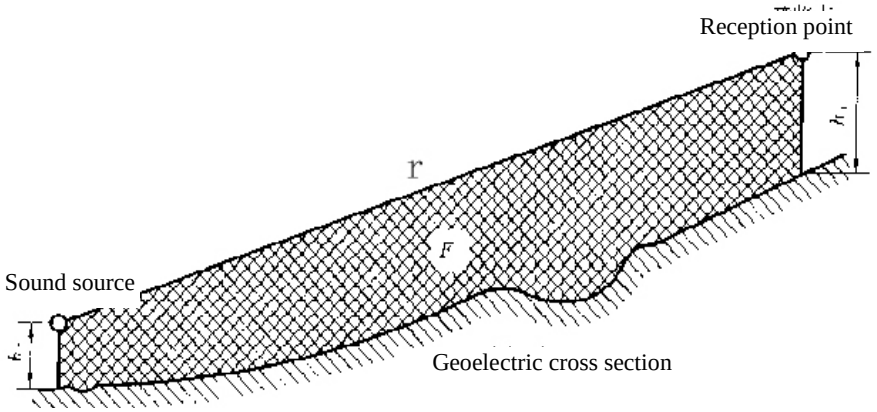


Fig. 5.3-2: Method for Estimating the Average Height hm

(3) Road Traffic Noise Prediction and Assessment

The sound environment of this project executes Sound Environment Quality Standard (GB3096-2008). For sections with the buildings on both sides are mainly those over three storeys (including three storeys), Sound Environment Quality Standard (GB3096-2008) Class 4a standard will be executed for the area of the side of the first row of buildings facing the road, then class 2 standard will be executed for the area of the building back side to the road; the main sections have buildings below three storeys (including open areas); calss 4a standard will be executed in areas 25m within the redline and class 2 standard will be executed 25m beyond the redline.

According to the prediction mode and in combination with the various parameters determined for the proposed road, the predicted traffic noise value along the line for the assessment year is calculated. The assessing scope this time is 25~200m within the areas on both sides of the road center line. As the vertical alignment of road changes continuously, the elevation difference to the ground also changes continuously; therefore, in the traffic noise prediction, just the traffic noise of each section in each characteristic year under conditions of flat embankment, infinite length, and soft ground is predicted. The prediction characteristic year is 2017, 2032, and 2037. The specific subgrade form and height will be considered when specific sensitive points are predicted for noise.

For the traffic noise prediction result of each road section, please refer to Table 5.3-7, from which we can see that the construction of the road causes certain impact on the sound environment along the line; in addition, as the traffic volume increases gradually, the impact of traffic noise during the operation period gets more and more serious. Table 5.3-8 gives the distribution characteristics of the traffic noise along the road line.

Table 5.3-7: Predicted Traffic Noise Value in the Assessment Year of the Project [flat embankment) (*α*=0.5) (dB (A))

Area	Section	Years	Time	Distance between the calculation point and the central line (m)													
				20	30	40	50	60	70	80	90	100	120	140	160	180	200
Yanliang District	Hongyao Road	2017	Day time	66.0	63.7	60.5	58.8	57.6	56.7	55.9	55.3	54.7	53.8	53.1	52.5	51.9	51.4
			Night time	59.9	57.7	54.4	52.7	51.5	50.6	49.8	49.2	48.7	47.8	47.0	46.4	45.8	45.4
		2032	Day time	67.0	64.7	61.5	59.8	58.6	57.7	56.9	56.3	55.7	54.8	54.1	53.5	52.9	52.4
			Night time	60.9	58.6	55.4	53.6	52.4	51.5	50.8	50.2	49.6	48.7	48.0	47.3	46.8	46.3
		2037	Day time	67.8	65.5	62.3	60.6	59.4	58.5	57.7	57.1	56.6	55.7	54.9	54.3	53.7	53.2
			Night time	61.6	59.4	56.2	54.4	53.2	52.3	51.6	50.9	50.4	49.5	48.8	48.1	47.6	47.1
	North Guangyang Street	2017	Day time	64.0	61.7	58.5	56.7	55.5	54.6	53.9	53.3	52.7	51.8	51.1	50.4	49.9	49.4
			Night time	57.9	55.7	52.4	50.7	49.5	48.6	47.8	47.2	46.7	45.8	45.0	44.4	43.8	43.4
		2032	Day time	65.0	62.7	59.5	57.7	56.5	55.6	54.9	54.3	53.7	52.8	52.1	51.4	50.9	50.4
			Night time	58.8	56.5	53.3	51.6	50.4	49.5	48.7	48.1	47.6	46.7	45.9	45.3	44.7	44.2
		2037	Day time	65.8	63.5	60.3	58.5	57.3	56.4	55.7	55.1	54.5	53.6	52.9	52.2	51.7	51.2
			Night time	59.6	57.4	54.2	52.4	51.2	50.3	49.6	49.0	48.4	47.5	46.8	46.1	45.6	45.1
	Guangsan Road	2017	Day time	64.0	61.7	58.5	56.7	55.5	54.6	53.9	53.3	52.7	51.8	51.1	50.4	49.9	49.4
			Night time	57.9	55.7	52.4	50.7	49.5	48.6	47.8	47.2	46.7	45.8	45.0	44.4	43.8	43.4
		2032	Day time	65.0	62.7	59.5	57.7	56.5	55.6	54.9	54.3	53.7	52.8	52.1	51.4	50.9	50.4
			Night time	58.8	56.6	53.3	51.6	50.4	49.5	48.7	48.1	47.6	46.7	45.9	45.3	44.7	44.3
		2037	Day time	65.8	63.5	60.3	58.5	57.3	56.4	55.7	55.1	54.5	53.6	52.9	52.2	51.7	51.2
			Night time	59.7	57.4	54.2	52.4	51.2	50.3	49.6	49.0	48.4	47.5	46.8	46.1	45.6	45.1
Chencang District	Longhai North Road	2017	Day time	59.9	57.7	54.4	52.7	51.5	50.6	49.8	49.2	48.7	47.8	47.0	46.4	45.8	45.3
			Night time	53.7	51.5	48.3	46.5	45.3	44.4	43.7	43.0	42.5	41.6	40.9	40.2	39.7	39.2
		2032	Day time	64.4	62.1	58.9	57.1	56.0	55.0	54.3	53.7	53.1	52.2	51.5	50.9	50.3	49.8
			Night time	58.2	56.0	52.7	51.0	49.8	48.9	48.2	47.5	47.0	46.1	45.3	44.7	44.2	43.7
		2037	Day time	65.2	62.9	59.7	57.9	56.8	55.8	55.1	54.5	53.9	53.0	52.3	51.7	51.1	50.6
			Night time	59.0	56.8	53.5	51.8	50.6	49.7	49.0	48.3	47.8	46.9	46.1	45.5	45.0	44.5
	Beikai Road	2017	Day time	61.1	58.8	55.6	53.8	52.7	51.7	51.0	50.4	49.8	48.9	48.2	47.6	47.0	46.5
			Night time	55.1	52.8	49.6	47.9	46.7	45.8	45.0	44.4	43.9	42.9	42.2	41.6	41.0	40.5
		2032	Day time	64.7	62.5	59.2	57.5	56.3	55.4	54.6	54.0	53.5	52.6	51.8	51.2	50.6	50.2
			Night time	58.6	56.4	53.1	51.4	50.2	49.3	48.5	47.9	47.4	46.5	45.7	45.1	44.5	44.0
		2037	Day time	65.5	63.3	60.1	58.3	57.1	56.2	55.5	54.9	54.3	53.4	52.7	52.0	51.5	51.0
			Night time	59.4	57.1	53.9	52.1	50.9	50.0	49.3	48.7	48.1	47.2	46.5	45.8	45.3	44.8

	Heping Road	2017	Day time	54.8	52.5	49.3	47.5	46.4	45.4	44.7	44.1	43.5	42.6	41.9	41.3	40.7	40.2
			Night time	48.7	46.4	43.2	41.4	40.2	39.3	38.6	38.0	37.4	36.5	35.8	35.1	34.6	34.1
		2032	Day time	58.7	56.5	53.2	51.5	50.3	49.4	48.7	48.0	47.5	46.6	45.8	45.2	44.7	44.2
			Night time	52.7	50.4	47.2	45.4	44.2	43.3	42.6	42.0	41.4	40.5	39.8	39.1	38.6	38.1
		2037	Day time	62.0	59.8	56.5	54.8	53.6	52.7	52.0	51.3	50.8	49.9	49.1	48.5	47.9	47.5
			Night time	55.9	53.7	50.4	48.7	47.5	46.6	45.8	45.2	44.7	43.8	43.0	42.4	41.8	41.4
Chengcheng County	Huifu Street	2017	Day time	67.8	65.5	62.3	60.5	59.3	58.4	57.7	57.1	56.5	55.6	54.9	54.2	53.7	53.2
			Night time	61.6	59.4	56.1	54.4	53.2	52.3	51.6	50.9	50.4	49.5	48.7	48.1	47.6	47.1
		2032	Day time	69.2	66.9	63.7	62.0	60.8	59.9	59.1	58.5	58.0	57.0	56.3	55.7	55.1	54.6
			Night time	63.1	60.8	57.6	55.9	54.7	53.8	53.0	52.4	51.9	50.9	50.2	49.6	49.0	48.5
		2037	Day time	69.6	67.4	64.1	62.4	61.2	60.3	59.6	58.9	58.4	57.5	56.7	56.1	55.6	55.1
			Night time	63.5	61.3	58.0	56.3	55.1	54.2	53.4	52.8	52.3	51.4	50.6	50.0	49.4	48.9
	Yangguang Road	2017	Day time	65.9	63.7	60.4	58.7	57.5	56.6	55.8	55.2	54.7	53.8	53.0	52.4	51.8	51.3
			Night time	59.8	57.5	54.3	52.6	51.4	50.5	49.7	49.1	48.6	47.7	46.9	46.3	45.7	45.2
		2032	Day time	67.9	65.6	62.4	60.6	59.5	58.5	57.8	57.2	56.6	55.7	55.0	54.4	53.8	53.3
			Night time	61.7	59.5	56.2	54.5	53.3	52.4	51.7	51.0	50.5	49.6	48.8	48.2	47.7	47.2
		2037	Day time	68.5	66.3	63.0	61.3	60.1	59.2	58.4	57.8	57.3	56.4	55.6	55.0	54.4	53.9
			Night time	62.4	60.1	56.9	55.1	53.9	53.0	52.3	51.7	51.1	50.2	49.5	48.8	48.3	47.8
	Dongba Road	2017	Day time	69.2	66.9	63.7	61.9	60.7	59.8	59.1	58.5	57.9	57.0	56.3	55.6	55.1	54.6
			Night time	63.0	60.8	57.5	55.8	54.6	53.7	53.0	52.3	51.8	50.9	50.2	49.5	49.0	48.5
		2032	Day time	70.8	68.5	65.3	63.5	62.3	61.4	60.7	60.1	59.5	58.6	57.9	57.2	56.7	56.2
			Night time	64.6	62.4	59.1	57.4	56.2	55.3	54.6	53.9	53.4	52.5	51.7	51.1	50.6	50.1
		2037	Day time	71.2	69.0	65.7	64.0	62.8	61.9	61.2	60.5	60.0	59.1	58.3	57.7	57.1	56.7
			Night time	65.1	62.8	59.6	57.9	56.7	55.8	55.0	54.4	53.9	53.0	52.2	51.6	51.0	50.5
Yintai District	North Section of Binhe West Road	2017	Day time	64.5	62.2	59.0	57.2	56.0	55.1	54.4	53.8	53.2	52.3	51.6	50.9	50.4	49.9
			Night time	58.4	56.1	52.9	51.1	50.0	49.0	48.3	47.7	47.1	46.2	45.5	44.9	44.3	43.8
		2032	Day time	65.5	63.3	60.0	58.3	57.1	56.2	55.5	54.8	54.3	53.4	52.6	52.0	51.5	51.0
			Night time	59.5	57.2	54.0	52.2	51.0	50.1	49.4	48.8	48.2	47.3	46.6	45.9	45.4	44.9
		2037	Day time	66.2	64.0	60.7	59.0	57.8	56.9	56.2	55.5	55.0	54.1	53.4	52.7	52.2	51.7
			Night time	60.1	57.9	54.6	52.9	51.7	50.8	50.0	49.4	48.9	48.0	47.2	46.6	46.0	45.5
	Binhe East Road	2017	Day time	60.7	58.4	55.2	53.5	52.3	51.4	50.6	50.0	49.5	48.6	47.8	47.2	46.6	46.1
			Night time	54.7	52.4	49.2	47.4	46.2	45.3	44.6	44.0	43.4	42.5	41.8	41.2	40.6	40.1

		2032	Day time	63.4	61.1	57.9	56.1	54.9	54.0	53.3	52.7	52.1	51.2	50.5	49.8	49.3	48.8
			Night time	57.2	55.0	51.7	50.0	48.8	47.9	47.2	46.5	46.0	45.1	44.3	43.7	43.1	42.7
		2037	Day time	64.6	62.4	59.2	57.4	56.2	55.3	54.6	54.0	53.4	52.5	51.8	51.1	50.6	50.1
			Night time	58.6	56.3	53.1	51.3	50.2	49.2	48.5	47.9	47.3	46.4	45.7	45.1	44.5	44.0
	Weiyi Road – Weiliu Road	2017	Day time	57.9	55.6	52.4	50.6	49.4	48.5	47.8	47.2	46.6	45.7	45.0	44.3	43.8	43.3
			Night time	52.0	49.7	46.5	44.8	43.6	42.7	41.9	41.3	40.8	39.8	39.1	38.5	37.9	37.4
		2032	Day time	59.9	57.7	54.4	52.7	51.5	50.6	49.9	49.2	48.7	47.8	47.0	46.4	45.9	45.4
			Night time	53.8	51.5	48.3	46.5	45.3	44.4	43.7	43.1	42.5	41.6	40.9	40.2	39.7	39.2
		2037	Day time	62.3	60.0	56.8	55.1	53.9	53.0	52.2	51.6	51.1	50.1	49.4	48.8	48.2	47.7
			Night time	56.3	54.0	50.8	49.0	47.8	46.9	46.2	45.6	45.0	44.1	43.4	42.7	42.2	41.7
Hantai District	North Section of Lianfeng Road	2017	Day time	71.8	69.5	66.3	64.6	63.4	62.5	61.7	61.1	60.6	59.7	58.9	58.3	57.7	57.2
			Night time	65.7	63.4	60.2	58.5	57.3	56.4	55.6	55.0	54.5	53.6	52.8	52.2	51.6	51.1
		2032	Day time	72.5	70.3	67.0	65.3	64.1	63.2	62.5	61.8	61.3	60.4	59.6	59.0	58.4	58.0
			Night time	66.4	64.1	60.9	59.2	58.0	57.1	56.3	55.7	55.2	54.2	53.5	52.9	52.3	51.8
		2037	Day time	72.9	70.6	67.4	65.6	64.4	63.5	62.8	62.2	61.6	60.7	60.0	59.3	58.8	58.3
			Night time	66.7	64.5	61.2	59.5	58.3	57.4	56.6	56.0	55.5	54.6	53.8	53.2	52.6	52.2
	Lianhua Road	2017	Day time	72.6	70.4	67.1	65.4	64.2	63.3	62.5	61.9	61.4	60.5	59.7	59.1	58.5	58.1
			Night time	66.5	64.3	61.0	59.3	58.1	57.2	56.4	55.8	55.3	54.4	53.6	53.0	52.4	51.9
		2032	Day time	73.1	70.9	67.6	65.9	64.7	63.8	63.1	62.4	61.9	61.0	60.2	59.6	59.1	58.6
			Night time	67.0	64.8	61.5	59.8	58.6	57.7	56.9	56.3	55.8	54.9	54.1	53.5	52.9	52.4
		2037	Day time	73.5	71.3	68.0	66.3	65.1	64.2	63.4	62.8	62.3	61.4	60.6	60.0	59.4	59.0
			Night time	67.4	65.1	61.9	60.2	59.0	58.1	57.3	56.7	56.1	55.2	54.5	53.9	53.3	52.8
	Bei’er Road	2017	Day time	71.4	69.1	65.9	64.1	62.9	62.0	61.3	60.7	60.1	59.2	58.5	57.8	57.3	56.8
			Night time	65.3	63.0	59.8	58.0	56.8	55.9	55.2	54.6	54.0	53.1	52.4	51.7	51.2	50.7
		2032	Day time	72.4	70.1	66.9	65.2	64.0	63.1	62.3	61.7	61.2	60.3	59.5	58.9	58.3	57.8
			Night time	66.3	64.0	60.8	59.0	57.9	56.9	56.2	55.6	55.0	54.1	53.4	52.8	52.2	51.7
		2037	Day time	72.8	70.5	67.3	65.6	64.4	63.5	62.7	62.1	61.6	60.6	59.9	59.3	58.7	58.2
			Night time	66.7	64.4	61.2	59.4	58.2	57.3	56.6	56.0	55.4	54.5	53.8	53.1	52.6	52.1
Hanyin County	Nanqu Road	2017	Day time	66.7	64.4	61.2	59.4	58.2	57.3	56.6	56.0	55.4	54.5	53.8	53.1	52.6	52.1
			Night time	60.6	58.3	55.1	53.4	52.2	51.3	50.5	49.9	49.4	48.4	47.7	47.1	46.5	46.0
		2032	Day time	68.2	65.9	62.7	60.9	59.7	58.8	58.1	57.5	56.9	56.0	55.3	54.6	54.1	53.6
			Night time	62.0	59.8	56.5	54.8	53.6	52.7	51.9	51.3	50.8	49.9	49.1	48.5	47.9	47.4
		2037	Day time	69.0	66.8	63.5	61.8	60.6	59.7	59.0	58.3	57.8	56.9	56.1	55.5	55.0	54.5

			Night time	62.9	60.6	57.4	55.7	54.5	53.6	52.8	52.2	51.7	50.8	50.0	49.4	48.8	48.3
	West Extension Section of Binhe South Road	2017	Day time	69.4	67.1	63.9	62.2	61.0	60.1	59.3	58.7	58.2	57.2	56.5	55.9	55.3	54.8
			Night time	63.3	61.0	57.8	56.1	54.9	54.0	53.2	52.6	52.1	51.2	50.4	49.8	49.2	48.7
		2032	Day time	70.0	67.8	64.5	62.8	61.6	60.7	60.0	59.3	58.8	57.9	57.1	56.5	56.0	55.5
			Night time	63.9	61.7	58.4	56.7	55.5	54.6	53.8	53.2	52.7	51.8	51.0	50.4	49.8	49.4
		2037	Day time	70.8	68.5	65.3	63.6	62.4	61.5	60.7	60.1	59.6	58.6	57.9	57.3	56.7	56.2
			Night time	64.6	62.4	59.2	57.4	56.2	55.3	54.6	53.9	53.4	52.5	51.8	51.1	50.6	50.1

The new road of this project is involved with six districts and counties including Yanliang, Chencang, and Chengcheng; totally there are 17 new roads; since the sections have different design traffic flow, the traffic noise impact scope of each section to the areas along the line is also different.

(1) Yanliang District

The section of the most traffic volume in this district is Hongyao Road. During the operation period, the short, medium, and long term predicted traffic volume is 888, 1110, 1332pcu/h respectively. According to the prediction, if not considering other noise attenuating factors, the area within 40m distance to the road center line will exceed class 4a standard and that within 80m~200m distance to the road center line will meet class 2 standard during the short term of the operation. In the medium term, the area within 45m distance to the road center line will exceed class 4a standard and that within 95m~200m distance to the road center line will meet class 2 standard. In the long term, the area within 55m distance to the road center line will exceed class 4a standard and that within 110m~200m distance to the road center line will meet class 2 standard.

(2) Chencang District

The section of the most traffic volume in this district is Heping Road. During the operation period, the short, medium, and long term predicted traffic volume is 421, 837, 1084pcu/h respectively. According to the prediction, if not considering other noise attenuating factors, the area within 29m distance to the road center line will exceed class 4a standard and that within 48m~200m distance to the road center line will meet class 2 standard during the short term of the operation. In the medium term, the area within 40m distance to the road center line will exceed class 4a standard and that within 75m~200m distance to the road center line will meet class 2 standard. In the long term, the area within 45m distance to the road center line will exceed class 4a standard and that within 95m~200m distance to the road center line will meet class 2 standard.

(3) Chengcheng County

The section of the most traffic volume in this district is Dongba Road. During the operation period, the short, medium, and long term predicted traffic volume is 1841, 2651, 2933pcu/h respectively. According to the prediction, if not considering other noise attenuating factors, the area within 58m distance to the road center line will exceed class 4a standard and that within 150m~200m distance to the road center line will meet class 2 standard during the short term of the operation. In the medium term, the area within 75m distance to the road center line will exceed class 4a standard and that beyond 210m distance to the road center line will meet class 2 standard. In the long term, the area within 80m distance to the road center line will exceed class 4a standard and that beyond 230m distance to the road center line will meet class 2 standard.

(4) Yintai District

The section of the most traffic volume in this district is the north section of Binhe West Road. During the operation period, the short, medium, and long term predicted traffic volume is 624, 796, 932pcu/h respectively. According to the prediction, if not considering other noise attenuating factors, the area within 33m distance to the road center line will exceed class 4a standard and that within 60m~200m distance to the road center line will meet class 2 standard during the short term of the operation. In the medium term, the area within 36m distance to the road center line will exceed class 4a standard and that within 72m~200m distance to the road center line will meet class 2 standard. In the long term, the area within 39m distance to the road center line will exceed class 4a standard and that within 80m~200m distance to the road center line will meet class 2 standard.

(5) Hantai District

The section of the most traffic volume in this district is Lianhua Road. During the operation period, the short, medium, and long term predicted traffic volume is 4079, 4567, 4970pcu/h respectively. According to the prediction, if not considering other noise attenuating factors, the area within 105m distance to the road center line will exceed class 4a standard and that beyond 310m distance to the road center line will meet class 2 standard during the short term of the operation. In the medium term, the area within 120m distance to the road center line will exceed class 4a standard and that beyond 310m distance to the road center line will meet class 2 standard. In the long term, the area within 130m distance to the road center line will exceed class 4a standard and that beyond 370m distance to the road center line will meet class 2 standard.

(6) Hanyin County

The section of the most traffic volume in this district is the west extension section of Binhe South Road. During the operation period, the short, medium, and long term predicted traffic volume is 944, 2238, 2654pcu/h respectively. According to the prediction, if not considering other noise attenuating factors, the area within 60m distance to the road center line will exceed class 4a standard and that within 155m~200m distance to the road center line will meet class 2 standard during the short term of the operation. In the medium term, the area within 65m distance to the road center line will exceed class 4a standard and that within 175m~200m distance to the road center line will meet class 2 standard. In the long term, the area within 75m distance to the road center line will exceed class 4a standard and that beyond 205m distance to the road center line will meet class 2 standard.

Table 5.3-8: Traffic Noise Distribution of the Project, dB (A)

Area	Section	Year	Time	Standard class	Standard value dB (A)	Standard distance (m)	Standard class	Standard value dB (A)	Standard distance (m)
Yanliang District	Hongyao Road	2017	Day time	4a	70	/	2	60	45
			Night time	4a	55	40	2	50	80
		2032	Day time	4a	70	/	2	60	50
			Night time	4a	55	45	2	50	95
		2037	Day time	4a	70	/	2	60	55
			Night time	4a	55	50	2	50	110

	North Guangyang Street	2017	Day time	4a	70	/	2	60	35
			Night time	4a	55	32	2	50	60
		2032	Day time	4a	70	/	2	60	40
			Night time	4a	55	35	2	50	65
		2037	Day time	4a	70	/	2	60	45
			Night time	4a	55	37	2	50	75
	Guangsan Road	2017	Day time	4a	70	/	2	60	35
			Night time	4a	55	32	2	50	60
		2032	Day time	4a	70	/	2	60	40
			Night time	4a	55	35	2	50	70
		2037	Day time	4a	70	/	2	60	45
			Night time	4a	55	38	2	50	75
Chencang District	Longhai North Road	2017	Day time	4a	70	/	2	60	27
			Night time	4a	55	25	2	50	35
		2032	Day time	4a	70	/	2	60	37
			Night time	4a	55	35	2	50	60
		2037	Day time	4a	70	/	2	60	40
			Night time	4a	55	35	2	50	70
	Beikai Road	2017	Day time	4a	70	/	2	60	28
			Night time	4a	55	27	2	50	40
		2032	Day time	4a	70	/	2	60	40
			Night time	4a	55	35	2	50	65
		2037	Day time	4a	70	/	2	60	42
			Night time	4a	55	37	2	50	70
	Heping Road	2017	Day time	4a	70	/	2	60	32
			Night time	4a	55	29	2	50	48
		2032	Day time	4a	70	/	2	60	42
			Night time	4a	55	40	2	50	75

		2037	Day time	4a	70	/	2	60	48
			Night time	4a	55	45	2	50	95
Chengcheng County	Huifu Street	2017	Day time	4a	70	13	2	60	65
			Night time	4a	55	48	2	50	110
		2032	Day time	4a	70	17	2	60	70
			Night time	4a	55	60	2	50	150
		2037	Day time	4a	70	20	2	60	80
			Night time	4a	55	65	2	50	160
	Yangguang Road	2017	Day time	4a	70	10	2	60	45
			Night time	4a	55	38	2	50	80
		2032	Day time	4a	70	13	2	60	55
			Night time	4a	55	48	2	50	110
		2037	Day time	4a	70	15	2	60	65
			Night time	4a	55	55	2	50	130
	Dongba Road	2017	Day time	4a	70	26	2	60	70
			Night time	4a	55	58	2	50	150
		2032	Day time	4a	70	28	2	60	95
			Night time	4a	55	75	2	50	210
		2037	Day time	4a	70	29	2	60	100
			Night time	4a	55	80	2	50	230
Yintai District	North Section of Binhe West Road	2017	Day time	4a	70	/	2	60	36
			Night time	4a	55	33	2	50	60
		2032	Day time	4a	70	/	2	60	40
			Night time	4a	55	36	2	50	72
		2037	Day time	4a	70	/	2	60	45
			Night time	4a	55	39	2	50	80
	Binhe West Road	2017	Day time	4a	70	/	2	60	28
			Night time	4a	55	26	2	50	37

		2032	Day time	4a	70	/	2	60	33
			Night time	4a	55	30	2	50	50
		2037	Day time	4a	70	/	2	60	37
			Night time	4a	55	34	2	50	63
	Weiyi Road — Weiliu Road	2017	Day time	4a	70	/	2	60	25
			Night time	4a	55	24	2	50	30
		2032	Day time	4a	70	/	2	60	27
			Night time	4a	55	25	2	50	35
		2037	Day time	4a	70	/	2	60	30
			Night time	4a	55	29	2	50	45
Hantai District	the north section of Lianfeng Road	2017	Day time	4a	70	30	2	60	115
			Night time	4a	55	90	2	50	260
		2032	Day time	4a	70	32	2	60	130
			Night time	4a	55	105	2	50	300
		2037	Day time	4a	70	32	2	60	140
			Night time	4a	55	110	2	50	330
	Lianhua Road	2017	Day time	4a	70	31	2	60	135
			Night time	4a	55	105	2	50	310
		2032	Day time	4a	70	32	2	60	140
			Night time	4a	55	120	2	50	310
		2037	Day time	4a	70	33	2	60	160
			Night time	4a	55	130	2	50	370
	Bei'er Road	2017	Day time	4a	70	28	2	60	105
			Night time	4a	55	85	2	50	230
		2032	Day time	4a	70	30	2	60	130
			Night time	4a	55	100	2	50	290
		2037	Day time	4a	70	32	2	60	140
			Night time	4a	55	110	2	50	320

Hanyin County	Nanqu Road	2017	Day time	4a	70	20	2	60	47
			Night time	4a	55	42	2	50	90
		2032	Day time	4a	70	20	2	60	60
			Night time	4a	55	50	2	50	120
		2037	Day time	4a	70	20	2	60	70
			Night time	4a	55	55	2	50	140
	West extension Section of Binhe South Road	2017	Day time	4a	70	20	2	60	75
			Night time	4a	55	60	2	50	155
		2032	Day time	4a	70	20	2	60	80
			Night time	4a	55	65	2	50	175
		2037	Day time	4a	70	28	2	60	95
			Night time	4a	55	75	2	50	205
Note: "/" indicates the standard distance is below 15m; the standard distance is the distance to the road center line.									

5.3.2.2 Mitigation Measures

(1) The noise radiation from sound source is reduced through strict control of construction quality and guarantee of high-quality project. Especially in the sections with noise sensitive point around, actions shall be taken to treat the subgrade to ensure that related problems to sinking, crack and irregularity will not happen during the operation of the road and the noise emitted by the traveling vehicles will not increase.

(2) The routes of noise transmission are controlled through increasing the greening installations on both sides of the road. In accordance with the local ecological construction planning, efforts shall be made to green the sections that can be afforested in the range of land acquisition for proposed road works. The uniform greening design shall be carried out on the embankment slope and in the drainage ditches. The forest belt of multi-layered structure should be constructed on the village sections where the road runs through to form the three-dimensional barriers so as to strengthen the block and absorption of traffic noise. In addition, the best use of the idle lots between the village and the road shall be made to forest the four sides (i.e. house side, village side, roadside and waterside).

(3) The management of motor vehicles shall be strengthened by strictly implementing the requirements of traffic management for rate limiting and overloading prohibition and setting up the no-honking signs at the sections with larger population density. Efforts shall be made to reduce the noise from source of noise pollution and gradually limit the vehicles of poor technical condition and high noise from running on the road so as to remove the problems of traffic noise nuisance.

(4) The road maintenance department should always maintain the roads by repairing the damaged roads without delay and maintaining the flatness of highway surface to avoid the increase of traffic noise from jarring of vehicles arising out of poor road conditions.

5.3.2.3 Prediction and Evaluation of Noise at Sensitive Points

(1) Impact Prediction

The predictive value of environmental noise at the sensitive points within the scope of the evaluation of road operation period is generated through superimposing the predictive value of section traffic noise and the background value of noise after the former is properly corrected according to the impact factors of acoustic environment at the sensitive points. On the correction of traffic noise value, comprehensive consideration should be given to such factors as the landform at the sensitive points, altitude difference with the pavement and vegetation cover. For the predictive value of ambient noise at such sensitive points as along-line villages and schools, see Table 5.3-10; according to the evaluation standard, the abovementioned table also indicates the excess at the sensitive points.

(2) Mitigation Measures

Since the noise prediction mode is built in the statistics, it is in great relevance with traffic forecast, speed distribution and vehicle-model ratio. Especially the change of the distance to the ambient sensitive point (object) arising out of line position adjustment is very common, so the environmental impact statement indicates that there may be the prediction error in the measures against noise, which arises out of the uncertainty in the stage of environmental evaluation. According to the mode are analyzed the predictive accuracy and the measured data at completion acceptance of highway. If the recent predictive value of ambient noise above the standard is below 3dB, it is appropriate to conduct the ambient noise monitoring and timely implement the noise abatement measures; if the recent predictive value of ambient noise above the standard is 3dB, the initial measures against noise should be determined and the related costs, estimated.

According to the noise prediction results, the round-the-clock noise in the villages on both sides of the newly constructed road for this project is not excessive. Excess sometimes happens at night, with the excessive amount of 0.1 ~ 4.8 dB (A). With the increase of development level in the area where the project is located, the land on both sides of the project may have been developed into the financial and commercial one in the period of highway operation. In such a case the anti-noise measure taken in the residential area of the project will lose its relevance. Therefore, we suggest strengthening the follow-up monitoring in the operating period of this project. If there is actually the excessive noise in the housing residential area forward, the noise-reduction measure shall be established at the sensitive points of excessive noise in the years of noise excess based on the specific circumstances of the sensitive points and according to the following principles of determining the noise reduction measures (see Table 5.3-11).

At present, the noise reduction measures commonly implemented at home mainly include noise barrier building, environmental relocation, sound-proof window installation, forestation for noise reduction and the like. Now several noise reduction measures are compared as follows, and according to the actual situation of the sensitive points of the project, the noise reduction measures suitable for the sensitive points of this project with excessive noise, analyzed. For the comparative details of various measures, see Table 5.3-11.

Table 5.3-11: Comparative Statement of Common Noise Control Measures

Names	Applicability	Noise Reduction Effect	Advantages	Disadvantages	Investment	Applicability to This Project

House Relocation or Misuse	The places without noise effect, where the seriously excessive individual households are relocated	Good	Noise is reduced completely and noise effect, completely removed, but it is only fit for a few excessive households.	With higher costs and limited applicability, it has some impact on people's living.	The repurchase of land for housing replacement is needed, with larger investment.	The excessive amount of noise at the along-line sensitive points of this project is smaller, so it is not suitable.
Sound Barrier	The sensitive points of seriously excessive noise, which are very close to the road.	8~15dB (A)	With better effect, it is applicable to the road, easy to implement and beneficial to a large population.	Its investment is higher. Some barriers influence landscape.	Sound-absorbing Type: RMB1000.00/m2; Reflection Type: RMB700.00/m2	The application of sound barriers on the municipal roads will block residents' travel, so it is not suitable.
Build or heighten the fences.	Some dwellings or schools with generally excessive noise close to the road	3~5dB (A)	It is of general effect and lower costs.	With limited noise reduction and small applicability, it impacts on lighting and ventilation.	It is about RMB200.00/m2, so it is smaller in investment.	The residential areas with excessive noise along the line of this project contain many single-detached courtyards of 1F-2F, so this measure is comparatively suitable.
Common Sound-proof Window	The distributed villages that are seriously influenced	About 20dB (A)	It is better in effect, lower in costs and strongly applicable.	Unventilated and unfit for summer, it influences people's living.	It is about RMB500.00/m2, so it is smaller than sound barrier in vestment.	The unventilated sound-proof window has greater influence on people's living, so it is not suitable.
Ventilated Sound-proof Window	The distributed villages that are influenced more seriously	About 0dB (A)	With better effect, lower costs and stronger applicability, it has smaller influence on people's living.	it is hard to implement because the housing structure must be very good.	It is about RMB800.00/m2, so it is smaller than sound barrier in vestment.	The ventilated sound-proof window is flexible in use and strong in applicability, and the structure of the houses along the line is better, so this measure is more suitable.

Greening	The villages with planting conditions, whose noise excess is not very serious	30m-wide green belt may reduce noise by 3~ 5dB (A).	It can improve the eco-environment by reducing noise, purifying air and beautifying road appearance.	It will take a long time to achieve some effect. The seasonal change of effect is greater and the investment higher. Some land needs to be acquired.	It is of higher investment in removal.	The sensitive points of excessive noise in this project are generally close to the roads and the land resources are limited, so greening is restricted.

In accordance with the applicable conditions of different noise reduction measures and their advantages and disadvantages shown in Table 5.3-11, and in combination of the specific circumstances of the along-line sensitive points in this project, this assessment suggests that it is a better noise-reduction method to add the ventilated sound-proof window to the windows on the side to the street. For some residential areas of the 1F-2F single-detached courtyards, it is also a better noise-reduction method to build or heighten the fence. For the detailed noise control measures advanced in this assessment, see Table 5.3-12 as follows:

In addition, the regular follow-up monitoring of noise at the along-line sensitive points on both sides of the newly rebuilt road should be strengthened in the operation period of this project. The reasonable and feasible noise attenuating measures shall be determined according to the actual monitoring results.

Table 5.3-10: Predicted Environment Noise Values and Out-of-limit for the Villages in the Assessment Scope during the Operation Period

S/N	Location		Name of sensitive points	Distance to road redline (m)	Distance to the road center line (m)	Executed standard	Height difference (m)	Present value dB(A)		Predicted value, sound environment and out-of-limit, dB(A)								
										2017			2032			2037		
										Traffic noise	Environment noise	Out-of-limit	Traffic noise	Environment noise	Out-of-limit	Traffic noise	Environment noise	Out-of-limit
1	Yanliang DistrictWutun Town	Hongyao Road (15m)	Beitun Central Primary School	22.5	30	Class 4a	0	Day	46.5	59.4	59.6	/	60.4	60.6	/	61.2	61.4	/
								Night	36.2	53.4	53.4	/	54.3	54.4	/	55.1	55.1	0.1
2			Beitun Middle School	22.5	30	Class 4a	0	Day	46.2	59.4	59.6	/	60.4	60.6	/	61.2	61.4	/
								Night	37.1	53.4	53.5	/	54.3	54.4	/	55.1	55.2	0.2
3			Beitun Kindergarten	22.5	30	Class 4a	0	Day	45.7	59.4	59.6	/	60.4	60.6	/	61.2	61.4	/
								Night	37.1	53.4	53.5	/	54.3	54.4	/	55.1	55.2	0.2
4			Sanzhang Village	0.5	8	Class 4a	0	Day	42.4	62.2	62.2	/	63.2	63.2	/	64.0	64.0	/
								Night	39	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
5			Liqiao Village	0.5	8	Class 4a	0	Day	46.1	62.2	62.3	/	63.2	63.2	/	64.0	64.0	/
								Night	38.2	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
6			Donglai Village	0.5	8	Class 4a	0	Day	47.3	62.2	62.3	/	63.2	63.3	/	64.0	64.1	/
								Night	40.1	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
7			Xinfeng Village	0.5	8	Class 4a	0	Day	46.9	62.2	62.3	/	63.2	63.3	/	64.0	64.1	/
								Night	39	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
8			Gengxi Village	0.5	8	Class 4a	0	Day	47.2	62.2	62.3	/	63.2	63.3	/	64.0	64.1	/
								Night	38.5	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
9			Gengdong Village	0.5	8	Class 4a	0	Day	46.5	62.2	62.3	/	63.2	63.3	/	64.0	64.1	/
								Night	40.2	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
10			Xinmin Village	0.5	8	Class 4a	0	Day	47	62.2	62.3	/	63.2	63.3	/	64.0	64.1	/
								Night	41	56.1	56.2	1.2	57.0	57.1	2.1	57.8	57.9	2.9
11		North Guangyang Street12m	Guangyang Village	2	8	Class 4a	0	Day	45.6	61.0	61.1	/	62.0	62.1	/	62.8	62.9	/
								Night	36.1	55.0	55.0	0.0	55.8	55.9	0.9	56.7	56.7	1.7
12	Chencang District	Longhai North Road18m	Gaojialeng Village	1	10	Class 4a	1	Day	46.8	56.4	56.8	/	60.8	61.0	/	61.6	61.8	/
								Night	40.1	50.2	50.6	/	54.7	54.8	/	55.5	55.6	0.6
21	Chengcheng	Huifu	Yangjiazhuang	2	15.5	Class 4a	0.5	Day	46.1	62.9	63.0	/	64.3	64.4	/	64.8	64.8	/

	County	Street(27)	Village					Night	41.0	56.8	56.9	1.9	58.2	58.3	3.3	58.7	58.7	3.7
22			Zengjia Village 村	2	15.5	Class 4a	0	Day	47.8	62.3	62.5	/	63.7	63.8	/	64.2	64.3	/
								Night	39.6	56.2	56.3	1.3	57.6	57.7	2.7	58.1	58.1	3.1
26	Yintai District	Binhe West Road(15m)	Shunhe Village	42.5	50	Class 2	0	Day	46.3	55.7	56.1	/	56.8	57.1	/	57.5	57.8	/
								Night	36.5	49.6	49.8	/	50.7	50.8	0.8	51.3	51.5	1.5
27	Puzhen Town Hantai District	Lianfeng Road(40m)	Mosque on Lianfeng Road	2	22	Class 4a	0	Day	47	63.6	63.7	/	64.3	64.4	/	64.6	64.7	/
								Night	35.7	57.5	57.5	2.5	58.2	58.2	3.2	58.5	58.5	3.5
28			Lianfeng Village	2	22	Class 4a	0	Day	45.9	63.6	63.7	/	64.3	64.4	/	64.6	64.7	/
								Night	36.6	57.5	57.5	2.5	58.2	58.2	3.2	58.5	58.5	3.5
29			Xinxiang Estate	2	22	Class 4a	0	Day	48.1	63.6	63.7	/	64.3	64.4	/	64.6	64.7	/
								Night	37.4	57.5	57.5	2.5	58.2	58.2	3.2	58.5	58.5	3.5
30	Hanyin County	Nanqu Road(24m)	Zhongyan Village	2	14	Class 4a	0	Day	45.5	62.6	62.6	/	64.1	64.1	/	64.9	65.0	/
								Night	40.2	56.5	56.6	1.6	57.9	58.0	3.0	58.8	58.9	3.9
31			Huaba Village	15	27	Class 4a	0	Day	46.3	57.1	57.4	/	58.6	58.8	/	59.5	59.7	/
								Night	41.7	51.0	51.5	/	52.5	52.8	/	53.3	53.6	/
32		Binhe South Road(19m)	Taiping Village	10.5	20	Class 4a	0	Day	-	64.6	-	-	65.2	-	-	66.0	-	-
								Night	-	58.5	-	3.5	59.1	-	4.1	59.8	-	4.8

Table 5.3-12: List of Noise Reduction Measures for Villages within the Assessment Scope during the Operation Period

S/N	Location		Name of sensitive points	Distance to road redline (m)	Distance to the road center line (m)	Executed standard	Height difference (m)	Present value dB(A)		Out-of-limit dB(A)			Out-of-limit
										2017	2032	2037	
1	Yanliang District Wutun Town	Hongyao Road	Sanzhang Village	0.5	8	Class 4a	0	Day	42.4	/	/	/	Monitor for the short term, implement the preventive measures as appropriate
								Night	39	1.2	2.1	2.9	
2			Liqiao Village	0.5	8	Class 4a	0	Day	46.1	/	/	/	
								Night	38.2	1.2	2.1	2.9	
3			Donglai Village	0.5	8	Class 4a	0	Day	47.3	/	/	/	
								Night	40.1	1.2	2.1	2.9	
4			Xinfeng Village	0.5	8	Class 4a	0	Day	46.9	/	/	/	
								Night	39	1.2	2.1	2.9	
5			Gengxi Village	0.5	8	Class 4a	0	Day	47.2	/	/	/	
								Night	38.5	1.2	2.1	2.9	
6			Gengdong Village	0.5	8	Class 4a	0	Day	46.5	/	/	/	
								Night	40.2	1.2	2.1	2.9	
7			Xinmin Village	0.5	8	Class 4a	0	Day	47	/	/	/	
								Night	41	1.2	2.1	2.9	
11		North Guangyang Street	Guangyang Village	2	8	Class 4a	0	Day	45.6	/	/	/	
								Night	36.1	0.0	0.9	1.7	
12	Chencang District	Longhai North Road	Gaojialeng Village	1	10	Class 4a	1	Day	46.8	/	/	/	
								Night	40.1	/	/	0.6	
21	Chengcheng County	Huifu Street	Yangjiazhuang Village	2	15.5	Class 4a	0.5	Day	46.1	/	/	/	
								Night	41.0	1.9	3.3	3.7	
22			Zengjia Village	2	15.5	Class 4a	0	Day	47.8	/	/	/	
								Night	39.6	1.3	2.7	3.1	
26	Yintai District	Binhe West Road	Shunhe Village	42.5	50	Class 2	0	Day	46.3	/	/	/	
								Night	36.5	/	0.8	1.5	
27	Hantai District Puzhen Town	Lianfeng Road	Lianfeng Road Mosque	14	34	Class 4a	0	Day	47	/	/	/	
								Night	35.7	/	/	/	

28	Hanyin County	Nanqu Road (24m)	Zhongyan Village	2	14	Class 4a	0	Day	45.5	/	/	/	
								Night	40.2	1.6	3.0	3.9	
29			Taiping Village	10.5	20	Class 4a	0	Day	-	-	-	-	Ventilation and sound insulation window recommended
								Night	-	3.5	4.1	4.8	

5.4 Impact of Solid Waste

The solid waste arising in the construction period of this project mainly includes the construction waste arising out of demolition and the building rubbish and household refuse at the workyard. As a construction project of municipal infrastructure, this project has nothing to do with the productive activities. It itself does not produce any solid waste, but in its operation period there is the household garbage along the road, the road refuse and the periodically cleaned garbage at storm water discharge outlets.

5.4.1 Impact of Solid Waste and Their Disposal Measures in the Construction Period

1. Environmental Impact

(1) **Project spoil**

The analysis of the earthwork and stonework balance in 2.1.5 indicates that Yanliang District, Chencang District, Wugong Town, Xunyi County and Chunhua County Runzhen Town subprojects have a certain quantity of spoil, and single project site has small quantity of spoil. Runzhen project has 34600m^3 of spoil, the largest quantity, and Xunyi 15200 m3, the smallest quantity. In addition, Chengcheng County and Yintai District Hantai and Hanyin County have larger quantity of fill, requiring a certain quantity of borrow. Hanyin County subproject has 201560 m^3 of borrow material, the largest quantity, and Hantai District, 1908.01 m^3, the smallest one.

Currently, the project is at feasibility study period, it is proposed that spoil should be buried in the waste valley, but the specific location of spoil and earthing for greening scheme are not given. According to the field survey by assessment group, there are the waste valleys available surrounding the subproject, generally, the spoil to be buried in the waste valley is feasible. In addition, for the location of spoil is not determined, requirement for selecting location of spoil is proposed during assessment as following:

- The location to be selected shall be far from the collapsed or landslide area;
- The location to be selected shall not occupy the basic farmland or arable land;
- The location to be selected shall not occupy river channel and spoil shall not be poured within area that is vulnerable to flood.

When the location of spoil ground is finalized, the spoil ground site selection scheme, spoil scheme and ecological restoration measure for the spoil ground shall be documented and submitted to EIA report approval authority for filing.

The necessary retraining and covering measures shall be taken during discarding the spoil to avoid washing away or the dust that may be generated in windy days. After completion of discarding spoil, the spoil ground shall be greened, namely on which the grass shrub suitable to local condition shall be planted. In conclusion, the project will produce small quantity of spoil, and the waste valley scheme for burying the spoil is feasible. Under the premise of proper selection of site, and strengthening management of spoil and later ecological restoration, the impact of spoil produced in the project is smaller.

(2) Impact of Demolition Construction Waste on the Environment

The construction waste dumped at random occupies land. The hazardous substance from the waste that is dumped in the open and caught in the rain for a long time will pollute the soil;

the dust from the construction waste in the open drifts away and forms flowing-dust pollution. Thus it can be seen that the construction waste should be removed without delay.

(3) Impact of Household Refuse on the Environment

The household refuse arising in the construction period is 1.0 kilograms per person every day, and it is collected and delivered to the refuse landfill for treatment. The household refuse has smaller impact on the environment.

(4) Impact of Construction-site Building Rubbish on the Environment

The construction-site building rubbish mainly refers to the remaining road-building materials, including stone, sand, lime, asphalt, cement, steel, wood, precast element and etc. If lime or cement seeps into the underground with water, it will, in addition to hardening soil and causing the rise of pH value, pollute the groundwater and make this land lose its productive capacity so as to give rise to the waste of land resources. In order to reduce and eliminate the impact of building rubbish on the environment, the project plan and construction progress shall be followed in purchase of road-building materials and the residual materials, minimized while the use of materials is controlled. Secondly, the residual materials should be kept available for the construction of rural roads or buildings around to reduce the impact of building rubbish on the environment.

2. Anti-pollution Measures

The solid waste arising in the construction period of this project means the construction waste and the household refuse from the construction workers in the construction period.

① The demolition construction waste shall uniformly be delivered to the construction refuse landfill for treatment as required by the environmental sanitation department.

In the control of construction waste, the principle that whoever produces waste shall clear it shall be implemented. Those rubbish creators who are incapable of clearing rubbish can entrust it to the qualified unit. The units or individuals who cause the scattering of waste must be responsible for rubbish clearing and the costs arising therefrom.

The charge system shall be implemented in the disposal of construction waste. The charging standards shall be carried out as approved by the department in charge of price.

The site supervision of the project should be in the charge of the specially-assigned person who shall prohibit the vehicles against the sanitary requirements for city appearance and environment from being driven out of the construction site; and who shall be responsible for filling in the Daily Report for Disposal of Construction Waste.

The construction units shall timely clear different kinds of construction waste it produces in order to keep clean the construction site from beginning to end.

② The household refuse from the construction workers shall, after classified and collected, be periodically delivered to the town refuse landfill for treatment.

③ The spoil shall be used for roadbed fill of new roads or land leveling of its reorganized and expanded road works. This project shall not have the spoil ground.

④ The residual materials shall be strictly controlled and minimized according to the plan and construction procedures. In case of the residual materials, they shall be stored orderly and kept safely to be used for the road building or road or building maintenance in the surrounding area.

⑤ Other solid waste arising in the construction period shall be reduced in the recycling

method and the solid waste that can't be recycled shall be collected and delivered to the along-line town refuse landfill for treatment. Besides, attention shall be paid to the stacking of waste oil, pitch and other solid waste in the construction process, which can't be stacked beside the water body, but removed in time.

5.4.2 Impact of Solid Waste and Their Disposal Measures in the Operating Period

1. Environmental Impact

The solid waste in the operating period mainly refers to the household refuse from the residents along the line and the garbage from the drivers and conductors. In addition, a certain amount of road construction waste is also produced in the process of road maintenance and repair. Some garbage also comes from road cleaning and some waste proceeds from periodic cleaning at the storm water discharge outlet. The abovementioned rubbish and waste shall be collected into one place and delivered to the town refuse landfill for treatment. The waste of road maintenance can comprehensively be used in the building of country roads. It follows that the solid waste in the operating period will have a smaller impact on the environment along the line.

2. Mitigation Measures

The solid waste arising in the operating period mainly refers to the solid waste thrown at random by the drivers and passengers. In order to reduce the impact of such waste on the environment, it is recommended to take the following measures:

(1) Strengthen the sanitation advocacy to improve the people's awareness of environmental protection so as to end the bad behavior of littering;

(2) Improve the sanitation workers' work awareness to clean up the scattered waste without delay.

5.5 Ecological Impacts

5.5.1 Ecological Impacts and Their Mitigation Measures in the Construction Period

1. Environmental Impact

(1) Impact of Project Land Occupation

This project mainly means the construction, reconstruction and extension of roads, the laying of pipe network and the construction of wells. The new roads will change the original landform and natural landscape so as to transform the nature of land use fundamentally. This project will occupy some farmlands and change them into roads, resulting in the reduction of greening rate in the area. The damage to the original agro-ecology and greenbelt, which will arise from this project, will give rise to the reduction of farmland area and biomass, having a certain impact on the ecology. Road greening after the completion of roads will have some compensation for the ecology in the area.

(2) Impact of the Project on the Ecological Environment

After the project is completed, the local infrastructure will greatly improve and the nature of land use change, which will promote town development.

(3) Impact on Water and Soil Erosion

The impact of the project on soil erosion mainly occurs in the construction period. The earth excavation in the construction period will destroy the soil-layer structure and vegetation of the

original ground and the relative stability of original water-soil conservation, so erosion will easily happen under the action of such external forces as rain, wind and others.

Especially during the construction in the rainy season, the surface runoff will scour off the temporarily piled dirt to a certain extent so as to result in the water and soil loss, so precautions should be taken against the soil erosion in the rainy season.

After the completion of road works, the road surface will be hardened and the bare land afforested completely, which will greatly reduce the intensity and volume of soil erosion. Therefore, it will have a smaller impact on soil erosion in the road operation period.

2. Mitigation Measures

This project is located in the urban built-up areas and the nature of land is changed into the land for transportation, but in order to maintain the ecological security inside the areas, efforts shall be made to reduce the temporarily occupied lands in the construction period and to green or reclaim them after the construction ends.

(1) Protective Measures for Land Resources

① Efforts shall be made to select the temporarily occupied land in the range of road acquired land in the construction period, and occupy no farmland or less farmland.

② Where the construction camps are needed, the local residences or public buildings shall be leased as far as possible or the camps shall be built in the range of the land for road. In addition, actions shall be taken against the pollution of farmland and field by household sewage and refuse.

③ The construction units shall strictly control the number of temporarily used land and comprehensively consider the construction roads, various stockyards and precast fields according to the construction schedule. Such a land shall be provided in the range of road land as far as possible.

④ The temporary grit chamber shall be used for collection of construction wastewater in the construction period. Exterior drainage is not allowed to prevent construction wastewater from being drained into farmland and fields so as to cause pollution.

⑤ The construction waste and household refuse in the construction period shall uniformly be cleared by the local sanitation department. It is disallowed to stack them at random so as to occupy land resources. The percolate shall be prevented from polluting soil.

⑥ The construction road shall be maximized by the existing roads.

(2) Soil and Water Conservation Measures

① During the construction the reasonable arrangements for construction sequencing and section construction shall be made to shorten the construction time.

② Efforts shall be made to reduce earthwork in the engineering design to strike a balance and reduce soil erosion.

③ It is suggested that in the stage of alteration and adjustment for construction drawing design and construction-period design, the design of plan for temporary stripping and stacking of farmland topsoil (0~30cm) with higher fertility in the main work and temporary work, as well as its precautions against soil erosion, shall be defined to ensure these mellow soil of topsoil can be used for land reclamation or landscaping in the later part of the project.

④ The construction units should do well in the drainage works inside the temporary

construction site to prevent runoff erosion; after the construction site is used, they must remove all the upper buildings and hardened ground surface, and backfill cultivated soil without delay. All the waste shall timely be delivered to the uniform stocking area designated by the local sanitation department.

(3) Protective Measures for Along-line Plant Resources

① The temporarily used land in the construction period shall be selected in the range of acquired road land and the existing buildings and places, leased as the construction camps to the greatest extent. All the land (including those inside and outside the road) bare because the vegetation is destroyed in the road construction shall be renovated and used after the construction ends through vegetation restoration or garden making for farmland.

② The construction scheme shall be designed reasonably. In the excavation, efforts shall be made to reduce the area of occupied land, shorten stacking time and implement the measures of centralized stacking.

5.5.2 Ecological Impacts and Their Mitigation Measures in the Operating Period

1. Environmental Impact

The area where the project is located is characteristic of original urban and agricultural ecology. After the project is completed, this area shall gradually be characteristic of urban ecology. Relative to agro-ecological system, the ecological value of its urban ecological system is lower, so the construction of this project will generate a certain impact on the local environment. However, after the corresponding actions for ecological protection and restoration are taken, the impact of this project on the environment may be mitigated effectively. Generally this project will not produce a great impact on the ecological environment. This assessment suggests that the corresponding compensative measures shall be taken to increase the work amount of road greening so as to maintain the ecological stability inside the area.

2. Mitigation Measures

Inside the areas influenced by the construction shall be taken the measures of vegetation restoration and landscape reconstruction. In the period of vegetation restoration and landscape reconstruction, such measures shall be adjusted to the local conditions and the principle of economic rationality followed to combine the landscaping and landform. On the local balance of cut and fill, the stratified structure of trees, shrubbery, grass, and flowers shall be used to increase the green coverage ratio and ecological benefits so as to give play to the integrated function of greening to the greatest extent.

5.6 Impact of material and cultural resources

5.6.1 Analysis of the impact of material and cultural resources

The material and cultural resources inside the construction areas of this project mainly refer to Chenghuang Temple at Wugong Town, Taita Tower at Chengguan Town of Xunyi County and the mosque at Lianfeng Village Puzhen Town of Hantai District. For the details of socially concerned objects, see Table 5.6-1.

Table 5.6-1: Table for Basic Information of Socially Concerned Objects in the Project Location

Locations			Protected Objects	Basic Information	Positional Relation	Remarks
Xianyang City	Wugong County	Wugong Town	Chenghuang Temple	Chenghuang Temple of Wugong located in the north and facing the south is the building group of Ming Dynasty, with land area of 4500 square meters and building area of 1645 square meters. Its main buildings are, in proper order, the decorated archway, gate, playhouse, bell tower, drum tower, offering hall, main hall and rest hall. On the eastern and western sides there are separately nine accompanying halls, which are the high-platform buildings. Its protective range extends to the moat outside-edge on the north, to East Street on the south, to the moat outside-edge and residential area on the east and to the folk houses on the west.	8m to the eastern side of East Street	Listed as the provincial-level cultural relics in 1992
	Xunyi County	Chengguan Town	Taitai Tower	Taita Tower in Xunyi is a pavilion-style 7-storied brick tower with eight angles and 56-meter height, which was built in the first month of the 4th Year of Emperor Jiayou of the Northern Song Dynasty (A.D. 1059). Its protective range: the key protective area is within 53 meters of the Tower; the common protective area is the same as the key one; the construction control zone is the same as the common one.	100m to the northern side of Taita Road	Listed as the state-level cultural relics in 2001
Hanzhong City	Hantai District	Puzhen Town	Mosque at Lianfeng Village	It is not only the main place of the town for Islamic Muslin worship, but also the key site of religious activity in the township.	15m to the eastern side of Lianfeng Road	Listed as the key site of religious activity
Note: The positional relationship between the identity of the project is the relationship between the material and cultural resources in the region and the border						

(1) Impact of Project Construction on material and cultural resources

The project is a construction project of municipal infrastructure without any productive activities. The planned roads, storm water and sewage pipe network are not involved in the socially concerned objects in the area. The construction of this project has no direct impact on cultural relics and religious venues. Only the temporary traffic blocking arising out of the construction in the construction period will indirectly influence such objects.

The red line width of Lianfeng Road is 40m in previous design, the road adopts three roadway sections, which may result in relocation of mosque. In order to ensure smooth construction and protect ethnic culture, after consulting with historical and cultural protection department and local people, it is decided that the road is to be connected to existing Fenglian Road (the completed south and middle sections of Fenglian Road), the road section is to keep in line with existing road section, with red line width is 16m in design. The vehicle flow rate of the road during operation period is reduced compared with previous design. The implementation of the project has little adverse influence on cultural relics and shall save travel time and improve travel efficiency and facilitate religious activity.

(2) Impact of Project Construction on Religious Activities

The indirect adverse impacts of the project on the socially concerned objects are mainly generated in the construction period. No adverse impact on the local historic preservation and religious activity will appear after the project is completed and operated. However, the construction process may impact on the communication to the Chenghuang Temple during the temple fair, the number of visitors to the Taita Temple and the environment of the road for Muslems to go to the mosque for worship.

5.6.2 Impact Mitigation Measures

A number of targeted measures of management and engineering shall be put forward.

(1) In the construction process, the construction methods should be optimized, prohibiting the use of large machinery, conducting the careful excavation, strictly controling the construction area, setting up the construction fence.

(2) Reasonable arrangements for the construction period, while avoiding as much as possible the important activities of residents' time. Construction segmented approach can be taken to reduce the construction time of construction period.

(3) Within the construction area should be set up the signs to notify the residents of the main content and construction time of project and seek for their understanding for the inconvenience arising out of construction. Besides, the construction markers and guiding marking should be erected, too.

(4) Safe work shall be thought highly of in the construction period and efforts shall be made to leave the pedestrian passageways so that the local residents can go to the temple fair, the tourists visit the Taita Tower and people go to the mosque for worship. In addition to installing the corresponding lighting facilities and setting up the guard railing, we shall accelerate the construction progress near the mosques, cultural relics and heavily populated areas to minimize the impact on local people’s travel and transportation.

(5) Cultural relics and historic sites are the immovable and valuable remains in kind created by human being or left by human activity, so great importance shall always be attached to the effective protection of cultural relics and historic sites through strengthening the education and awareness fostering of managements and construction workers in historic preservation.

(6) As the general venues for religious activity, mosques belong to the material culture resources. Therefore, in the construction of this section, the local ethnic culture should be respected fully for fear of impact on ethnic culture.

(7) It is not allowed to temporarily occupy the land for construction in the areas of cultural relics and religious activity during the construction arrangement. Moreover, after the construction ends, the restoration measures can be taken, such as slash and vegetation restoration, to minimize the impact.

5.7 Analysis of Impact on Road Safety

1. Impact Analysis

As indicated by the domestic and foreign literature, a considerable number do deep-seated accidents related to road safety arise out of low-grade roads that mean the defective ones. Classified according to the difficulty level of defect identification, the defects include dominant defects and recessive defects. The dominant defects of road herein are the road defects that can directly be found out in the general observation method, such as shortage of guardrails on both sides of the road, incomplete guardrails, poor road shoulders, dilapidation of road and its structure after being damaged, and damage or smoothness of road surface. The recessive defects of road herein refer to the road defects that is hard to be found out easily and directly in the observation method, such as the straight-line sections (more than 5km) of continuous many kilometers for expressway, and others. For the status of some existing sections in this project, see Figure 5.7-1.

It can be seen from Figure 5.7-1 that the existing roads in this project have the dominant

defects such as pavement damage, poor shoulder condition and damaged road and its structure. Road safety is in greater hidden danger.

All the pavement of the roads constructed in this project is the bituminous pavement of cement concrete. The road and its structure are complete. In Hanyin County of Ankang City and the built-up area of Yintai District of Tongchuan City, there are complete traffic safety facilities of road. After the project is implemented, the smoothness of the pavement will greatly be improved, the anti-slide performance of pavement, strengthened; and the traffic safety facilities of road, perfected. Therefore, the road safety will better after the project is completed.

Present conditions of the east section of Hongyao Road

Present conditions of North Guangyang Street

Present conditions of Wei'er Road

Present conditions of North Chuangye Road

Present conditions of Nanqu Road

Present conditions of Lianfeng Road

Fig. 5.7-1: Pictures of the Present Conditions of Some Roads for This Project

2. Mitigation Measures

(1) Set up different signs and marks according to the sensitive points along the line.

① Set up speed reduction and slow-down signs as well as speed limit zone as appropriate for roads passing environment protection objects, such the section of Hongyao Road passing Beitun Subdistrict Office and Xinmin Village etc where villages are on both sides and passing such villages as Yangjiazhuang Village Huifu Street, Zengjia Village etc.

② Set up speed limit signs and NO HORN signs for sections passing kingdergartens and schools etc where special population is assembled, such as the section of Hongyao Road passing Beitun Central Primary School, Beitun Middle School, Beitun Kindergarten.

③ Cheng Huang Temple is 8m to the north sides of Wugong Town Wugong County; it's recommended to control the traffic on the east street regularly during the temple fair period.

(2) Guiding facilities

The guiding facilities are for the safety of vehicles driven at night. For this purpose, it's recommended extruding reflective spike on the pavement, with the guard railing painted in red on both sides, provided with yellow reflective guide post, as well as reflective signs etc at the branching points etc.

(3) Anti-collision facilities

On both sides of the road shoulder, single-pole and single-side wave guardrails are provided to prevent running vehicle from interference to the carriageway in the other direction and rushing out of the road when it's getting out of control,

5.8 Accumulative Environment Impact Analysis

5.8.1 Analysis of Accumulative Positive Environment Effect

The implementation of the project road works will improve the regional traffic conditions; layout of pipe networks will improve the regional water environment quality; therefore, the environment accumulative effect resulted from implementation of the project will mainly be positive environment benefits, which are specifically as follows:

1. Implementation of the water supply project will improve the quality of the portable water for the residents, improve the life environment and quality.

For this project, water mains will be laid out in Yanliang District, Chencang District, Xunyi County, Runzhen Town of Chunhua County, and Hanyin County of Hanzhong City; at the same time, a water supply factory will be constructed in Wugong Town of Xianyang City, taking the place of well water supply with centralized water supply, which can improve the portable water quality, living environment quality in rural areas, reduce the disease incidence of the project area for portable water safety, playing an active role in improving the living environment and quality.

2. Layout of sewage pipe network will improve the urban sewage collection rate and improve the urban water environment quality.

For the improvement of urban sewage collection system, improve the urban sewage treatment rate, has a very significant role. "Table 5.1-2 estimate pollutant emission reduction," estimates pursuant to Section 5.1, after the implementation of the project, due to the sewage collection rate, and are relying on the sewage treatment plant sewage treatment, will reduce the regional discharge of COD by 30657.1t/a and that of BOD_5 by 21013.3t/a, NH_3-N by 1582.5t/a, and SS by 14012.9t/a.

3. Construction, reconstruction, and extension of roads will relieve the original noise and airborne dust pollution resulted from poor traffic conditions.

The pavement of the newly constructed, reconstructed, and extended pavement is of high quality and convenient for access, which can, to some extent, reduce the noise and airboredust pollution resulted from poor traffic conditions; in addition, implementation of the road project can improve the road traffic capacity, facilitate the production and life of the people, and improve the residents' living environment.

5.8.2 Analysis of Accumulative Negative Environment Effect

As an urban infrastructure construction project, this project is unavoidable to produce, during the construction process, some environment changes for the construction activities, leading to negative impact to the environment. The negative environment impact is analyzed as follows:

1. This project occupies some farmland, which reduces regional biomass.

Construction of the project will occupy some farmland more or less; while the road landscaping after the project is completed can make up for the losses resulted from the project to some extent; in addition, road landscaping can have such environment effect as beautifying the environment; inhibiting and absorbing the airborne dust and exhaust gases, as well as increasing oxygen etc.

2. Impact load may be caused to the lower-reach sewage treatment, affecting the water quality of the sewage collection water bodies.

As the urban sewage collection rate improves, the load for sewage treatment in the lower-reach areas will increase, which may produce impact load to the sewage treatment facilities . the environment capacity of surface water bodies and the total pollutant discharge during the sewage discharge process directly relate to the water quality changes of the sewage collecting water bodies; the rate of operation malfunction of the sewage treatment facility can be minimized through strict demonstration and management of the scale, process, and treatment load etc of the lower-reach sewage treatment facilities, so as to ensure that the water outlet from the sewage treatment facility meet the standard for discharge.

3. As the roads are newly constructed, reconstructed, and extended, the population around will increase and be densified, thus resulting in increase of discharge of various pollutants to the air and water, noise, and solid wastes etc.

4. After the project is implemented, the traffic conditions of the reconstructed and extended roads get better, and some urban roads will be constructed, which will increase the motor vehicles in the areas around, producing motor vehicle exhaust gases, noise, and traffic jam etc.

In conclusion, implementation of this project will improve the traffic conditions the existing urban roads, perfect the road network layout, and improve the road traffic capacity, facilitate the production and life of the people, improve the residents' living environment, beautify the cities and towns, making the urban life more reasonable, good for the quality improvement of the urban environment. At the same time, it's required to strengthen the environment protection propaganda work; collect the residential domestic sewage and rubbish collectively and treat centrally, forbid discharge at random. Ensure the scale and load of the corresponding Sewage Treatment Plant can meet the drainage demand of this project. Under precondition that the outlet water of the sewage treatment facilities meets the standard, the accumulative environment impact of the project is positive, and there is also better social benefits as well.

6. Environment Risk Analysis and Preventive Measures

This project is a township municipal infrastructure construction project of low environment risks. The main possible environment risks include watercourse environment pollution risks resulted from accidental effluence of construction wastewater and solid wastes such as oily dirt etc draining to the nearby rivers during the construction period; soil and watercourse environment pollution risk resulted from overturn of vehicles carrying dangerous chemicals during the operation period; and environment pollution risks resulted from direct drainage of untreated wastewater to the river course.

6.1 Environment Risk Identification

6.1.1 Environment Risks Identification for the Construction Period

This project is mainly for reconstruction of the pavement of the existing urban streets or the water supply & drainage pipe network; some of the sections are constructed along the river and some roads go across rivers, where is susceptible to the environment risks during the construction period.

For the profiles of the rivers concerned during the construction period of the project, see Table 6.1-1.

Table 6.1-1: Profiles of the Rivers Concerned during the Construction Period

Project area	Project construction contents	Rivers concerned	Water function classification	Relationship
Xunyi County	Donghedi Road,Songjiagou Xihedi Road,Nanzhigou Xihedi Road	Sanshui River	Class Ⅲ	On the bank
Yintai District	The north section of Binhe West Road; Binhe East Road; 6 E-W link roads (Weiyi Road-Weiliu Road)	Qishui River (Tongchuan)	Class Ⅰ	On the bank, going across
Hanyin County	the west extension section of Binhe South Road	Yuehe River	Class Ⅲ	On the bank

The environment risks during the construction period are embodied in the following aspects:

(1) Some of the construction area and road of this project are along the rivercourse; improper management of the rivers near the construction points may lead to drainage of wastewater polluted by oil from vehicles and plants, waste soils and spoils etc to the triver, polluting the river water.

(2) The construction points of the project are scattered; improper management of the construction wastewater, the domestic sewage of the construction personnel, and the domestic garbage may make the river water polluted.

6.1.2 Environment Risk Identification during the Operation Period

No “Three Wastes” will be discharged during the operation period of the project; however, some works of this project is involved with river water quality, especially those of demanding requirements for water environment functions (such as Qishui River), for which risk control must be strengthened. The sensitive water bodies concerned with this project is as shown in Table 6.1-1; in addition, the wastewater of this project is basically treated in the regional Sewage Treatment Plants, some of which are still in preliminary preparation period. Whether

the project of the Sewage Treatment Plant can be constructed at the same time with the project is also one of the risks for water quality pollution.

The environment risks during the operation period of the project are embodied in the following aspects:

(1) Water body pollution resulted from overturn and spillage of vehicles carrying dangerous chemicals;

(2) If the wastewater treatment works cannot be completed on time, the wastewater will be directly drained to the water body to cause pollution.

6.2 Environment Risk Analysis

6.2.1 Environment Risk Analysis for the Construction Period

(1) Pollutions risks by waste oils, spoil soils and construction wastes

This project is involved with the construction of roads, water supply & drainage pipe network, for which massive plants are unavoidable and there will be certain excavation works, which may produce water body pollution risks in the nearby river areas, thus preventive measures shall be strengthened.

Leakage of the oils of the construction vehicles and plants for the project may pollute the soil as well as the water bodies once draining to the river, resulting in out-of-limit petroleum pollutants in the surface water and poor water quality. According to the similar surveys, there will be generally no petroleum fuel use, transport, and storage in large amount during the construction of this project; therefore, no large-scale oil leakage will occur; in addition, the possibility for leaked oil directly entering the farmland or river is also low; in this case, the risk of soil and surface water pollution by oil leakage is low under precondition of strengthened management and implementation of the necessary preventive actions.

Besides, the construction of roads and pipe network of this project will need excavation of some earthworks; improper management of the earthworks may also pollute the surface water, resulting in short-term out-of-limit of suspended matters in the river and poor water quality. There is small amount of earthwork excavation for this project and the work is distributed linearly; after filling back, the earthworks can be kept in balance basically; there will be no much spoils; with reasonable piling points, strengthened management measures, the necessary covering facilities, and measures for preventing erosion, the environment pollution risks by spoils will be quite low.

(2) Pollution risks by construction wastewater, domestic sewage, and domestic garbage

The construction wastewater of this project is mainly produced by the concrete mixing station, from structure and pavement maintenance, and domestic sewage. At the construction points along the rivers, the sewage may flow to the watercourse to pollute the surface water, making the river section water quality poor locally. The pollution is mainly domestic pollution with pollutants mainly suspended matters and COD, ammonia nitrogen. Through comparative surveys, the general wastewater flow is small; therefore, after the management measures are strengthened, the risks of leaked pollutants entering the rivers are dramatically reduced.

Besides, the domestic garbage collection system of area is not complete; the risks of improper domestic garbage management exist objectively. Therefore, the measures for collection and management of the domestic garbage during the construction shall be strengthened to prevent it from spilling into the river, causing surface water pollution and landscape changes.

(3) Risks of road traffic safety

Construction of the project will resulting in poor traffic conditions of the construction road section; however, construction of this project is concerned with some areas of dense traffic, such as cultural relics and schools etc; in the assessment, it requires to take measures for the peak hours of such road sections (period for students going to and leaving school, religious activity time period etc) to ensure traffic safety, such as NO ACCESS, setting up of speed limit zone and safety signs, special assignment of personnel for guidance.

6.2.2 Environment Risk Analysis for the Operation Period

(1) Risks of leakage of dangerous chemicals from transport vehicles

After the project is completed, there may be vehicles carrying dangerous chemicals running on the road, if overturn of such vehicle occurs, the chemicals spilled or leakaged will produce pollution risks to the river water quality, thus, preventive measures shall be taken, especially at the project points in Yintai District, where the water quality function of Qishui River belongs to class I, having demanding requirement for water quality. Occurrence of pollution accident will cause serious impact on the water quality of Qishui River; thus, strict preventive measures must be worked out. In the assessment, it requires to restrict the access of vehicles carrying dangerous chemicals to the road section; set up traffic control sign to vehicles carrying dangerous chemicals on both ends of the riverside road (crossing the river), thus to forbid access of such vehicles and effectively control the environment risks.

Some roads in Xunyi County and Hanyin County go along the rivers, belonging municipal landscape road. Presently, the roads for crossing the cities are outside the urban area, therefore, the possibility of access of vehicles carrying dangerous chemicals is low and the environment risks are relatively low; however, the NO ACCESS sign for vehicles of dangerous chemicals shall still be set up to avoid risks.

(2) Risks of supporting function failure of the sewage supporting facilities

The water supply plants supporting the overall water supply pipes of this project have been completed; and the design water supply scope of the water supply plant covers the area where the project is. The purpose for implementation of this project is for perfecting the water supply pipe network in the project area; therefore, the supporting function of the water supply pipe is good for the project.

The Sewage Treatment Plants for supporting the sewage pipes of this project are constructed as actually needed; the operation conditions can be in three cases: the first case is that the Sewage Treatment Plant has been completed, and the held sewage amount is far below the plant's design treatment capacity, in this case, it can totally accept the sewage collected by the sewage pipes constructed for this project, including Yanliang District (Xi'an Zhongtian Bosheng Water Purification Co., Ltd. of treatment capacity of 25000 m^3/d and actual treatment capacity of 15000 m^3/d); Chunhua CountyRunzhen Town (Chunhua Sewage Treatment Plant of treatment capacity of 8000m^3/d and actual treatment capacity of 3000m^3/d); Chengguan Town of Chengcheng County (Chengcheng County Sewage Treatment Plant of treatment capacity of 20000 $m^{3/}$d and actual treatment capacity of 10000 m^3/d); Yintai District (Tongchuan Sewage Treatment Plant of treatment capacity of 35000 m^3/d and actual treatment capacity of 20000 m3/d), Puzhen Town of Hantai District (Hanzhong City Sewage Treatment Plant of treatment capacity of 100000 m^3/d and actual treatment capacity of 20000m^3/d). The second case is that the Sewage Treatment Plant has been completed while further expansion is needed for accepting the sewage collected by the sewage pipes constructed for this project, including Chencang District (Baoji Guo Sewage Treatment Plant

of present treatment capacity of 42000 m^3/d; for accepting the sewage collected by this project, it needs 20000 m^3/d more treatment capacity); Chengguan Town of Xunyi County (Xunyi County Sewage Treatment Plant of present treatment capacity of 3000 m^3/d; for accepting the sewage collected by this project, it needs 5000 m3/d more treatment capacity). The third case is that the Sewage Treatment Plant has not been completed, including Wugong Town of Wugong County (Wugong Town Sewage Treatment, which is at preparatory construction period, it is expected to be operated in 2015 with t reatment capacity of 5000m^3/d）, Zhitian Town of Xunyi County (without Sewage Treatment Plant, for which small-size WSZ-AO buried type wastewater treatment facilities will be provided according to the actual sewage collection conditions, with unit sewage treatment capacity is 80m^3/h); Hanyin County (Hanyin County Sewage Treatment Plant, completed while not put into operation, with treatment capacity of 10000 m^3/d).

According to the above analysis, the first case has good supporting function; both the second and third cases have uncertainty to some extent; therefore, in the assessment, it requires taking the corresponding countermeasures to the two latter cases respectively. For the second case, it requires informing the related administrative department of the incompatibility and strengthening the coordination, ensuring the simultaneous capacity expansion of the supporting works and this project. For the third case, the employer is required to strengthen coordination with the regional administrative unit of Sewage Treatment Plant to ensure the sewage drainage of the project is well supported. If the supporting work cannot be in operation on time, oxidation pond shall be constructed timely as temporary treatment facility; no direct drainage is allowed. Through adopting the above measures, the risks must be controlled to certain degree.

6.3 Environment Risk Preventive Measures

With regard to the potential environment risks, the preventive and mitigation measures proposed for the project is as shown in Table 6.2-1.

Table 6.2-1: Environment Risks Prevention and Mitigation Measures

Stage	Risk type	Preventive and mitigation measures
Construction period	Pollution risks of waste oils, spoils and construction wastes	Strengthen environment protection propaganda to the construction personnel; Strengthen the management and supervision over the construction activities; Strengthen maintenance of construction vehicles and facilities; Set up warning signs on sensitive sections.
	Pollution risks of construction wastewater, domestic sewage, and domestic garbage	Strengthen environment protection propaganda to the construction personnel; Strictly implement the works for treatment for construction wastewater and domestic sewages; Strictly implement the measures for classification and centralized disposal of domestic garbage; Strengthen maintenance of construction vehicles and plants.

Operation period	Risks of leakage of vehicles carrying dangerous chemicals	Strengthen propaganda of vehicle driving safety; Along sensitive water bodies, set up NO ACCESS signs to vehicles carrying dangerous chemicals; Along general water bodies, set up BYPASS signs to vehicles carrying dangerous chemicals.
	Risks of the supporting function of the sewage supporting facilities	Strengthen coordination between the related regional departments; Inform incompatibility of the load ahead of time and urge for engineering reconstruction; Actively coordinate for the synchronous construction of Wugong Sewage Treatment Plant; if this is impossible, oxidation pond shall be constructed as a temporary treatment facility.

7. Social Environment Impact Analysis

The Foreign Loan Supporting Project Management Office of Shaanxi Province (Foreign Loan Office) authorized Project Appraisal Center of Shaanxi Academy of Social Science to prepare Social Impact Assessment Report and Resettlement Action Plan For WB Loan Funded Shaanxi Small Towns Infrastructure Construction Project, the main contents of the chapter are based on the two reports.

The project is to be constructed in 9 counties (districts) in 7 cities in Shaanxi Province, the project construction shall have influence on 13 towns (subdistrict offices), including Guanshan Town, Wutun Town in Yanliang District in Xi'an; Chengguan Town and Zhitian Town of Xunyi County of Xianyang; Run Town in Chunhua County, Wugong Town in Wugong County; Chengguan Town in Chengcheng County in Weinan; Chenlu Town and Beicheng Town in Yintai District in Tongchuan; Guo Town, Qianwei Subdistrict in Chenchang District in Baoji; Pu Town in Hantai District in Hanzhong; Chengguan Town in Hanyin County in Ankang;

Although the project is to focus on small towns in Guanzhong-Tianshui Economic Zone, considering that the project is a provincial demonstration project and there is difference between small towns in South Region and Guanzhong Region in Shaanxi Province, thus, a small number of small towns in South Region have also been selected for implementation of the project. The project is to improve the environment of small towns, create favourable living environment and improve living condition and promote urbanization by the aid of capital and knowledge from World Bank so as to play a demonstrative role in Guanzhong-Tianshui Urban System and Urban System in Shaanxi Province.

Since the project contains traffic infrastructure and water supply and drainage works, involving road construction, trench excavation, construction or maintenance of water supply and drainage facilities and construction of pipe network, including reconstruction of old road, removal of houses etc. it shall occupy urban road and disturb traffic condition and exert adverse influence on travel and work of local urban residents.

7.1 Environment Impact and Mitigation Measures for Resettlement and Removal

7.1.1 Environment Impact by Resettlement and Relocation

The road works, water supply & drainage works of this project involves land occupation, resettlement and relocation, where the related work contents and impact are summarized in Table 7.1-1.

Table 7.1-1: Summary of Land Acquisition, Resettlement, and Relocation of this Project

S/N	Area	Land acquisition area (mu)	Population impacted by land acquisition		Building relocation (m2)	Relocation impacted population		Cost (yuan)
			Households	Number of people		Households	Number of people	
1	Yanliang District	260	218 households	821 persons	6174	27 households	90 persons	20912.56
2	Chencang District	301	88 households	318 persons	27742.4	90 households	317 persons	26016.88

3	Wugong County	10	0	0	778.95	9 households	38 persons	572.26
4	Xunyi County	0	0	0	0	0	0	100.50
5	Chunhua County	55	55 households	228 persons	1748	34 households	141 persons	2681.28
6	Chengcheng County	217.55	36 households	142 persons	11258	54 households	171 persons	38009.85
7	Yintai District	141.33	27 households	96 persons	1990	38 households	155 persons	8497.37
8	Hantai District	516	58 households	288 persons	18539	57 households	286 persons	25152.03
9	Hanyin County	148.7	73 households	330 persons	3305.1	26 households	109 persons	31300.95
10	Total	1649.15	55 households	2223 persons	71527.45	335 households	1307 persons	153153.23

Information of each subproject is as shown in Table 7.1-2.

Table 7.1-2: Summary of Land Occupation, Resettlement, and Relocation Values of each Subproject

S/N	Place	Subproject	Land acquisition area (mu)	Villages affected (Nos.)	Land acquisition (farmland) affected population (households/ persons)	Building relocation (㎡)	Building type	Relocation affected population (households/ persons)	Relocation of dedicated facilities	Relocation of other auxiliary objects
1	Xi'an CityYanliang District	Hongyao Road extension works	480	4 (Beitun, Sanhe, Xixiang, Hongfeng)	211/796	6174	brick concrete	27 households 90 persons	Electric (communication) pole: 31 (Nos.); Electric wire: 1150 (m); Communication wire: 1210 (m); Transformer: 5 (Nos.)	Grown trees: 668 (Nos.); Young trees: 30 Nos.; Trees grown with fruits: 690 Nos.
		Guangsan Road	36	1(Guangyang)	6/21	0		0	Electric (communication) pole: 14 (Nos.); Electric wire: 600 (m)	Grown trees: 145 (Nos.); Young trees: 115 Nos.; Trees grown with fruits: 24 Nos.
		North Guangyang Street	24	1(Guangyang)	1/4	0		0	Electric (communication) pole: 12 (Nos.); Electric wire: 450 (m); Transformer: 1 (Nos.)	Grown trees: 154 (Nos.); Young trees: 121 Nos.; Trees grown with fruits: 52 Nos.
2	Baoji CityChencang District	Longhai North Road	92	2(Jiajiaya, Beibu)	46/151	7403	brick concrete	40 households 134 persons	Electric (communication) pole: 23 (Nos.); Electric wire: 1210 (m); Communication wire: 750 (m);	Grown trees:300 (Nos.); Young trees: 150 Nos.;

									Transformer: 1 (Nos.)	
		Beikai Road	35	1(Dongbu)	7/30	0		0	Electric (communication) pole: 11 (Nos.); Electric wire: 750 (m); Communication wire: 550 (m); Transformer: 1 (Nos.)	Grown trees: 270 (Nos.); Young trees: 100 Nos.;
		Heping Road	47	1(Dazhong Team 1) Beer Factory, Nitrogenous Fertilizer Plant	9/37	9228	brick concrete	22 households 79 persons	Electric (communication) pole: 13 (Nos.); Electric wire: 990 (m); Communication wire: 350 (m)	Grown trees: 190 (Nos.); Young trees: 150 Nos.;
		Shuilian West Road	20	1(Shuilianzai)	5/19	3248	brick concrete	17 households 59 persons	Electric (communication) pole: 10 (Nos.); Electric wire: 500 (m); Communication wire: 300 (m);	Grown trees: 130 (Nos.); Young trees: 120 Nos.;
3	Xianyang City Wugong County Wugong Town	Construct a new water supply work in the old town area and lay out water supply pipes in the area	10	The former Weiyuan Company (state-owned land)	0	0		0	0	0
		Reconstruction of the trunk storm and sewage pipeline and roads in the	0	0	0	778.95	Brick concrete	9 households 38 persons	Electric (communication) pole: 22 (Nos.); Electric wire: 2000 (m);	Grown trees: 7 (Nos.); Young trees: 12 Nos.; Landscaping trees:

		old town area (Renyi Blvd, Dongjie Street, Nanguan Central Street, the old Xibao North Line etc)								59 Nos.
	Xianyang City Xunyi County	1. Reconstruction of storm and sewage pipes and the roads in Chengguan Town: (1)Beida Street (2)Nandajie Street (3)Taita Road (4)Donghedi Road, West Riverbank Road,Songjiagou Xihedi Road,Nanzhigou Xihedi Road,total L=2310m; (5) Storm water pipeline on Yangguan Blvd.	0	0	0	0		0	Electric (communication) pole: 27 (Nos.); Electric wire: 2300 (m); Communication wire: 1100 (m); Transformer: 2 (Nos.)	
	Xianyang City Chunhua CountyRunzhen Town	(1)Chuangxin Road (2)Chuangye North Road (3)Huimin Road (4)Chuangye	55	2(Wuai, Wuyi)	55/228	1748	brick concrete, brick and timber	34 households 141 persons	Electric (communication) pole: 54 (Nos.); Electric wire: 1500 (m); Communication	Grown trees: 320 (Nos.); Young trees: 4000 Nos.; Trees grown with fruits: 860 Nos.

		Blvd (5)street lanes (6)Runwu Road (7)Runbu Road (8)Zhenxing Blvd							wire: 1300 (m); Transformer: 1 (Nos.)	
4	Weinan City Chengcheng County	Huifu Street	130.05	2(Yangzhuang Village, Yangjiazhuang Village)	17/65	5175	brick and timber , brick concrete	23 households 77 persons	Electric (communication) pole: 20 (Nos.); Electric wire: 3800 (m); Communication wire: 50 (m);	Young trees: 500 Nos.;
		Yangguang Road	77.72	1(Yangzhuang Village)	13/58	3975	brick concrete	15 households 49 persons		Grown trees: 50 (Nos.); Young trees: 50 Nos.;
		Dongba Road	9.38	1(Yangzhuang Village)	6/19	2100	brick concrete	14 households 45 persons		Grown trees: 50 (Nos.); Young trees: 50 Nos.;
		Qingzheng Street	0	0	0	0		0	Electric (communication) pole: 90 (Nos.); Electric wire: 8000 (m); Communication wire: 2100 (m); Transformer: 3 (Nos.)	Grown trees: 700 (Nos.);
		Dongliu Road	0	0	0	0			Electric (communication) pole: 14 (Nos.); Electric wire: 2400 (m); Communication wire: 350 (m);	Grown trees: 180 (Nos.);

									Transformer: 1 (Nos.)	
5	Tongchuan City Yintai District	(1)The north section of Binhe West Road (2)Binhe East Road (3) Six line roads	141.3	2(Shunhe, Liuwan	27/96	1990		26 households 100 persons	Electric (communication) pole: 5 (Nos.); Electric wire: 200 (m); Communication wire: 100 (m); Transformer: 1 (Nos.)	Grown trees: 10 (Nos.); Young trees: 10 Nos.; Trees grown with fruits: 20
		Reconstructed by Napo-Chenlu Road Bureau	0	0	0	0		0	Electric (communication) pole: 4 (Nos.); Electric wire: 200 (m);	Grown trees: 140 (Nos.); Young trees: 670 Nos.; Trees grown with fruits: 130
6	Hanzhong City Hantai District	The north section of Lianfeng Road	108	1	13/56	6870	brick concrete, civil engineering, movable steel shed	12 households 50 persons	Electric (communication) pole: 10 (Nos.); Electric wire: 800 (m); Communication wire: 220 (m); Transformer: 1 (Nos.)	Grown trees: 150 (Nos.); Young trees: 100 Nos.; 3210 ㎡ factories and institutions
		Lianhua Road	240	2	26/101	5266	brick concrete,civil engineering,movable building	26 households 108 persons	Electric (communication) pole: 15 (Nos.); Electric wire: 1200 (m); Communication wire: 500 (m)	Grown trees: 220 (Nos.); Young trees: 170 Nos.; 1100 ㎡ factories and institutions
		Bei'er Road	168	3	32/131	6403	brick concrete,brick and timber, movable buildings	32 households 128 persons	Electric (communication) pole: 18 (Nos.); Electric wire: 1500 (m);	Grown trees: 310 (Nos.); Young trees: 130 Nos.; 1085 ㎡ factories and

									Communication wire: 860 (m)	institutions
7	Hanzhong CityHanyin County	Nanqu Road	83.7	3	33/160	3305.1	Earth wall, brick concrete, brick and timber	26 households 109 persons	Electric (communication) pole: 12 (Nos.); Electric wire: 500 (m); Communication wire: 200 (m); Transformer: 1 (Nos.)	Grown trees: 180 (Nos.); Young trees: 300 Nos.; Trees grown with fruits: 200
		the west extension section of Binhe South Road	65	1	40/170	0		0	Electric (communication) pole: 14 (Nos.); Electric wire: 8000 (m); Communication wire: 1000 (m); Transformer: 1 (Nos.)	Grown trees: 65 (Nos.); Young trees: 72 Nos.;

From Table 7.1-1 and 7.1-2, it can be seen that the new road construction works, water supply and drainage, and road reconstruction works included in the subprojects in Yanliang District of Xi'an City are of large scale, needing more land to be acquired and occupied which is 540 mu compared with other subprojects. The second is the subproject in Puzhen Town Hantai District of Hanzhong City, occupying land of 518mu; the subproject of Chencang District of Baoji City is in the third position, occupying land area 369mu. The rest subprojects have less land to be acquired and occupied. All the lands to be occupied are farmland. The Xunyi County subproject of Xianyang City is not concerned about land acquisition and relocation works.

For this project, the buildings in Chencang District of Baoji City rank the highest in relocations rate, which has a total area of 19879m^2; the second is Hantai District of Hanzhong City, with total building area to be relocated up to 18539m^2. The relocation scale of the Chengcheng County subproject of Weinan City numbers the third, the area is up to 11250m^2. Except the Xunyi County subproject of Xianyang City is not concerned about relocation, the relocation scale of Wugong County subproject of Xianyang City has the lowest relocation scale, with total area 778.95 m^2.

The Hantai District subproject of Hanzhong City has the most number of people impacted by relocation, for which totally 286 people of 70 households are involved with. The second is Chencang District subproject of Baoji City, for which totally 272 people of 79 households are involved with. The third is Chengcheng County subproject of Weinan City, for which 171 people of 52 households are involved with. Except that Xunyi County subproject of Xianyang City is not involved with relocation population, the lest number of people impacted by relocation is Wugong County subproject of Xianyang City, totally 38 people of 9 households.

In addition, construction of the overall project is involved with relocation of some dedicated infrastructures such as electricity (telecommunication) poles, and electric wires etc; at the same time, construction of the project also damages some of the economic forest. In general, for this project, Yanliang District subproject of Xi'an City has the biggest engineering scale, needing the most land to be acquired and occupied. The building relocation and population impacted by relocation for Chencang District subproject of Baoji City, Hantai District subproject of Hanzhong City, and Chengcheng County subproject of Weinan City are relatively high, which shall be highly attended to.

In conclusion, this project is for municipal infrastructure construction without productive activities; however, it will occupy land during the construction period, leading to building relocation, relocation of some dedicated facilities, and resettlement; at the same time, small amount of economic forest will be damaged. The lands occupied by this project are farmland. Therefore, the permanent land occupation of the project will result in agricultural economic loss, although such loss is small in proportion that will not produce serious impact on the local economy, it will produce relatively serious impact to the farmers who are impacted by the land acquisition. Besides, the house for the relocated residents will direct affect their life; in this case, reasonable compensation and resettlement measures shall be taken for the project land occupation and relocation, so as to ensure that the directly affected people will have life quality no reduced for the construction of the project road.

7.1.2 Mitigation Measures for Land Acquisition and Resettlement Relocation

(1) It can be seen from the above analysis that all the lands to be occupied by this project are farmland; therefore, the compensation system for occupation of farmland will be strictly executed; by following the principle of "just acquiring the land to be occupied", the unit to occupy the farmland is responsible for reclaiming the area of farmland of area and quality

equal to that to be occupied. For farmland that is unconditioned for reclaimation or the reclaimed farmland is not as required, the applicable regulations of the province, municipalities, and autonomous regions for payment of farmland reclaimation fee shall be executed for special reclamation of new farmland, ensuring the balance between the occupied farmland, the developed and reclaimed farmland.

(2) The unit to occupy the farmland is required to excavate by layers and pile the earth excavated by layers during the farmland reclaimation process, using the soil of the plough layer of the occupied farmland for new farmland reclaimation.

(3) Compensation for relocation shall be performed in an open and just way through consultations with the households to be relocated; implement unified compensation standards and disclose the information to the related people ahead of time, so that the compensation standard is open and transparent, thus ensuring the life quality of the relocated people will not be reduced for construction of the project road.

(4) Follow the principle of resettling first and then relocating, ensuring that the relocated residents can be resettled smoothly.

(5) Respect the rights of the relocated people to select the compensation and resettlement and provide convenience for people who are willing to rechoose the residence area.

7.2 Social Impact of Construction Works and the Mitigation Measures

The works for this project mainly include road construction, reconstruction and extension; layout of water supply & drainage and water well construction, having long preliminary preparation time, including old road reconstruction and building relocation etc. during the construction period, many urban roads will be occupied, which will interfere with the urban traffic and bring about impact on and inconvenience to the travel and work of the urban residents.

7.2.1 Social Impact of the Construction Work

(1) Analysis of the impact on urban transport

This project will be constructed in the open; during the construction process, the construction wastes produced for relocation are proposed for filling in the local urban refuse landfill; the earth and stones produced during road widening and excavation will be piled on both sides for the road nearby, which will temporarily impact on the urban traffic and the landscape of the areas near the construction site, bring about much inconvenience to the life of the neighboring population. The impact is concerned about the traffic, shopping, medical service seeking, tourism, and sightseeing etc. During the construction process, many construction plants and transportation vehicles will be used, which will gradually increase the traffic flow along the life, bringing about production interference to the urban traffic. Therefore, it’s very important to reasonably arrange the construction plan, make centralized efforts and construct by sections, so as to reduce the construction period.

(2) Analysis of impact on the daily life of the residents

It can be seen from the analysis of impact of the project on the urban traffic that during the construction period, the urban traffic may be interfered, leading to urban road traffic jam and congestions, for which temporary measures such as traffic diversion and bypass etc will be taken, which will bring about impact on and inconvenience to the travel, work, and life of the urban residents, especially that there are 10 schools distributed along the project road, namely Xi’an Yanliang Beitun Middle School, Beitun Central Primary School, Beitun Kindergarten,

Wugong Town Daxuejie Primary School of Wugong County of Xianyang City, Xianyang Chunhua Runzhen Town Middle School, Runzhen Town Primary School, Runzhen Town Kindergarten,Weinan Chengcheng Chengguan Chenghe Mining Bureau Middle School, Chenghe Mining Bureau Primary School, and Chenghe Mining Bureau Kindergarten. Fully enclosure for construction of the road will bring about impact on the students going to and leaving the kindergartens and schools, especially those living on the other side of the kindergartens and schools.

Besides, during the construction process, the water use and drainage may be interrupted temporarily, which will also bring about inconvenience to the life of the nearby residents; however, such impact is temporary and for short term; it will be eliminated as the construction period goes over.

7.2.2 Mitigation Measures for the Social Environment Impact by the Construction Work

(1) Well and fully prepare for the construction, perform surveys of the project-related contents in details such as the road, power supply and communication etc in detail; determine the relocation and diversion schemes with the related authorities ahead of time; make emergency preparedness ensure the normal status of the social life.

(2) Mitigate the impact on he life of the local people and the environment. High-noise plants near the residential points shall not be operated at night. Vehicles shall slow and move slowly when running on the village road to reduce the impact resulted from traffic noise and airborne dust to the residents along the line. During the preliminary construction design phase, care shall be taken to select the construction access; try to utilize the existing road to minimize new road construction and land occupation. Vehicles carrying materials shall be covered with tarpaulin to prevent spillage of the materials; the temporary earth pile resulted from construction shall be removed on time; during the preliminary design phase, the access to the construction work belt shall be reasonably designed to reduce the obstacle impact from construction. For the 10 schools, safety accesses to such places shall be reserved for the students during the construction period, ensuring the school bus can be in and out of the area freely. Or arrange the construction in the summer vocation to reduce the threat to the safety of the children.

(3) Mitigation measures to the impact of the project on the local traffic

The main accesses (temporary) during the construction period shall be far away from the residential area and try to avoid crossing or simultaneous operation with the existing trunk road; try to keep the shortest transportation distance. Unitarily organize the traffic organization and stop or reduce the transportation work during the peak hour of the haulage road used, so as to reduce the traffic congestion degree. At the same time, set up NO HORN and safety precaution sign near the haulage road in the neighboring villages.

Before the construction is started, the main haulage road shall be reinforced and reconstructed; or construct access to connect the original road. The serious damage to the local road for the construction shall be repaired immediately or pay the local road administrative department with compensation fee for repair. In case the existing road is widened and reinforced as the temporary construction access, the construction period shall avoid the peak hour of the local road. After the construction is over, the road shall be repaired timely and returned to the local authority for use.

(4) Set up billboard on the construction site to indicate the main contents of the project as well as the construction time, try to explain to the public and acquire understanding from

them for the inconvenience brought about by the construction; indicate the contact person and complaint tel. number etc.

(5) The hanging height and direction of the construction light shall be ensured not affecting the residents resting at night.

7.3 Social Impact for Project Operation and Mitigation Measures

Implementation of the project construction is urgent for the urban sustainable development; it can fill the blank for urban infrastructure construction and solve the most prominent problem of the present urban construction; play a significant role in perfecting the construction of urban infrastructure construction; effectively improve the urban environment, create good human habitation environment and improve human living quality.

7.3.1 Social Impact of the Project Operation

(1) Saving travel time and promoting urban economic development

After the project is implemented, it can dramatically improve people's traffic speed in the city and save travel time; promote the efficiency; so that the people can create more value for the society. Besides, implementation of the project can also improve the exchange speed of the urban logistics; push real property development on both sides of the line, thus improving the urban economic development.

(2) Good for improving the living conditions and promoting people's living quality

After the project is implemented, as the water supply, storm and sewage pipe network are perfected as well as the landscaping and lighting etc are implemented, the life and production infrastructure of the local people will be dramatically improved. In addition, as the sewage collection rate of the region and the traffic conditions improve, the living conditions of the local people will be improved significantly and the life quality will be improved quickly.

(3) Analysis of impact on urban landscape

Urban landscape is a combination of natural landscape, building landscape, and culture landscape. It ecologically requires coordination with the natural landscape as well as the coordination between urban building and urban resource development, economic development and ecological environment protection, so that the cities and towns can be developed in good order, so as to eliminate urban ecological disease, forming good cycle of the urban ecological system.

After the project is implemented, the conditions of the existing roads will be improved. It will reduce the traffic dust and soil erosion; strengthen the landscaping and result in the effect of adjusting and improving the comprehensive road environment; further improve the landscape environment along the line, beautifying the road appearance. Plants are one of the main elements for creating beautiful urban space, with the variety of aesthetic factors of the unique contour, shape, and color of the plants as well as the changes for different reasons, which can be utilized to form strong characteristics with different tree species well matched for the ornamental duration and configuration; coordinated with street lights and rubbish bins etc, thus forming colorful street landscape. In addition, road greenery patches can also decorate the cities and foil the architecture art facing the street; at the same time, it can fulfill the demand of people along the street eager for green land.

In general, completion of this project will increase the aesthetic perception of the city and beautify the urban appearance, rendering pleasing feeling to the people.

7.3.2 Social Environment Impact in the Operation Period and Mitigation Measures

(1) Strengthen the management of the pavement and the running vehicles during the operation period to reduce exhaust gases and noise, minimize the noise impact on the villagers around.

(2) For sections densely populated such as those near schools etc, conspicuous speed reduction signs shall be set up; in addition, speed reduction belt shall also be provided a necessary to ensure vehicle and passersby safety.

(3) Pay attention to strengthening the management of traffic safety accident; set up the related prompt signs on the roadside to ensure traffic safety. Take safety measures to isolate and alert for road maintenance and set up traffic safety signs.

8. Analysis of Alternatives

The implementation of this project can fill the gap in the construction of urban infrastructure and solve the most prominent problems in the current city construction, having a significant role in the improvement of urban infrastructure. In addition, it can, besides effectively improving the urban environment and creating a good living environment, better human habitat.

8.1 overall Analysis of Alternatives

For the detailed comparison between the project implementation program and alternative (zero program) of this project, see Table 8-1.

Table 8-1: Comparison of Project Implementation Program and Alternative

Types	Project Implementation Program	Alternative (Zero Program)
Advantages	1. The engineering construction complies with Shaanxi's urban system planning; 2. It can fill gaps in the construction of urban infrastructure; 3. It can solve the most prominent problems in the current urban construction; 3. It can play a significant role in the improvement of urban infrastructure and effectively improve the urban environment; 4. It can create a good living environment and improve the quality of human settlements; 5. It is conducive to further accelerating the construction of tourist and cultural towns; 6. It can promote the building of a new socialist towns, help resolve the outstanding problems of construction and development and build a harmonious society; 6. It can promote the development of economy, society and tourist culture in the construction area; 7. It can gradually improve environmental conditions in the project area.	1. Efforts are made to maintain the environmental status not to make the project construction produce the environmental impacts; 2. The value of land use will not be changed (the land will not be occupied); 3. No problems of land requisition and demolition will be generated;
Disadvantages	1. It will tie up land resources and cause some soil erosion; 2. It will destroy the vegetation and produce raising dust; 3. The project construction and migration resettlement activities will generate a short-term adverse impact on the environment;	1. The status of existing infrastructure is maintained, but it can't be bettered. 2. The environmental pollution can't be removed; 3. The road can't be improved, which will result in the further degradation of atmospheric environment
Anal prehe nsive	From the social and environmental viewpoint, the project construction program is better than the zero program.	

Through the above comparison, the status quo is maintained and no new environmental impact appears in the zero program, but it is not conducive to social and economic development in the project area because it is impossible to change the status that there are broken pavements and cavities in the township, that most of sections are not provided with the supporting rainwater and sewage pipe network and that the majority of towns are not equipped with the water supply network. The project implementation program has a certain environmental impact, but its implementation will generate significant environmental, social

and economic benefit, and the adverse impact from its construction and operation can be reduced to the acceptable extent through implementation of project management measures, so it is better to carry out this project implementation program than the zero program and the project construction is necessary from the viewpoint of promoting regional economic development and protecting environment.

8.2 part Analysis of Alternatives

8.2.1 mosque in LianFeng Road

The project design in the initial feasibility study, the red line width of Lianfeng Road is 40m in previous design, the road adopts three roadway sections, which may result in relocation of mosque. Taking into account the smooth implementation of the project as well as the protection of national culture, through consultation on cultural relics protection units, surrounded by the masses, this adjustment at the line position, avoiding the demolition of the mosque. The road to be constructed shall be connected to existing Lianfeng Road (the completed south and middle sections of Fenglian Road), the road section is to keep in line with existing road, the red line width is 16m in design.

In previous design, the mosque in Lianfeng Road is only 2m away from red line of the road, after relocation, the mosque shall be 14m away from the red line of the road.

Therefore, the vehicle flow rate of the road during operation period shall be obviously reduced compared with the previous design, as shown in table 8.2-1:

Table 8.2-1 Traffic volume forecast （pcu/h）

Road section	Traffic volume in 2020	Traffic volume in 2025	Traffic volume in 2030
The project	2120	2458	2687
Previous design	3379	3972	4267

Ambient noise forecast and value out of limits of mosque in Fenglian Road during operation period are as shown in table 8.2-2

Table 8.2-2 Ambient noise forecast and value out of limits of mosque during operation period

Current value dB(A)		Forecast, acoustic environment and value out of limits dB(A)								
		2017								
		Traffic noise	Environmental noise	Value out of limits	Traffic noise	Environmental noise	Value out of limits	Traffic noise	Environmental noise	Value out of limits
Day	47	63.1	63.4	/	68.6	68.8	/	69.5	69.7	/
Night	35.7	52.4	52.5	/	53.5	53.8	/	54.3	54.6	/

It is observed from table 8.2-3 that the project, after relocation, shall have little noise influence on mosque, satisfying the requirement of class 4a of Acoustic Environment Quality Standard （GB3096-2008）

In addition, the project, after implementation, shall greatly increase the traffic speed and save travel time and improve work efficiency and facilitate religious activity for local residents.

8.2.2 Water supply plant in Wugong Town

The project is intended to build a new water supply plant in Wugong Town, 3 wells (2 for operation and one for standby), with a design water capacity of 3000m^3 / d, using groundwater. For the choice of water sources, the sources of surface and ground water in Wugong Town is analyzed as follows:

(1) Surface water source

① River

There are three rivers around the township, namely, Qishuihe River, Mogu River and Wei River. The upstream pollution in recent years leads to the deterioration of water quality for the rivers, and the villagers no longer use the river water. Some domestic garbage and sewage are directly discharged into the river without unified treatment. Since the water is stored in the Wool Bay Reservoir in the upstream of Qishuihe River, perennial drying appears in the downstream of the river in non-rainy season. Therefore, surface runoff can not be used as source of water supply.

② Reservoir

Wool Bay Reservoir is located in Qianxian County, Xianyang City, 23 km away from Wugong Town in the north. It is one of nine large reservoirs in Shaanxi Province, with the total reservoir capacity of 120 million m^3, the effective storage capacity of 52.2 million m^3. The reservoir has a width of 3km (from east to west), a length of 7km (from north to south), a water area of 5,000 mus, aquaculture area of 3,500 mus, and an average depth of 12m. Completed in 1970, it is a large-scale water conservancy project focusing on irrigation, allowing for comprehensive utilization functions such as flood control, and cultivation, which mainly serves 14 counties of Qianxian, Wugong Town, and Yongshou Counties. It cannot be used as the source of drinking water supply in cities and towns.

(2) Ground water source

The topography in Wugong Town is favorable to form abundant groundwater. Groundwater is buried in lithosols, and sand soil layer, belonging to hidden water in alluvium, with the general burial depth of about 50m, confined water of 70 ~ 120m, influential radius of 160m, specific capacity of 0.5 ~ 1t / h • m, and salinity of less than 1g / L. Make-up water is mainly from atmospheric precipitation and Qishuihe River.

The groundwater has long been used as a source of water supply in the township. According to the existing inspection report for groundwater quality, the groundwater quality is excellent, and the yield of single well is 35 ~ 80m3 / h.

(3) Choosing water source

It can be seen from the above analysis for water sources that, rivers and reservoirs around the Wugong Town are not suitably used as the water sources of new water plant due to the water quality, water quantity, and distance and other reasons. As the water demand in Wugong Town area is not large, there is water intaking section planned for groundwater body function in the geographic location, and allowable yield is greater than the design yield (refer to the completed wells), witch is in line with the requirements of regional water resource planning and configuration, the groundwater is chosen as the source of water supply for Wugong Town.

The place near Weiyuan Company is selected as water intaking site of the water source. With appropriate hydrogeological conditions, it is the water intaking section of water function plan. According to the hydrogeological data of drilled wells in the project site, available water

volume is plenty and reliable, yield of single well is not less than $50m^3$ / h, and the groundwater exploitation would not cause the continuous decline of water level, deterioration of water quality and land subsidence and other hazards. Refer to the water quality report of the completed wells in Shangying Village of Wugong Town for Water quality parameters. The parameters meet the standards. The disinfected raw water can reach the existing national standard of for drinking water.

8.2.3 Sewage treatment plan for Wugong Town

In the long-term planning of Wugong Town, it is proposed to build a wastewater treatment plant with a daily processing capacity of $5000m^3$ / d, but the investment and construction of the wastewater treatment plant is not determined at this stage. In order to promote the construction of the infrastructure in Wugong Town and improve the ecological environment in and around the township, the intermediate solution for wastewater treatment is considered for the project; that is, before future wastewater treatment plant is completed, the applicable water treatment scheme is selected for the recent sewage that can be collected on the basis of analysis for low-cost, simplified treatment, so that the sewage meets the sewage discharge standard for receiving water body as much as possible, in order to reduce the degree of pollution to the rivers and provide a reference for the construction and expansion of the wastewater treatment plant in the future. The selectable process schemes for sewage treatment in Wugong Town are compared in terms of the treatment efficiency, the cost of investment, operation and maintenance.

Centralized sewage treatment facilities are usually composed of two parts, i.e., pre-treatment section (mainly used to remove waste, impurities, sand, etc.), and biological treatment section (mainly used to remove soluble and degradable organics and nutrients and other contaminants, etc.). Pre-treatment facilities usually include grilles, and settling basin.

Applicable processes for biological treatment section are:

(1) Stabilization pond process: wastewater stabilization pond is a large, manually dug sewage treatment system, which can effectively remove BOD and SS in the wastewater, with the similar treatment effect as that of mechanical wastewater treatment plant (e.g., activated sludge wastewater treatment plant). The sewage discharged into the pond is mainly treated by means of the natural purification. Due to its long hydraulic retention time, pathogenic microorganisms and viruses are well treated. Through the settlement process, the parasite cysts and eggs and so on can also be removed. Stabilization pond is usually divided into three types, namely, anaerobic, facultative anaerobic and aerobic. Three types of stabilization ponds can be used in series to achieve better treatment effect.

(2) Constructed wetlands: the purification of sewage is completed by using the physical, chemical and biological synergy of the matrix, microbes, and plant; the functions of adsorption, sedimentation, filtration, and ion-exchange are mainly exercised through the matrix; plants absorbs sewage nutrients and heavy metals and other harmful substances, and microorganisms serve the function of the transformation and degradation of pollutants for the purpose of wastewater treatment, while biogeochemical cycles of nutrients and moisture promote plant growth, achieving harmless water resources.

(3) Subsurface infiltration system: it is one type of land treatment. The principle is that the domestic sewage pretreated in hydrolysis acidification pool is dosed to the soil layer with a construction, a certain depth from the ground, and good diffusion properties in a controlled manner, and wastewater moves in each direction by means of the percolation of the soil and capillary power together, finally the pollutants in the wastewater are removed by

means of the filtration, precipitation, and adsorption of soil, microorganisms and plants and comprehensive purification of microbial degradation.

According to the data provided in the applicable information, the processing capacity and cost of several available processes are compared in the Table 8.2-3:

Table 8.2-3 processing capacity and cost of available processes

Processing technology	**Stabilization pond**	**Constructed wetlands**	**Subsurface infiltration**
Demand for land covered	Larger	Larger	General
Temperature Effect	Large	Larger	Small
Investment	100~150yuan/m^2	1000 to 1200 yuan/ton water investment	1000 to 1200 yuan/ton water investment
Removal rate of BOD_5	90-95%	80-90%	90-95%
Removal rate of SS	80-95%	80-90%	80-95%
Removal efficiency of pathogen	Good	Good	Good
Removal efficiency of nitrogen and phosphorus	Facultative pond have a role	Better	Better

As can be seen from Table 8.2-3, through the analysis of a variety of factors such as the local climate, the actual terrain, inflow water quality, effluent water standard compliance, maturity and applicability of the process, investment costs, ease of operation and management, and operating costs, stabilization pond technology is recommended for this project, which could save investment and operating costs, and provide available waste pond.

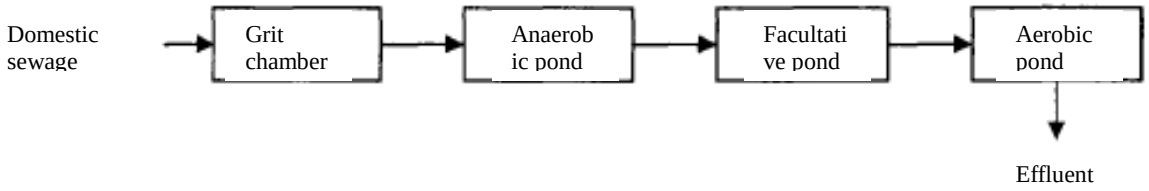


Figure 8.2-1 Sewage treatment flow chart

The scheme is intended to trim waste pond properly, and add necessary structures to build stabilization pond. The wastewater can flow into the pond by itself, and the treated water can be directly used for farmland irrigation or aquaculture development.

9. Public Participation and Information Disclosure

9.1 Purpose and Meaning of Public Participation

The purpose of public participation lies in acquainting the public in the project area with the basic information of construction project and its potential environmental impact to obtain the opinions, suggestions and requirements of the public on project construction; strengthening the information exchange among the public, construction units and other interested parties according to the negligence and omissions that may appear in the evaluation of environmental impact the public participate in to make the planning, design, environmental monitoring and management more perfect and reasonable and strive to achieve the optimized unification of environmental, social and economic benefit in the project construction and operation.

9.2 Methods and Processes of Public Participation

9.2.1 Methods

As regulated in the Law of the People's Republic of China on Environmental Impact Assessment, (Huanfa No. 2006[26]) Interim Measure for Public Participation in Environment Impact Assessment and the business policy of World Bank, and according to the characteristics of natural environment and social environment in the proposed project site, the public participation in activities shall be carried out in the environmental impact assessment of this project in the forms of information announcement, public consultation forums and questionnaire survey of public opinions.

In the earlier stage of this project was conducted the vigorous propaganda so as to basically acquaint the public in the project area with the project. The information of this environmental impact assessment will be announced in the project information bulletin pasted in the proposed project site. The project information will firstly be disclosed in the project office's website and secondly published in the provincial-level newspaper (Sanqin City Daily), one of the common media within the province. The public consultation forum will be held in the form of the forum held in the towns and village committees of proposed project site. The questionnaire survey of public opinions will be conducted in the form of questionnaire randomly distributed in the proposed project site.

9.2.2 Objects of Public Participation

The public participation objects are centered on the residents in the proposed project site and the administrators of village and towns, while the respondents concerned include farmers, workers, individual operators, governmental functionaries and professional technicians.

9.2.3 Public Participation Process

At present the first announcement of this project has been completed. Such activities as public consultation forum, the second project announcement (paper publicity), questionnaire survey and publicity of environmental impact statement shall be carried out prior to the assessment of World Bank. For details, see Table 9.2-1.

Table 9.2-1: Public Participation Survey Form

Public participation and contents		Time	Place	Executed by	Remark
First information disclosure	Notice on the website	2013.09.04	Website of PPMO	Cui Jinghai	No objections received
	Post notice on the proposed construction site	2013.09.25	Publicity column of Yanliang Wutun Town Government of Xi'an City	Liu Liang	Carried out in the same period with public consultation, no objections received
		2013.09.04	Publicity columns of Chencang District and Guo Town government of Baoji City	Ding Taohui	
		2013.09.02	Publicity column of Wugong Town Government of Xianyang City	Ding Taohui	
		2013.09.26	Publicity column of Xunyi Zhitian Town Government of Xianyang City	Ding Taohui	
		2013.09.27	Publicity column of Chunhua Runzhen Town Government of Xianyang City	Ding Taohui	
		2013.09.26	Publicity column of Chengcheng Chengguan Town Government of Weinan City	Liu Liang	
		2013.09.04	Publicity column of Yintai Chenlu Town Government of Tongchuan City	Xu Feng	
		2013.09.05	Publicity column of Hantai Puzhen Town Government of Hanzhong City	Liu Liang	
		2013.09.06	Hanyin Chengguan Town Zhongyan Village Committee of Hanzhong City	Liu Liang	
Second information disclosure		2013.11.22	Sanqin City Daily	Ding Taohui	No objections received from the public
Public consultation symposium		2013.09.25	Yanliang District Planning Bureau of Xi'an City, Wutun Town Government	Liu Liang	Carried out simultaneously with notice posting on the project site; general understanding of the project by the public was acquired; they supported the construction of the project and raised opinions and suggestions.
		2013.09.04	Shuilianzai Village Committee of Chencang Qianwei Subdistrict Office of Baoji City	Ding Taohui	
		2013.09.02	Wugong Town Government of Xianyang City	Ding Taohui	
		2013.09.26	Xunyi Zhitian Town Government of Xianyang City	Ding Taohui	
		2013.09.27	Chunhua Runzhen Town Government of Xianyang City	Ding Taohui	

	2013.09.26	Chengcheng County Chengguan Town Government of Weinan City	Liu Liang	
	2013.09.04	Yintai Chenlu Town Government of Tongchuan City	Xu Feng	
	2013.09.05	Hantai Puzhen Town Government of Hanzhong City	Liu Liang	
	2013.09.06	Hanyin Chengguan Zhongyan Village Committee of Hanzhong City	Liu Liang	
Public-participation and survey	2013.12.01	Qianwei Subdistrict Office and Guo Town etc of Chencang District	Tian Peng, Fang Rongliang	The contact person of each subproject performed questionnaire survey around the proposed place of the project and further informed the interviewed of the project progress.
	2013.11.29	Wugong Town of Wugong County	Zhang Jiaxing, Yan Caiqi	
	2013.11.27	Zhitian Town of Xunyi County	Zhang Jie	
	2013.11.27	Runzhen Town of Chunhua County	Guo Jilong, Du Jinsheng	
	2013.11.27	Chengguan Town of Chengcheng County	Wang Jianming, Yaojian	
	2013.11.28	Chenlu Town of Yintai District	Wang Tao	
	2013.12.03	Puzhen Town of Hantai District	Zhang Yangang	
	2013.11.26	Chengguan Town of Hanyin County	Wang Jing	
Full EIA report Announcement	apprasial by the World Bank before	Official website of the World Bank	WB	
	2014.03.24	PPMO and CPMO	PPMO, CPMO	

9.3 Public Participation Process and Its Content

9.3.1 First Information Disclosure

The first information disclosure shall be carried out through the website of provincial project office and the bulletins pasted at the site of each subproject.

(1) Publicity on the Website of the Project office

After the project EIA is commissioned, the construction unit (The Foreign Loan Supporting Project Management Office of Shaanxi Province) conducted the project announcement on its website on September 4, 2013, of which the content mainly refers to the project overview, the contact information of construction unit and EIA unit, the EIA work content, the major items for public opinions and the methods for the public to give opinions.

Publicity Web Links: http://www.fl-pmo.gov.cn/ShowArticle.asp?ArticleID=864;

For the publicity materials, see Annex 5.

(2) Information Bulletin Pasted at the Subproject Site

On the site survey of the project (from September 2, 2013 to September 27), the assessment unit will paste the bulletins on the notice boards of the village committee and town government in the project construction area to disclose the same information. For the content and the photos in the bulletin, separately see Annex 6 and Annex 7.

Until the expiration of the publicity, the assessment unit and the construction unit have not received any objections from the public.

9.3.2 Second Information Disclosure

The second information disclosure was carried out in Sanqin City Daily on November 22, 2013 after the first draft of the statement was completed. For the publicity materials, see Annex 8.

Until the expiration of the publicity, the assessment unit and the construction unit have not received any objections from the public.

9.3.3 Disclosure of Full Statement

March 24, 2014,The paper version of the well-prepared Statement (draft for examination) has been kept in the provincial project management office and each county project management office to seek for public opinions. The deadline of advice feedback is the date when this Statement is approved.

9.4 Public Survey

The public survey for EIA of this project is carried out in the forms of public consultation forum and questionnaire survey.

9.4.1 Public Consultation Forum

9.4.1.1 Overview of Public Consultation Forum

During the site survey of this EIA, 10 public consultation forums were separately held at the meeting room of the town or village committee in each subproject area, and attended by such

key attendants as assessment technicians, the persons-in-charge of project county or district, and the villager representatives of proposed project area. The overview of such forums is indicated in Table 9.4-1. For the name list of attendants, see Annex 9; for the attendant signature form, see Annex 10; and for the field photos of public consultation forum, see Annex 11.

Table 9.4-1: Project Symposium Information

Proposed subproject place	Symposium place	Symposium time	Number of people participating (person)	Symposium contents
Yanliang District of Xi'an City	Yanliang District Planning Bureau	2013.09.25 in the morning	15	Project introduction and public opinion collection
	Wutun Town Government	2013.09.25 In the afternoon	12	Environment problem investigation and public opinion collection
Chencang District of Baoji City	Shuilianzai Village Committee	2013.09.04 In the afternoon	14	Project introduction and public opinion collection
Wugong County of Xianyang City	Wugong Town Government	2013.09.02 In the afternoon	18	Project introduction and public opinion collection
Xunyi County of Xianyang City	Zhitian Town Government	2013.09.26 In the afternoon	16	Project introduction and public opinion collection
Chunhua County of Xianyang City	Runzhen Town Government	2013.09.27 in the morning	17	Project introduction and public opinion collection
Chengcheng County of Weinan City	Chengguan Town Government	2013.09.26 In the afternoon	15	Project introduction and public opinion collection
Yintai District of Tongchuan City	Chenlu Town Government	2013.09.04 In the afternoon	14	Project introduction and public opinion collection
Hantai District of Hanzhong City	Puzhen Town Government	2013.09.05 In the afternoon	19	Project introduction and public opinion collection
Hanyin County of Hanzhong City	Zhongyan Village Committee	2013.09.06 in the morning	19	Project introduction and public opinion collection

9.4.1.2 Analysis and Summary of Opinions from the Forum

At the public consultation forum, the persons responsible from project counties and districts introduced the project overview and the relevant information on environmental impact assessment to the attendants and sought for their opinions in connection with the project popularity, the environmental status of the proposed construction area, the view and worry about environmental impact of project construction, as well as the degree of support to the project.

It can be found through discussion that the necessary propaganda and announcement were conducted in the preliminary work stage of the project, so the villagers in the proposed construction area have all known something about this project. The project is aimed at improving the infrastructure of small towns, so the construction content of each subproject refers to the infrastructure locally needed to be constructed. The completion of the project can

help improve the sanitary conditions and road traffic conditions in the project area and facilitate the residents' living and travel. The public in the proposed project area not only support the construction of this project, but also give their opinions and suggestions. For the analysis and summary of public opinions, see Table 9.4-2.

Table 9.4-2: Analyze and Summary the Public Opinions from Project Symposium

Proposed place for subproject	Symposium place	Public opinions	Countermeausres
Yanliang District of Xi'an City	Yanliang District Planning Bureau	1. To reconstruct Hongyao Road from a rural road into urban road, it shall be widened properly and provided with water supply & drainage, lighting, and landscaping etc; the city appearance department shall be responsible for collecting and disposing the domestic garbage produced by the residents on both sides of Hongyao Road. 2. During the construction period, it's required to reduce the noise and airborne dust impact to the nearby residents. 3. During the construction period, it's not allowed to move the original landscaping; the water supply plant shall ensure the supply water quality and quantity.	1. Properly widen Hongyao Road on the original basis; support it with such facilities as water supply & drainage, lighting, and landscaping etc; the domestic garbage produced by the residents on both sides of Hongyao Road shall be collected by the environment sanitation department. 2. Strictly implement the environment protection measures during the construction period to reduce the noise and airborne dust impact to the nearby residents. 3. Overall operation of the water supply plant to ensure fulfillment of the water demand of the urban residents.
	Wutun Town Government	1. Random placement of garbage, basically untreated domestic sewage. There are less other environment problems. 2. It requires constructing the supporting sewage drainage system to solve the problem of sewage collection and drainage of the urban residents.	1. Strictly implement the environment management during the construction period and timely remove the construction wastes; 2. Construct the supporting water supply and drainage pipelines along the line to collect domestic sewage, then send it to the Sewage Treatment Plant for treatment
Chencang District of Baoji City	Shuilianzai Village Committee	1. Try to minimize relocation for construction of the project. 2. Make a point to landscape and harden the road; treat the sewage of the open channels and improve the outlook and land pollution f the villages. 3. Strengthen the control measures for the construction period and minimize the impact on travel of the residents. 4. Strengthen the management of the existing enterprises for sewage drainage and minimize the stink impact of the drainage channel.	1. Minimize the volume of relocation to save construction cost of the project. 2. Divert the storm water to eliminate the blocking of the drainage channel by the sewage; 3. Work out reasonable construction plan to reduce impact on the travel of the residents.
Wugong County	Wugong	1. The domestic sewage shall be	1. At the time of reconstructing

of Xianyang City	Town Government	treated to reduce the stink for the sewage discharge on the street. 2. The drainage channel shall have storm water and sewage separated; provide embedded pipes for sewage to prevent storm water with sand and earth from entering the channel leading to blockage. 3. The water supply work shall ensure the quality and quality of water supply.	the road network, construct the supporting water supply & drainage facilities to realize separation of stormwater and sewage, with the sewage drained to the Sewage Treatment Plant (proposed) via embedded pipe; 2. Strengthen the management of the water supply work to improve the water quality.
Xunyi County of Xianyang City	Zhitian Town Government	The road reconstruction shall be sped up to solve the problem as road damage, water ponding, and random placement of domestic garbage etc as soon as possible.	Work out the construction plan and items in urgent need shall be constructed with priority.
Chunhua County of Xianyang City	Runzhen Town Government	1. Dead-end road in the town areas shall be interconnected to form a road network, for which the road water supply & drainage facilities shall be perfected. 2. The street and lane branches of the trunk roads shall be constructed at the same time; hardened on the basic of the existing pavement and provided with supporting water supply & drainage facilities, thus prevent bringing the soiled water from the branch road to the trunk road during rainy seasons.	1. In this project, most of the dead-end roads in the town area will be interconnected to form a road network, with the water supply and drainage facilities completed at the same time; 2. The street and lane branches will be constructed with reduced class, having been taken into the project.
Chengcheng County of Weinan City	Chengguan Town Government	1. The old urban roads are seriously damaged and are often repaired, with poor environment sanitation conditions; 2. The water drainage wells are often flooded during heavily rainy days. For the long-term consideration of the urban zone, the storm water and sewage shall be diverted from each other, for which the construction pipelines will be constructed with higher standard; 3. Random spraying and pouring of sewage in the night market causes serious ponding of water on the street, which shall be applied with strict management, so that the sewage can flow into the drainage pipes; 4. Construct water drainage facilities on Huifu Street can effective relieve the drainage problems of Zhuangtou Town; 5. Speed up the project progress and implement the project construct as soon as possible.	1. Reconstruct the water drainage system for the old urban roads to separate the storm water and sewage; 2. Construct the supporting water drainage facilities for Huifu Street.

Yintai District of Tongchuan City	Chenlu Town Government	1. The pavement of the township roads is too narrow and there is a lack of safety precaution signs at the turns of the road; 2. Sewage discharge is mainly realized through open channel and in a scattered way, which shall be improved.	Napo-Chenlu, Ceramics Factory-Chenlu road bureau shall be responsible for the reconstruction; with the turns at the road widened properly and provide with safety precaution signs.
Hantai District of Hanzhong City	Puzhen Town Government	1. Heping Street is muddy without infrastructures in place; 2. Lianfeng Road is lag behind for facilities, which are also aged and waiting for solution; 3. The agricultural irrigation channel of Lianfeng Village is drained with domestic sewage; after the separation of storm water and sewage, no sewage will flow into it anymore; 4. Sewage assembles on the pavement of Xinnan Street, for which environment sanitation facilities shall be provided.	With this project, old township street and lane roads will be reconstructed for drainage works.
Hanyin County of Hanzhong City	Chengguan Town Government	1. The domestic sewage is directly drained to the creeks via the household cesspools; drainage near the road has been provided with sewage discharge pipe network. 2. The environment sanitation facilities are simple and lag-behind; 3. Most of the people can accept the relocation or land acquisition; while there are still difficulties. Attention shall be paid to the chain effect of the relocation resettlement, which shall be considered local area, planned and constructed unitarily.	1. This project is constructed with the supporting water supply & drainage pipe network; the collected domestic sewage will be sent to the Sewage Treatment Plant; 2. Properly handle the relocation resettlement and relocation consultation for land acquisition.

9.4.2 Public Questionnaire Survey

The project is concerned about 9 subproject areas. For this public questionnaire survey, each subproject area is designed with 55 (totally 495) questionnaire forms, with the emphasis put on the residents impacted by the project, especially those to be relocated. Totally there are 427 questionnaire forms actually returned, the actual recovery rate is 86.3%. For the sample of the questionnaire, see Annex 12.

9.4.2.1 Objects Surveyed

The main objects to be surveyed are the residents impacted in the proposed place of the project. For the basic information of the surveyed objects, see Table 9.4-3.

Table 9.4-3: Analysis on the Basic Information of the Objects Surveyed via Questionnaire

Items / Results	Sex		Age			Educational background			Occupation					
	Male	female	18~35	36~49	≥50	Below primary school	Middle school and secondary high school	Above junior college	Farmer	Workers	Teachers	Administrative personnel	self-employed entrepreneurs	others
Number of persons surveyed	339	88	54	184	189	93	277	57	296	29	6	35	15	46
Proportion (%)	79.4	20.6	12.6	43.1	44.3	21.8	64.9	13.3	69.3	6.8	1.4	8.2	3.5	10.8

From the above table, we can see that most of the surveyed are male, accounting 79.4% total number having been surveyed. From the age structure, each age section takes a proportion, the highest proportion is over 36 years old, accounting for 87.4% total number surveyed; the educational background is mainly secondary education, such people accounting for 64.9% total number surveyed. From the occupational structure, most of the surveyed are farmers, accounting for 69.3% total number surveyed; the second is other occupation and administrative people, also teachers, workers, and self-employed entrepreneurs, which means that the objects surveyed for this time are extensively distributed, being representative to some extent, in consistency with the regional population.

9.4.2.2 Analysis of the Survey Result

For the statistical result of the public participation for this assessment, see Table 9.4-4.

Table 9.4-4: Result of the Public Opinion Survey

S/N	Issues surveyed	Options	Number of people	%	Remark
1	How much do you know the project?	Know a lot	121	24.9	
		I don't know	335	69.1	
		I know	29	6.0	
2	How do you think of the environment and sanitation conditions of the project place?	Good	223	46.0	
		Fairly good	160	33.0	
		Fair	94	19.4	
		Poor	8	1.6	
3	What are the environment impact factors you think will be brought about by the project?	Air pollution	126	26.0	Multiple options allowed
		Water pollution	106	21.9	
		Noise pollution	240	49.5	
		Solid waste pollution	79	16.3	
		Others	72	14.8	
4	If you need to relocate for the project, are you willing to move?	Yes	307	63.3	
		No	19	3.9	
		Yes, but with the reasonable compensation	159	32.8	
5	Do you think whether the project can improve the local sanitation conditions or not?	Yes	454	93.6	
		Know	8	1.6	
		I don't know	23	4.8	
6	Can you accept the impact of the project construction on your life?	Acceptable	423	87.2	
		Unacceptable	9	1.9	
		Doesn't matter	53	10.9	
7	How is your attitude to the construction of the project?	I agree	452	93.2	
		I don't agree	0	0	
		Doesn't matter	33	6.8	

From Table 9.4-4, it can be seen that:

(1) The proportion knowing the project accounts for 69.1%; those knowing much account for 24.9% and not knowing account for 6.0%, indicating that the employer has made propaganda about the project and most of the villages understand the project; there are still some surveyed people know the project for that much propaganda has been done in the proposed place of the project and most of the public know the project. The employer shall further strengthen the propaganda, so that the public can understand the progress of the project.

(2) 19.4% of the surveyed public think that the local environment sanitation conditions are fair; 46.0% believe it's good, 33.0% think it's fairly good; and 1.6% select the option of being "poor".

(3) 49.5% of the surveyed public think that the project may bring about noise pollution for environment impact, 26.0% believe air pollution will be brought about; 21.9% choose water pollution, 16.3% choose solid waste pollution, 14.8% think other impact will be brought about, such results indicate that the public are concerned about the overall environment factors of the project area; the most concerned problem is noise pollution, for which the employer shall vigorously carry out the various environment protection measures and strengthen environment protection, thus to minimize the environment impact of the project construction.

(4) 32.8% of the surveyed public are willing to move for the project only if reasonable compensation is made; 63.3% are willing to move; and 3.9% are not willing to move, which indicate that not all the people are willing to move; in this case, the construction scope of the project shall be minimized to reduce land use and relocation volume.

(5) In the surveyed public, 93.6% believe that construction of the project will play a positive role in the local environment sanitation conditions and 1.6% think it's benefitless; 4.8% don't know whether there is any benefit, indicating that the public is optimistic to the environment benefit of the project; the employer shall promote the quality of the project to meet the purpose for improving the local environment sanitation conditions.

(6) 87.2% of the surveyed public believe that the project impact on their life is acceptable; 1.9% of the surveyed public believe it's unacceptable; 10.9% think it doesn't matter.

(7) For the basic attitude of the surveyed public towards the project construction, 93.2% agree with the project, 6.8% think it doesn't matter, and no one is against the project construction.

In addition, the public also raise some suggestions and opinions on the project construction and operation, summarized as follows:

(1) Strengthening environmental protection, reduce the environment pollution and improve the project quality;

(2) Speed up the project progress and improve the environment sanitation conditions as early as possible.

9.4.4 Adoption of Public Opinions

According to the advice and suggestions of the public opinion survey, the employer decides to adopt the overall reasonable suggestions, promise to strictly carry out the variety of environment protection measures during the project construction, minimize the impact of the project construction on the residents' life and the environment; promote project construction speed and project quality. For the public opinion adoption form and commitment letter of the employer, see Annex 13.

9.5 Summary of Public Participation

For the public participation of this time, information disclosure and public opinion questionnaire survey are adopted in a combined way; the scope of public participation is extensive; the participating objects can reflect the characteristics of the local population.

The result of public participation indicates that most of the public support the project and they think the project can push the local economic and social development. While the surveyed

also expressed their concerns about the environment impact of the project construction and operation; the report actually reflects the public opinions and information feedback. The employer promises in written to actively adopt the reasonable public opinions and suggestions as well as properly handle the relationship between the project construction and the public around.

10. Environmental Management Plan

10.1 Purpose of Preparing the Environmental Management Plan

Environmental management is a part of project management as well as the important link of effectively conducting the environmental protection of the project. The environmental management plan prepared in accordance with the projects of Shaanxi for small-town infrastructure construction in which the loan from the World Bank is used (hereinafter referred to as "Small-town Project") is a set of technically feasible and financially sustainable and operable countermeasures of environmental protection, which are formulated in connection with the inevitable environmental impact in the project to define the responsibility of project contractors, supervisors, operators and environmental management departments for implementing the measures and arrangements on environmental impact mitigation, environmental management and institution building in order to eliminate or mitigate the adverse impact of the project on society and environment so as to ensure the environmental quality in the project area will not be lowered and that the ecological environment can be protected, and maximize the beneficial impact of project on the environment.

10.2 Main Content of Environmental Management Plan

The environmental management plan for Small-town Project is prepared on the basis of environmental impact assessment. Its content mainly includes environmental management system, environmental management training, environmental monitoring plan and environmental statement system. The anti-pollution measures and environmental investment estimation are brought forward in connection with the adverse impact in the environmental impact assessment.

10.3 Environmental Management System and Its Responsibility Definition

10.3.1 Environmental Management System

According to the administration authority in the Environmental Protection Law of the People's Republic of China and the Regulations on Environmental Protection and Management of Construction Project, the examination and approval of the EIA statement for this project is in the charge of Shaanxi Provincial Environmental Protection Department, the organization of environmental management for this project, whose duty is to advance the requirements for environmental protection and coordinate the environmental management among departments according to the content of the EIA statement for this project and take charge of the "three-simultaneity" acceptance inspection of environmental protection facilities. In the framework of the overall project administrative agencies, the project led by the provincial PMO, county PMO is responsible for project specific environmental management, coordinating the construction side, the operator of the implementation of specific environmental management plans.

The PPMO is responsible for the planning and design of the project, environmental supervision and management of the project in procedures and organization of skill training for project environmental managements inside the province; the environmental protection bureau of each country is mainly responsible for the daily supervision of environmental management for this project; the environmental monitoring agency commissioned by the CPMO is responsible for the monitoring of environmental quality in the project area during the project

construction and operation.

The project CPMO intends to have a special environmental manager responsible for environmental management of the project in each stage, implementation of environmental protection laws and plan, implementation check of anti-pollution measure for this project, popularization and application of advanced environmental technology and experience, organization of technical training for relevant personnel and improvement of personnel quality.

The project will impact on the ambient during the construction and operation and the corresponding environmental protection measures will be taken separately in accordance with the characteristics of environmental impact during the construction and operation to reduce various impacts to the acceptable extent.

For the set-up diagram of environmental management system in the construction period, see Figure 10.3-1.

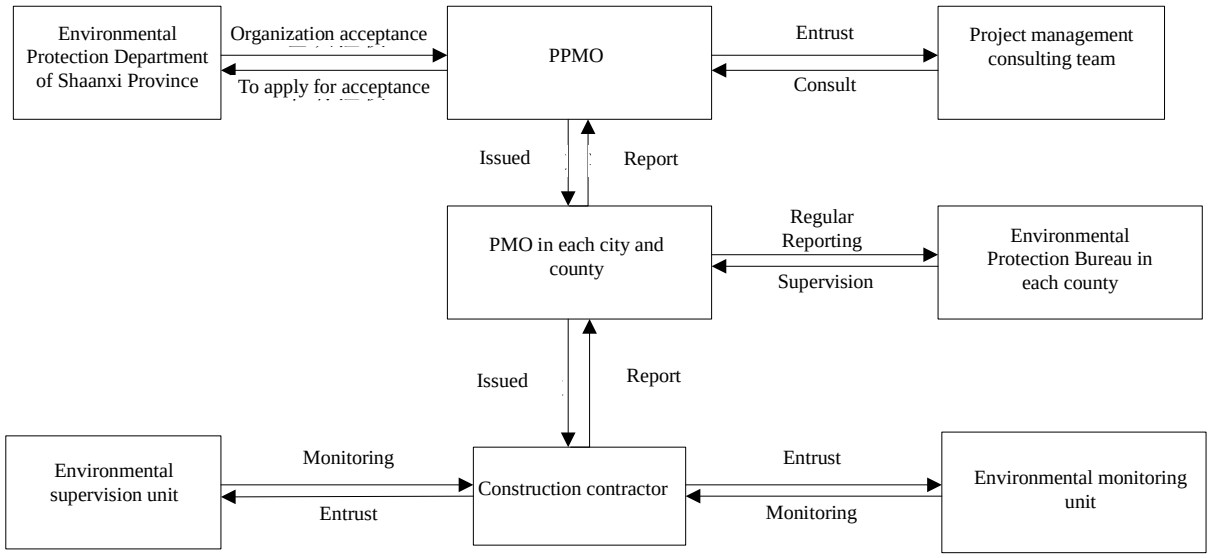


Fig. 10.3-1: Construction Environment Management System Chart

The environment management system for the operation period is as shown in Fig. 10.3-2.

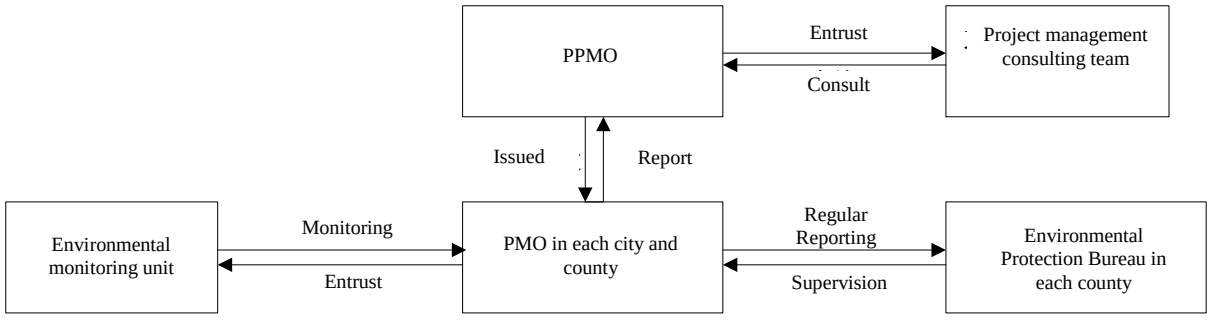


Fig. 10.3-2: Operation Environment Management System Chart

10.3.1.1 Environmental Management during design period

Shaanxi Provincial Project Management Office is responsible for supervision and environmental management during the entire project design period; environmental management, and organizing the project feasibility study, and the development of the environmental protection plan.

Provincial Environmental Protection Department is responsible for supervision of the implementation of Environmental Management Plan for the project, reviewing and approving environmental impact assessment documents, and auditing preliminary design of environmental measures.

10.3.1.2 Environmental Management during the Construction

The environment management in the construction period consists of that by the construction unit and that by the contractor, and is focused on the environmental management and supervision by the construction unit.

(I) Environmental management by the construction unit

(1) Management organization

In addition to establishing the complete environmental management system centered on the Foreign Loan Supporting Project Management Office of Shaanxi Province, this organization is responsible for implementing the environmental management plan of this project.

1) The Foreign Loan Supporting Project Management Office of Shaanxi Province will set up an environmental management group in charge of the environmental management for this project.

2) The project office of each county will designate a special person responsible for the environmental management of this project inside the county.

3) The Foreign Loan Supporting Project Management Office of Shaanxi Province will invite the consultant experts of environment to provide technical support for the environmental management of this project.

4) Each project county will engage the environmental monitoring agency to undertake the environmental monitoring of the project county; and appoint a special personnel responsible for conducting the environmental management and supervision of the construction projects in the county;

(2) Management Tasks

The construction unit will be responsible for the environmental protection and management in the period from construction to completion acceptance and assume the responsibility for environmental protection and management throughout the project area, including the preparation of the implementation plan for environmental protection measures, implementation organization and supervision in different links such as entrustment and examination of initial design, tender design, construction organization , environmental monitoring, environmental supervision, and completion acceptance.

1) Environmental Design Management

① The Implementation Plan of Environmental Protection Measures in the Project Construction Period according to the Small-town Infrastructure Projects of Shaanxi Supported by World Bank Loan will be prepared in accordance with the approved EIA statement and relevant approval documents.

② The qualified design unit will be commissioned to carry out the design of various environmental-friendly facility works according to the Implementation Plan of Environmental Protection Measures in the Project Construction Period.

③ After the preliminary design results of environmental facilities are examined by the environmental protection department, the approved design document will be followed to carry

out the design of tender and technical facilities for environmental protection facilities.

2) Tender Management for Environmental Protection

Responsible for formulating and examining the environmental protection clauses in the tender documents and the project contracts to ensure the approved environmental protection measures are included in the tender documents and contract terms one by one; carrying out the open tendering of each project without delay according to the design results and progress of environmental protection measures to guarantee the smooth implementation of various measures as scheduled.

3) Environmental Monitoring and Management

① formulate the environmental monitoring program according to the approved EIA statement and relevant approval documents.

② fully responsible for examining and verifying the qualification of environmental monitoring unit, managing the environmental monitoring contracts, checking and testing the laboratories under the monitoring units; take charge of auditing the monitoring report from the environmental monitoring unit, analyzing the reliability of monitoring results and supervising the environmental problems reflected in the monitoring results.

③ make reasonable use of the monitoring results to test the implementation effect of environmental and water protection measures and supervise the formulation and implementation of the corresponding solutions by the contractors to the outstanding problems of environmental impact reflected in the monitoring results.

4) Content of Routine Management during the Construction

① formulate the annual plan of environmental protection.

② audit and arrange the annual expenditure of environmental protection.

③ supervise the implementation of environmental protection measures by the contractors.

④ coordinate with the environmental department and others.

⑤ handle the environmental pollution accidents and disputes of this project and report the results to the higher authorities.

⑥ prepare the annual work report of environmental protection and submit the monthly, quarterly and annual statements to the higher authorities.

⑦ organize and carry out the propaganda, education and training for environmental protection.

5) Completion Acceptance and Management of Environmental Protection Facilities

① commission the relevant qualified assessment unit to make the Survey Report for Final Acceptance of the Small-town Infrastructure Project of Shaanxi Supported by World Bank Loan.

② responsible for organizing the acceptance check of single project and special environmental protection project and the stage acceptance check of project construction.

③ conduct the special or comprehensive environmental acceptance check according to the "three-simultaneity" principle during the acceptance check of main works.

④ invite the local environmental protection authorities to preside over the acceptance check

according to the environmental acceptance procedures.

(II) Environmental Management by Contractor

(1) Management body

The contractor shall establish the management office for environmental protection as the key responsible body and executing agency of environmental protection during the project construction, which shall concretely fulfill the environmental protection task undertaken by the construction units strictly according to the content of environmental protection specified in the contract terms and tender documents.

(2) Management tasks

The contractor's task for environmental protection and management is to take charge of the environmental protection in its construction and production, which includes the following content:

① The contractor should have at least a full-time environmental staff who must accept the training in the training plan to be qualified for his or her job.

② make the annual work plan for environmental protection.

③ check the construction progress, quality, operation and test of environmental protection facilities, and solve the problems in the implementation process.

④ During the construction, the contractor shall communicate and consult with the public in the project area and erect the bulletin boards at each construction unit to inform the public of the special construction activities and construction time and disclose the contact name and his or her liaison telephone number so that the public can complain and provide suggestions about construction activities.

⑤ check the use of annual expenditure for environmental protection.

⑥ report the implementation of environmental protection clauses in the contract agreement, require the contractor to monitor its environmental activities and provide the report of environmental performance once a day or a week, which shall be supervised and checked by the project office and the construction supervision group.

⑦ The contractor shall, in the funds of project contract, set aside the deposit for completion of environmental management according to the annual budget, of which the amount should account for about 3% of the budgetary resources.

10.3.1.3 Environmental Management during the Operation

The environmental management during the operation consists of that by the management center and that by the management site, which are responsible for the implementation of environmental management plan during the operation.

The detailed responsibilities are:

① manage the implementation of environmental protection measures for the project.

② coordinate with the environmental supervision and management department in solving the related environmental problems to the residents around.

③ commission the environmental monitoring station to conduct the routine monitoring of three wastes from the project facilities and of the environmental quality in the area.

④ conduct the emergency treatment of environmental risk in case of environmental

accidents.

⑤ responsible for timely submitting the relevant information of enterprise environmental management to Shaanxi Provincial Environmental Protection Department and Foreign Loan Supporting Project Management Office of Shaanxi Province.

⑥ archive and sort out the records of corporate environmental management.

10.3.2 Major Duties of environmental management unit

10.3.2.1 Overall Management

The PPMO shall conduct the overall management of the whole project and take charge of coordinating and supervising the environmental management. The project owner shall be responsible for the implementation of the relevant environmental management plan within the project with the help of the environmental supervision engineer. This project shall have at least an environmental supervision engineer. The duties of the bodies for implementation and supervision of such a plan go as follows:

① The PPMO takes overall charge of the environmental work management of the project and is responsible for organizing the feasibility study of the project construction, making the work plan of environmental protection, coordinating the environmental management between the competent department and construction unit, guiding the construction unit to take various management measures and coordinating the preparations and operation of the project.

② The full-time personnel of PPMO shall be responsible for the implementation of environmental protection plan and the environmental management of design stage.

③ The project owner shall be responsible for the implementation and management of environmental protection measures during the construction and operation.

④ Shaanxi Provincial Environmental Protection Department shall supervise the implementation of environmental management plan for the project.

The specific implementation of environmental management plan is mainly in the charge of the contractors and project owner. Their duties are shown in Table 10.3-1.

Table 10.3-1 Major Duties of Project Implementing Agencies

Names	Major Duties
Owner	a. Accept the supervision of environmental protection departments at all levels, project office and World Bank in environmental protection. b. Implement the environmental protection measures in the environmental protection laws and regulations and the EIA statement, as well as the environmental protection plan.c. Guarantee the normal operation of environmental protection facilities. Its environmental protection department conducts the self-inspection, establish the environmental files and reports to the project office and the environmental management departments at all levels. d. Sign the agreement of monitoring entrustment with the environmental monitoring department and carry out the implementation of environmental management plan. e. Provide funds for environmental inspection or spot check. In the process of project construction, the contractor will play a key role in environmental management, pollution control and prevention measure implementation. f. Entrust and implement the environmental supervision and include the environmental

	monitoring plan into the contract. g. Select the contractors with the strength and qualifications and include the environmental management plan into the contract in order to ensure the effective implementation of such a plan.
Contractors	a. The contractors and construction supervisors are required to receive the training of environmental protection and management prior to the project construction. b. The environmental impact mitigation measures in the construction period should be included in the contractor's bid documents, and finally in the construction contract, as the contract requirements for project contractors. c. The contractors are required to monitor their environmental activities and provide the log of environmental performance once on a regular basis. The project office and the construction supervision group shall supervise and review these records. d. The contractor shall appoint a full-time environmental staff for this project. These staffs must receive the training in the training plan to qualify themselves for their work.

10.3.2.2 Supervision and Management

The environmental supervision body for projects consists of Shaanxi Provincial Environmental Protection Department and the environmental protection bureaus of different cities and counties. Such an office is fully responsible for the environmental supervision and management. For the function of management and supervision for each organization in each stage, see Table 10.3-2.

The environmental supervision bodies shall conduct the supervision in the following stages:

(1) The feasibility study stage: Shaanxi Provincial Environmental Protection Department and the environmental protection bureaus of different cities and counties are responsible for supervision and management. The former is fully responsible for the environmental management of the project, the examination and approval of the EIA documents, the guidance of the environmental protection bureaus of cities and counties in implementing the laws and regulations, and completion acceptance of environmental facilities.

Shaanxi Provincial Environmental Protection Department is responsible for the environmental management of the project, the examination and approval of the EIA documents, the supervision and management of environmental work for the project, the organization and coordination of related agencies to serve the environmental protection of the project, and the guidance of the environmental protection bureaus of cities and counties to supervise and manage the environment of the project during the construction and operation.

(2) The design stage: The supervision and management shall be in the charge of the environmental department under the PPMO. The environmental departments of different cities and counties shall check and supervise the preliminary design of the project when it is jointly examined.

(3) The construction stage: Shaanxi Provincial Environmental Protection Department shall be responsible for the supervision and management. While accepting the work instruction from such a department, the environmental bureaus of different cities and counties shall supervise the construction unit in executing the environmental action plan, implementing the related laws and standards to the environmental management, coordinating the environmental work between departments, the completion acceptance and operation inspection of environmental facilities in the project.

(4) The operation stage: The PPMO and Shaanxi Provincial Environmental Protection

Department shall be responsible for the supervision and management together with the environmental bureaus of different cities and counties. The environmental protection bureaus of different cities and counties shall be responsible for implementing the laws and standards of environmental protection, formulating and supervising the implementation of the environmental rules and regulations and preparing the control objectives of environmental quality easy to test through understanding the environmental status of the project. In addition, they shall responsibly bring forward and report the control measures to the higher environmental departments and relevant leading department of trades, organize the environmental personnel to participate in related training and qualification test and carry out the technical exchange and research.

(5) The environmental monitoring during the construction and operation shall be in the charge of the environmental monitoring department. The project supervision unit in the project area shall be responsible for specific implementation of environmental supervision. After the project is completed, the environmental management agency shall be established and staffed with the full-time personnel in charge of the environmental work of the project.

Table 10.3-2: Supervision Plan for Environmental Protection of the Project

Stages	Agencies	Content	Purposes
Feasibility study stage	Shaanxi Provincial Environmental Protection Department and the environmental bureaus of different cities and counties	Examine and approve the EIA documents	1. Guarantee the completeness of EIA content, the properness of subject setting and the prominence of focal points. 2. Ensure the major potential problems that may appear in this project have been reflected. 3. Ensure that there is the specifically feasible implementation plan for measures of mitigating environmental impact.
Design and construction stage	Shaanxi Provincial Environmental Protection Department and the environmental protection bureaus of different cities and counties	1. Examine the preliminary design of environmental protection measures. 2. Check the restoration of temporarily occupied land, vegetation and environment. 3. Examine the measures for control of dust and noise pollution and determine the construction time. 4. Inspect the emission of the air pollutants. 5. Check the drainage and treatment of domestic sewage and construction wastewater at the jobsite.	1. Strictly implement the three-simultaneity principles. 2. Guarantee these places can meet the environmental requirements. 3. Reduce the impact of construction on the environment and implement the relevant environmental laws and standards. 4. Reduce the impact of construction on the environment and implement the relevant environmental laws and standards. 5. Avoid the soil erosion.
Operation stage	Shaanxi Provincial Environmental Protection Department and the environmental protection bureaus of different counties	1. Check the implementation of the monitoring plan. 2. Check the sensitive points to determine whether it is necessary to take the further environmental measures (the inestimable environmental problems may appear). 3. Check whether the environmental quality at the sensitive points is consistent with the related quality standard. 4. Strengthen the supervision against	1. Carry out the monitoring plan. 2. Effectively protect the environment. 3. Strengthen the environmental management and effectively protect the human sanitation. 4. Guarantee the compliance of pollutant emission with the emission standards.

		the unexpected accidents and formulate the emergency plan in advance to remove dangers in case of accidents.	

10.4 Summary of the Main Environment Items of This Project and Environment Protection Measures

10.4.1 Common Impact Analysis and Environment Protection Measures for the Project

This project is mainly for road construction, pipe network layout, and water well construction; the scale of the works is small, scattered in the project area of different counties (cities). This project will cause certain interference to the environment; however, it has no large-scale excavation and piling of large volumes of earthworks; the general impact is minor, with small scope and short time. The overall environment impact scope is small.

For the general environment protection practice of the project, see Table 10.4-1.

Table 10.4-1: General Environment Protection Practice of the Project

Time	Environment impact		Mitigation measures	Implemented by	Supervised by	Fees arranged
Design period	EIA documents		Review and approval EIA documents	Shaanxi Foreign Loan Office	Shaanxi Environment Protection Department	——
	Preliminary design of environment protection measures		Preliminary design for auditing environment protection measures	Shaanxi Foreign Loan Office	Shaanxi Environment Protection Department	——
Construction period	Water environment	(1) The construction wastewater mainly includes the muddy water produced during the foundation construction process, construction material flush water and vehicle flush water etc; domestic sewage by the construction personnel the large volume of sandy effluent from the construction site produced by the runoff during rainy days etc. (2) The production effluent mainly contain such pollutants as mud and sand, petroleum etc; the domestic sewage mainly contains COS, SS, ammonia nitrogen, animal and plant oils etc.	(1) For the domestic sewage produced by construction personnel, cesspool treatment is recommended after collection, then use it to irrigate the farmland in the surrounding villages. (2) Strengthen the management first of the production effluent to reduce the volume of the effluent during the construction process (effluent leaked from concrete mixing station, flushing water etc) and try to recycle the effluent onsite. (3) The muddy water produced during the foundation construction process shall be provided with a sedimentation pool for recycling the semdimentated water to spray the pavement; the construction materials and vehicle flushing water etc produced during the construction process which contain oils shall be treated in an oil separation and sedimentation tank for treating the wastewater for recycling. The rest part will be drained to the nearby drainage pipes. (4) In Wugong County old town area of Xianyang City, the reconstruction of the storm water & sewage pipeline of the trunk roads as well as the common roads, Yintai District road construction of Weinan City, and Hanyin County road construction of Hanzhong City will be concerned about the surface waters such as Qishui River, Hanjiang River, and Yuehe River; the construction effluent shall be collected unitarily and treated centrally; it's forbidden to drain the effluent directly to the watercourse. (5) Construction materials (cement and sand) piled shall be applied with covering measures to prevent rain scouring from causing surface and underground water pollution. After the project is	Employer, contractor	Environment protection bureaus of the counties	590,000 Yuan

			completed, the piling points not to be further used shall be landscaped and beautified. (6) Take the necessary measures to prevent earth and bulk construction materials from blocking the existing municipal water drainage pipes.			
	Environment air	During the construction period, the air pollution is mainly resulted from airborne dust and asphalt smoke. During the transportation, loading/unloading, and mixing process of the road building materials, much dust will get into the surrounding air environment. As blown by the wind during the piling process, the road construction materials will produce flying dust. This project adopts asphalt concrete pavement structure, which will cause certain pollution to the environment air and certain injury to the construction personnel. The phase mostly affected by asphalt smoke is the paving stage.	(1) Cover the construction material carrying vehicles to reduce spillage; materials likely to produce dust such as cement and lime etc shall be applied with wind protection measures such as covering with tarpaulin; in addition, the site shall be timely sprayed with water. (2) During subgrade construction, spray water as needed according to the compaction of the subgrade materials; the contractor shall often spray water after the materials are compressed to avoid secondary dust generation. (3) In order to avoid the negative impact on the sensitive points and crops by the airborne dust produced during such as soil-cement mixing and paving etc under wind conditions, the soil-cement mixing works shall have a unified mixing site and the mixer shall be provided with temporary fence 3m in height to prevent dust flying. It's recommended to provide the mixing site at downwind direction without sensitive points around. The mixed wet materials shall be transported to the road for paving to avoid production of airborne dust. The wet materials mixed shall be paved as it transported to the site, then compressed. (4) The transportation vehicles and construction plants shall keep good operation conditions, with intact rate over 90%; select with high-quality fuel, provide with exhaust gas purification device, so as to effectively reduce the emission of exhaust gas pollutants. (5) The employer shall collectively and integratedly consider road construction and reconstruction, the layout of infrastructures such as drainage and storm water pipelines, reasonably arrange the schedule of each facility; the first item to be constructed shall be the underground facilities such as drainage facilities etc; then the road works; it's required to avoid repeated excavation to minimize the environment impact.	Employer, contractor	Environment protection bureaus of the counties	
	Sound environment	The noise by the construction period of the project is mainly from the	(1) Reasonable layout of the construction site: reasonably and scientifically laying the construction site out is the main path for reducing the construction noise, such as centralizing the fixed vibration	Employer, contractor	Environment protection bureaus of	

		construction plants, such as bulldozer, road roller, loading machine, excavator, and mixer etc; when in operation, the noise at locations 5m to the plant will be up to 90~98dB(A), which will produce negative impact on the construction personnel and the residents around.	sources of the construction site to minimize the interference scope; the plants that can be fixed include air compressors and generators, which can be installed in the rooms onsite, with sound insulation board provided in the rooms to reduce the noise. The construction material site and material fabrication site shall be kept far away from the environment protection objects as possible as it can be. (2) Reasonable arrangement of the work time for construction: road construction plant noise is featured with burstiness, irregularity, discontinuity, and high intensity etc. Under precondition that the schedule is assured, the work time for construction shall be arranged reasonably, with construction of strong vibration prohibited at night. (3) Reasonable arrangement of route and direction of the transport vehicles: construction transport vehicles, especially massive vehicles for transportation shall have reasonably defined transportation route and time as specified by the related department. The main transport route selected shall be away from the sensitive points such as villages and residential areas etc as far as possible. For sensitive points that cannot be avoided, NO HORN sign shall be set up. (4) Reasonable selection of construction plants: during the construction process, the construction contractor must select the construction machineries and transportation vehicles according to the applicable national standard; try to select the construction plants of low noise and vibration, provide them with silencing devices and accessories; pay attention to the servicing and correct use, so as to keep the best work status and the lowest sound level; avoid using more than one high-noise plants on the same site at the same time. (5) Perform sound environment monitoring during the construction period, take the corresponding noise prevention measures according to the monitoring results.		the counties	
	Solid waste environment	The solid wastes discharged during the construction period are mainly the construction wastes produced during the construction period, the domestic garbage during relocation, and the	(1) The demolition construction waste shall uniformly be delivered to the construction refuse landfill for treatment as required by the environmental sanitation department. (2) The household refuse from the construction workers shall, after classified and collected, be periodically delivered to the town refuse landfill for treatment. (3) The spoil shall be used for roadbed fill of new roads or land leveling of its reorganized and expanded road works.	Employer, contractor	Environment protection bureaus of the counties	

		domestic garbage produced by the construction personnel. Random piling of such wastes will occupy and the land; by rain scouring, it may pollute the soil and water bodies; and form airborne dust during windy and dry seasons.	(4) The residual materials shall be strictly controlled and minimized according to the plan and construction procedures. In case of the residual materials, they shall be stored orderly and kept safely to be used for the road building or road or building maintenance in the surrounding area. (5) Other solid waste arising in the construction period shall be reduced in the recycling method and the solid waste that can't be recycled shall be collected and delivered to the along-line town refuse landfill for treatment. Besides, attention shall be paid to the stacking of waste oil, pitch and other solid waste in the construction process, which can't be stacked beside the water body, but removed in time.			
	Ecological conditions	Subgrade fill and excavation damage the vegetation along the line to some extent and the farmland to be occupied locally; the temporary spoil site will have naked ground surface, thus causing certain change to the local ecological structure of the areas along the line. After the naked ground surface being scoured, local soil erosion will occur, where the terrestrial ecological system will be affected to some extent.	(1) Efforts shall be made to select the temporarily occupied land in the range of road acquired land in the construction period, and occupy no farmland or less farmland. (2) Where the construction camps are needed, the local residences or public buildings shall be leased as far as possible or the camps shall be built in the range of the land for road. In addition, actions shall be taken against the pollution of farmland and field by household sewage and refuse. (3) The construction units shall strictly control the number of temporarily used land and comprehensively consider the construction roads, various stockyards and precast fields according to the construction schedule. Such a land shall be provided in the range of road land as far as possible. (4) The temporary grit chamber shall be used for collection of construction wastewater in the construction period. Exterior drainage is not allowed to prevent construction wastewater from being drained into farmland and fields so as to cause pollution. (5) The temporarily used land in the construction period shall be selected in the range of acquired road land and the existing buildings and places, leased as the construction camps to the greatest extent. All the land (including those inside and outside the road) bare because the vegetation is destroyed in the road construction shall be renovated and used after the construction ends through vegetation restoration or garden making for farmland. (6) The construction scheme shall be designed reasonably. In the excavation, efforts shall be made to reduce the area of occupied land,	Employer, contractor	Environment protection bureaus of the counties	

			shorten stacking time and implement the measures of centralized stacking.			
	Environment risks	(1) Some of the construction area and road of this project are along the watercourse; improper management of the rivers near the construction points may lead to drainage of wastewater polluted by oil from vehicles and plants, waste soils and spoils etc to the river, polluting the river water. (2) The construction points of the project are scattered; improper management of the construction wastewater, the domestic sewage of the construction personnel, and the domestic garbage may make the river water polluted.	(1) Vigorously implement the various environment protection measures for the production effluent and domestic sewage treatment during the construction period; irregularly perform construction site inspections; strictly forbidden direct drainage of production effluent and domestic sewage to the watercourse and riverbed; (2) Strengthen the traffic control of the dangerous section and traffic centralized lines; set up traffic signs; pay attention to pavement maintenance to minimize risk occurrence rate; (3) Strengthen training of and supervision on the operation personnel of the construction plants; strictly follow the operation practice to operate; (4) Establish accident emergency system to ensure the related personnel can evacuate timely in case of accident.	Employer, contractor	Environment protection bureaus of the counties	
	Cultural relics	① The project does not involve the social concern itself in the region, and the construction of the project has no direct impact on the cultural relics and sites for religious activities. Only the temporary traffic barrier caused by building activities during the construction period could have an indirect impact on the social concerns.	① In order to avoid the time of important activities of residents as much as possible, signs shall be set up to inform the residents of main contents and construction time for the project, and construction signs and guide logo shall be set up in advance. ② Attention should be paid to safety work during the construction period. The safe pedestrian paths for visiting the temple by local residents, visiting the Teta pogoda by tourists and going to church in the mosque, shall be retained as much as possible; the appropriate lighting facilities or the fences shall be set, or the progress of the works in or near mosques, historic monuments and sites, and densely populated areas is accelerated, to minimize the potential impact on local people's travel and transportation.	Employer, contractor	Environment protection bureaus of the counties	

		② The indirect adverse effects of the project on social concerns are mainly concentrated in the construction period. The completion and implementation of the project will not adversely impact the local heritage protection and religious activities.	③ in construction arrangement, temporary land for construction cannot be set in sites for cultural relics and religious activities, and the impact can be minimized by taking measures of site recovery and vegetation restoration.			
Operation period	Water environment	Construction of the water supply & drainage works for the project will change the original water consumption habit and ways, the collection and drainage pattern of storm water and sewage; improvement of the water consumption degree may lead to increase of water consumption, thus increasing the domestic sewage. Construction of the collection pipe network for the storm water and sewage will promote the collection rate of the wastewater and sewage as well as increase the local domestic sewage.	(1) Provide precipitation grille pool at the storm water discharge outlet to remove the sand and floating objects. (2) Construction of storm water and sewage pipe network must ensure the collected wastewater can be discharged to the local Sewage Treatment Plant, discharged after being treated to meeting the discharge standard; areas without completed Sewage Treatment Plant shall be assured with operation of the Sewage Treatment Plant ahead of the implementation and operation of the project. (3) Strengthen vehicle management. Vehicles carrying bulk materials such as coals, lime, cement, and earth etc which is likely to cause dust must be covered before driving on the roads; prevent overloaded vehicles from running on the public road; prevent materials carried from spilling on the road which may pollute the water bodies. (4) Regularly check and maintain the drainage facilities along the line (such as drain ditch); time repair shall be made in case of damages.	Employer	Environment protection bureaus of the counties	1,245,000 Yuan
	Environment air	Vehicle exhaust gas is the main pollution source for the environment air during the construction period of the project. Vehicles running on the road is a	(1) Landscaping by planting trees on road side: it's recommended to plant the local arbors and shrubs on both sides of the roads, especially in sensitive points, according to the local climate and soil features; strengthen the maintenance of the landscapes along the road line and maintain the pollution-reliving functions of the landscape, which is not only good for absorbing the airborne dust on the road,	Employer	Environment protection bureaus of the counties	

		flowing pollution source, whose exhaust gas contains CO, NOx, THC (total hydrocarbons), TSP (total suspended particulates) etc.	protecting the environment and air quality along the line, but also for beautifying the environment and improving the landscape along the road line. (2) Strengthen the operation management of the road; strictly implement the vehicle management system and the national motor vehicle emission limit standard, as well as restrict vehicles of over exhaust gas emission and carrying bulk materials without covering measures to go on the public roads. (3) Strengthen pavement maintenance and cleaning; keep the road in good operation conditions, and reduce airborne dust and vehicle exhaust gas pollution. (4) For vehicles transporting products that are likely to cause airborne dust (such as lime and coal etc), the management shall be strengthened; it shall be provided with tarpaulin cover, with constant speed kept during the driving process; avoid sudden braking to minimize material spilling. (5) Provide with tank car to regularly spray water and clean the pavement, so as to reduce the pollution by airborne dust.			
	Sound environment	The noise source of the motor vehicles running on the road is unstable. After the project is put into operation, the engine, cooling system and transmission parts of the running vehicles will produce noise. In addition, the air turbulence produced during the running process, the exhausting system, the friction between the tyres and the ground will also produce noise. Besides, the running vehicles will produce mechanical noise for road ground levelness.	(1) The noise radiation from sound source is reduced through strict control of construction quality and guarantee of high-quality project. Especially in the sections with noise sensitive point around, actions shall be taken to treat the subgrade to ensure that related problems to sinking, crack and irregularity will not happen during the operation of the road and the noise emitted by the traveling vehicles will not increase. (2) The routes of noise transmission are controlled through increasing the greening installations on both sides of the road. In accordance with the local ecological construction planning, efforts shall be made to green the sections that can be afforested in the range of land acquisition for proposed road works. The uniform greening design shall be carried out on the embankment slope and in the drainage ditches. The forest belt of multi-layered structure should be constructed on the village sections where the road runs through to form the three-dimensional barriers so as to strengthen the block and absorption of traffic noise. In addition, the best use of the idle lots between the village and the road shall be made to forest the four sides (i.e. house side, village side, roadside and waterside).	Employer	Environment protection bureaus of the counties	

			(3) The management of motor vehicles shall be strengthened by strictly implementing the requirements of traffic management for rate limiting and overloading prohibition and setting up the no-honking signs at the sections with larger population density. Efforts shall be made to reduce the noise from source of noise pollution and gradually limit the vehicles of poor technical condition and high noise from running on the road so as to remove the problems of traffic noise nuisance. (4) The road maintenance department should always maintain the roads by repairing the damaged roads without delay and maintaining the flatness of highway surface to avoid the increase of traffic noise from jarring of vehicles arising out of poor road conditions.			
	Solid waste environment	Mainly the domestic garbage produced by the residents along the road. Road construction wastes will also be produced during road maintenance process; in addition, solid wastes also include those by sweeping the road and accumulated at the storm water drainage ports.	(1) Strengthen the sanitation advocacy to improve the people's awareness of environmental protection so as to end the bad behavior of littering; (2) Improve the sanitation workers' work awareness to clean up the scattered waste without delay.	Employer	Environment protection bureaus of the counties	
	Ecological conditions	(1) Analysis of the impact on land use by project land occupation; (2) Impact on the plants of the areas where the road is.	Inside the areas influenced by the construction shall be taken the measures of vegetation restoration and landscape reconstruction. In the period of vegetation restoration and landscape reconstruction, such measures shall be adjusted to the local conditions and the principle of economic rationality followed to combine the landscaping and landform. On the local balance of cut and fill, the stratified structure of trees, shrubbery, grass, and flowers shall be used to increase the green coverage ratio and ecological benefits so as to give play to the integrated function of greening to the greatest extent.	Employer	Environment protection bureaus of the counties	
	Environment risks	(1) Water body pollution resulted from overturn and spillage of vehicles carrying	(1) Management of river bank traffic, specify that only qualified and good-conditioned organizations can transport oils and chemicals; the driver shall be certified and licensed correspondingly and the vehicles for transport shall be in good conditions. Transport of	Employer	Environment protection bureaus of the counties	

		dangerous chemicals; (2) If the wastewater treatment works cannot be completed on time, the wastewater will be directly drained to the water body to cause pollution.	dangerous goods shall avoid such negative conditions as heavy rains etc, thus to avoid potential traffic problem resulted from traffic conditions. (2) Strengthen pipe inspection and avoid blockage, replace immediately once water leakage is found. (3) Strengthen the inspection of the water supply facilities in the water supply work to ensure the water supply pump works normally under normal pressure.			
	Cultural relics	Except for increase in the number of visitors, the operation has less impact on cultural relics.	Constant vigilance and strengthening the training of management personnel in the education and awareness of heritage conservation are necessary for effective protection of cultural relics and historical sites.	Employer	Environment protection bureaus of the counties	

10.4.2 Analysis of Impact on Dedicated Items and Environment Protection Measures

Dedicated environmental regulations are mainly aimed at sensitive targets and special projects, which mainly involve schools, cultural relics, rivers, water supply plants, and sewage treatment equipment.

There are 10 schools, namely Beitun Central Primary School, Beitun Middle School, and Beitun Kindergarten on Wutun Hongyao Road of Yanliang District; Daxuejie Primary School on Wugong Dongjie Street of Wugong County; Runzhen Town Primary School, Runzhen Town Middle School, and Runzhen Town Kindergarten on Runzhen Chuangye Blvd of Chunhua County; as well as Chenghe Mining Bureau Middle School, Chenghe Mining Bureau Primary School, and Chenghe Mining Bureau Kindergarten in Chengguan Town of Chengcheng County.

There are 3 cultural relics and religious activity sites, namely Wugong Cheng Huang Temple of Wugong County; Chengguan Taita Tower of Xunyi County, and Puzhen Lianfeng Village Mosque in Hantai District of Hanzhong City.

There are 8 bridges, mainly including the existing bridge on Wugong Renyi Blvd of Wugong County 40m in length and 20m in width, crossing Qishui River, with class III water quality goal; there are also bridges on Wei'er Road, Weisi Road, Weiwu Road, Weiwu Road, and Weiliu Road in Yintai North Town, Yintai District of Tongchuan City, which are 40m in length and 12m in width, crossing Qishui River with water quality goal as class III; there are 2 bridges on Nanqu Road in Chengguan Town of Hanyin County in Hanzhong City, one of which is 25m length and the other is 100m in length, both 30m in width; the bridge in the west extension section of Binhe South Road is 10m in length and 22m in width, crossing Yuehe River, with class III water quality goal.

It is intended to build a new water supply plant, and 3 wells (2 for operation and one for standby) in Wugong Town, Wugong County, with a design water capacity of 3000m3 / d.

Sewage treatment project for Wugong Town, covers an area of 10000m2, using stabilization pond process. It is expected that it has the treating ability of 450 000 m3 sewage/ year after the project is completed.

Regarding these sensitive objects, Environment Protection Practice for Dedicated Items as shown in Table 10.4-2 is proposed.

Table 10.4-2: Environment Protection Practice for Dedicated Items

Time period	Environmental impact		Mitigation measures	Executer	Supervisor	Funds arranged
Design period	Environmental impact assessment documents		Review and approve the environmental impact assessment documents	PPMO	Provincial Environmental Protection Department	
	Preliminary design of environmental protection measures		Review the preliminary design of environmental protection measures	PPMO	Provincial Environmental Protection Department	
Construction period	10 School	① The noise of the project during the construction period mainly comes from the construction machineries, such as the bulldozers, rollers, loaders, excavators and mixer etc.. The noise can be as high as 90～98dB(A) in the place 5m away from the sound source when these machineries are running. These sudden and non-steady noise sources would produce adverse effects to the schools. ② The construction activities would cause some adverse effects for the students to go to school such as traffic jam and safety aspects.	① The reasonable arrangement of construction vehicle route and travel time. The reasonable transportation route and time should be determined for the construction vehicles, especially the large-sized transport vehicles, in accordance with the provisions of the competent authority. ② Erect the school, No Horn and speed limit signs. ③ Set the reserved passage for the students to go to/from school, a specially assigned person shall guide the evacuation of students. When necessary, even stop the construction to protect the safety of students. ④ Carry out the acoustic environmental monitoring during the construction period and take the corresponding noise control measures according to the monitoring results.	Owner and Contractor	Yanliang, Wugong, Chunhua, Chengcheng County Environmental Protection Bureau	480000 yuan

	3 Cultural relic	①construction process may affect residents' transportation Temple temple period. ② construction process may affect the number of tourists visiting Teta. ③construction process may affect access to the mosque road environment.	①retain as much as possible the safety of local residents visiting the temple walkway. ②retain as much as possible the safety of foreign tourists visiting Teta walkways. ③ mosque as venues for religious activities in general, belong to the material and cultural resources in the construction of this section, as the local people who retain the security line access to the mosque, and should fully respect the local culture, so as not to impact on national culture.	Owner and Contractor	Wugong, Xunyi, Hantai County Environmental Protection Bureau	
	8 Rivers	The surface water pollution during the bridge construction period mainly comes from the production wastewater from the construction operation and domestic wastewater from the construction personnel. Because bridges involved in this project are all small bridges, there is no large-sized bridge pier to build, so there have no drilling mud to contaminate the water in the river. Additionally, the waste oil from the construction can also cause water pollution. In the on-site pouring process of bridge superstructure, it shall use the formwork and machinery fuel, in case of leakage of machinery fuel or the waste oil is directly abandoned into the water body, it may increase the oil and other substances in the water quality index of the water environment, to degrade the water quality.	In the process of bridge construction, it should never discard the construction wastes, waste oil or waste water into the water body. After the bridge construction is completed, the construction site should be cleaned up to prevent the construction wastes being washed into the river by rainwater. At the same time, we should strengthen the management, the construction materials, such as asphalt, oil, chemicals, should be stacked far away from the riverbed, which should be equipped with the canvas for temporary sheltering to prevent the rainwater scouring. In a word, in the process of bridge construction, it shall strengthen the on-site management of construction machinery and construction materials to avoid and reduce the environmental pollution of surface water along the line by the bridge construction.	Owner and Contractor	Wugong, Yintai, Hanyin County Environmental Protection Bureau	

Operation period	10 School	After the project put into operation, when a vehicle is running, its engine, cooling system, drive system and other components, as well as the surface evenness, will produce noise. These noises can affect the schools.	① Set up the School, No Horn and speed limit signs. ② When the students are going to/from school, vehicles should low down and let the students go first, set the road deceleration strip.	Owner	Yanliang, Wugong, Chunhua, Chengcheng County Environmental Protection Bureau	900000 yuan
	3 Cultural relic	The impact on the cultural relics during the operation period is main that the number of visitors will increase, this would not cause any effect.	The effective protection to the cultural relics need the vigilance all the time, t should strengthen the education on the protection of historical relics and cultivation of awareness to the management personnel.	Owner	Wugong, Xunyi, Hantai County Environmental Protection Bureau	
	8 Rivers	After the completion of this project, there may have the vehicles carrying dangerous chemicals to pass through that it is possible to have the vehicle overturning or leakage of dangerous chemicals to cause the river water pollution, so we should strengthen the prevention.	① Strengthen the propaganda on the safety in vehicle driving. ② Set up the No Passing signs at the sensitive water bodies along the line to forbid the vehicle carrying dangerous chemicals to pass through. ③ Set up the By-Pass signs at the general water bodies along the line for the vehicle carrying dangerous chemicals	Owner	Wugong, Yintai, Hanyin County Environmental Protection Bureau	
	Water Plant	Affect the operation of the water plant, mainly to improve the construction of a secure, stable, reliable source of water, providing water for daily life for the entire township.	①Set water signage. ②water quality indicators for water and water monitoring. ③The project operator centralized management of the water company should strengthen the management of personnel training and education and awareness in the conservation of water resources.	Owner	Wugong County Environmental Protection Bureau	
	oxidation pond	Affect the operation of the oxidation pond, can effectively collect the township sewage pipe network can also continue to improve, the amount collected will be gradually increased.	①sewage treatment facility signage. ②oxidation pond water plant effluent quality indicators and monitoring. ③ in the construction process, treatment should be impermeable to prevent pollution of groundwater. ④centralized management, strengthen the management staff awareness and education.	Owner	Wugong County Environmental Protection Bureau	

10.5 Technical Support and Environment Management Training

10.5.1 Technical Support

The PPMO will according to the implementation of this project, invite the related experts on an irregular basis to provide the project with technical support and environment consultation service.

10.5.2 Environment Management Training

10.5.2.1 Training Purpose

The purpose of environment management training is for ensuring the environment management work to be carried out smoothly and the related personnel can be familiar with the contents and procedure for environment management, improving the environment management competence of the responsible personnel, so as to ensure that each environment protection measures can be carried out effectively; the main objects of environment capacity construction are the environment managerial personnel and environment supervision, training of them is one of the components of the technical support. The training courses are also used to train the construction contractors and the workers during the project implementation process. Before the project is commenced, all the construction contractors, operation organizations, and construction managerial personnel are required to take part in the training for environment, health, and safety compulsorily.

10.5.2.2 Training Objects

Training objects: the overall personnel of the provincial, cit, and county environment management office; the representatives of the environment supervision organization, environment monitoring organization, and the main contractors.

10.5.2.3 Training Objects

(1) Mastering and application of the World Bank's environment policies, domestic environment protection laws and regulations, environment standard;

(2) The environment management pattern and loan agreement environment terms for the township infrastructure construction projects of Shaanxi Province supported by loans of the World Bank;

(3) Environment impact assessment and environment management plan of this project;

(4) Environment management regulations of this project (the key point is on the environment management regulations in the construction period);

(5) Responsibilities of and interrelations between the environment managerial personnel, environment supervision personnel, environment monitoring personnel, and the contractors;

(6) Preparation of Environment management work report, environment supervision work report, environment monitoring report, and contractor monthly report.

10.5.2.4 Training Plan

(1) The overall personnel of the environment management office, the overall environment supervision personnel, and representative of the project management office;

The representatives of the overall personnel of the provincial, city, and county environment management offices and the environment supervision organizations; representative of the project management office will be organized to train by the provincial environment

management office before the project is implemented; the specific training contents are executed by the environment technical experts. Training will last for three days with training contents as follows:

1) The security policies of the World Bank and its environment protection rules formulated for the employer;

2) Project environment impact and the environment items required for monitoring;

3) Field operation process of the training items, including organization, exchange, roles, and responsibilities, decision-making process, reporting and standard observation procedure;

4) Study of the filing, information disclosure, exchange, and reporting mechanism of the World Bank for environment information;

5) Study of the health and safety inspection and declaration process of the World Bank;

(2) Representatives of the man contractors

Training of the representatives of the main contractors is centrally organized by the project management office before the project is implemented. The specific training contents will be executed by the experts for environment technology, hygiene and health; the training will be for 1 day with training contents as follows:

1) Introduction of the environment impact factors and environment protection measures related with the environment;

2) Definition of the especially sensitive areas in the construction area and introduction of the problems;

3) Introduction of environment management personnel, environment supervision roles and responsibilities, and key points of the environment problem report;

4) Health and safety common sense;

5) Fine for breaching the regulations, laws and regulations

10.6 Environment Protection Completion Acceptance

(1) Criteria for completion acceptance

Follow Measures for Management of Environment Protection Acceptance at Completion of Construction Projects

(2) Scope for acceptance

① The various environment protection measures related to the project, and the planned scheme for ecological restoration, environment landscaping, and water protection measures etc;

② Other environment protection measures specified in environment assessment documents, official reply and the related design documents to be taken;

(1) Contents for environment protection acceptance

The main contents for environment protection acceptance survey are as shown in Table 10.6-1.

Table 10.6-1: List of the Main Environment Protection Facilities for this Project for Acceptance (proposed)

Category	Name of environment protection facilities	Location	Requirements	Acceptance standard
Sound environment	Speed limit marking, speed limit sign, NO HORN sign etc	Schools, cultural relics etc.	The signed contents are conspicuous and complete	/
Construction wastes	Treatment of construction wastes and domestic garbage during the construction period	/	Sent to the landfill for construction wastes and the urban garbage landfill for treatment	/
Drainage facilities	Treatment of production effluent in the construction period	Construction site	Sedimentation tank, drain ditch, and interception ditch backfill	/
Water environment	Speed limit marking, sign for forbidding access of dangerous chemicals, and signs for bypass of vehicles for carrying dangerous chemicals	On both sides of the bridge	The signed contents are conspicuous and complete	/
Ecology	Ecological restoration works of the temporar access, temporary camp etc	Construction site	After the construction is over, start vegetation restoration and land reclamation	/
	Slope protection works, drainage works and vegetation works	Along the road line	Side slope protection, drainage facilities, and landscaping on both sides of the road	/
Society	Relocation resettlement	Households to be removed	Follow the relocation resettlement plan	
Environment protection	1-2 full-time environment protection staffs will be assigned for the project			
	2 full-time managerial staffs will be assigned for landscaping			

10.7 Environment Monitoring Plan

In the environment protection measures with regard to the main environment items, there are some are for environment monitoring, including such two parts as supervision management and monitoring.

10.7.1 Supervision Management

(1) Environment management of project construction

1) CMPO will entrust the corresponding project supervision engineer to perform field supervision on the compliance of the contractors with the “Construction Environment Protection Rules”;

2) The PPMO and CPMO will assign or invite professional technical personnel regularly to the construction site to inspect the implementation of “Construction Environment Protection Rules”, and correct any problem found out.

(2) Supervision and inspection during the project operation process

1) Each project county will assign environment protection personnel to supervise and manage

the implementation and operation of the construction project of the county;

2) The PMO will supervise and inspect the project implementation and operation.

10.7.2 Environment Monitoring Aimed at Environment Items

10.7.2.1 Common environmental monitoring project

(1) Environmental monitoring plan during construction period

The environmental monitoring sites, items, factor, frequency, and organization and implementation of the project during construction period are listed in Table 8.2-1.

Table 8.2-1 Table for environmental monitoring plan in construction period

Monitoring items		Monitoring Site	Monitoring Frequency	Executive Body	Supervisory Body
Name	Factor				
Noise	Boundary of construction site Noise LAeq	same as the existing monitoring points for noise	Once every two months	Contractor	EPB of the counties
Ambient air	PM_{10}	Both sides of the road	Once every two months	Contractor	EPB of the counties
Surface water	pH, SS, petroleum, ammonia	Discharge point at outlet of construction site	Once every two months	Contractor	EPB of the counties
1. Environmental monitoring during operation period is performed by professional environmental monitoring organization; 2. Monitoring frequency and requirements shall be in accordance with the relevant national provisions; 3. Main haulage roads are randomly monitored as required.					

(2) Environmental monitoring plan during operation period

The environmental monitoring sites, items, factor, frequency, and organization and implementation of the project during operation period are listed in Table 8.2-2.

Table 8.2-2 Table for environmental monitoring plan in operation period

Monitoring items		Monitoring site	Monitoring Frequency	Executive Body	Supervisory Body
Name	Factor				
Noise	Noise LAeq	same as the existing monitoring points for noise	Once every two months	Owner	EPB of the counties
Ambient air	PM_{10}	Both sides of the road	Once every two months	Owner	EPB of the counties
Automobile exhaust	PM_{10}	Both sides of the road	Once every two months	Owner	EPB of the counties
Surface water	pH, SS, petroleum, ammonia	Discharge point at outlet of construction site	Once every two months	Owner	EPB of the counties
1. Environmental monitoring during operation period is performed by professional environmental monitoring organization; 2. Monitoring frequency and requirements shall be in accordance with the relevant national provisions; 3. Main haulage roads are randomly monitored as required.					

10.7.2.2 Environmental Monitoring for specific project

(1) Environmental Monitoring Plan during construction period

Environmental monitoring sites, items, factor, frequency, and organization and implementation of sensitive targets and special items are listed in Table 8.2-3.

Table 8.2-3 Table for environmental monitoring plan in construction period

Monitoring items		**Monitoring Site**	**Monitoring Frequency**	**Executive Body**	**Supervisory Body**
Name	**Factor**				
Noise	Boundary of construction site Noise LAeq	10 schools and 3 cultural relics on both sides of the road	Once every two months	Owner, Contractor	Yanliang, Wugong, Chunhua, Xunyi, Hantai, Chengcheng County Environmental Protection Bureau
Ambient air	PM_{10}	10 schools and 3 cultural relics on both sides of the road	Once every two months	Owner, Contractor	
Surface water	pH, SS, petroleum, ammonia	Bridge across the river upstream of 8 500m, downstream 1000m	Once every two months	Owner, Contractor	Wugong, Yintai, Hanyin County Environmental Protection Bureau
1. Environmental monitoring during operation period is performed by professional environmental monitoring organization; 2. Monitoring frequency and requirements shall be in accordance with the relevant national provisions; 3. Main haulage roads are randomly monitored as required.					

(2) Environmental monitoring plan during operation period

Environmental monitoring sites, items, factor, frequency, and organization and implementation of sensitive targets and special items are listed in Table 8.2-4.

Table 8.2-4 Table for environmental monitoring plan in operation period

Monitoring items		**Monitoring site**	**Monitoring Frequency**	**Executive Body**	**Supervisory Body**
Name	**Factor**				
Noise	Noise LAeq	10 schools and 3 cultural relics on both sides of the road	Once every two months	Owner	Yanliang, Wugong, Chunhua, Xunyi, Hantai, Chengcheng County Environmental Protection Bureau
Ambient air	PM_{10}	10 schools and 3 cultural relics on both sides of the road	Once every two months	Owner	
Automobile exhaust	PM_{10}	10 schools and 3 cultural relics on both sides of the road	Once every two months	Owner	
Surface water	pH, SS, petroleum, ammonia	① Bridge across the river upstream of 8 500m, downstream 1000m ② Oxidation pond outlet discharge point	Once every two months	Owner	Wugong, Yintai, Hanyin County Environmental Protection Bureau

underground water	① Water quality: pH, total hardness, COD, ammonia, nitrate, permanganate index, sulfate, total dissolved solids and total coliform ②water level	①martial arts town water outlet to monitor water quality ②water level changes as well as martial arts town water surrounding villages [martial Town Mountain Village (from the project 1000m) and the village (from the project 900m)]	① Water quality: 12 times / year, once a month ②Water Level: 2 times / year, once every six months	Owner	Wugong, County Environmental Protection Bureau
1. Environmental monitoring during operation period is performed by professional environmental monitoring organization; 2. Monitoring frequency and requirements shall be in accordance with the relevant national provisions; 3. Main haulage roads are randomly monitored as required.					

10.8 Environment Reporting System

The environment management office, contractors, and monitoring organizations for the township infrastructure construction projects of Shaanxi Province supported by loans of the World Bank shall record the project progress, EMP execution, environment quality monitoring results etc during the construction process and timely report them to the related department, specifically including:

(1) The monitoring organization and contractors shall record the EMP execution in details and report it to the project office;

(2) The PMO must follow the requirements of the World Bank to finish the project progress report on time (such as semi - annual report) and submit to the World Bank; the report mainly includes the following contents:

1) Implementation of the EMP environment protection measures, environment management and training plan etc;

2) Progress of the project, such as schedule etc.;

3) Any compliant (if any) shall be recorded with the main contents, the solution and public satisfaction degree;

4) EMP execution plan of the next year

10.9 Environment Management Costs and Fund Assurance

Table 10.9-1 shows the estimate and summary of the fund needed for the environment management of this project; the fund items include environment consultation, training, monitoring, and other costs etc totaling to 3.445 million Yuan.

Table 10.9-1 Summary of environmental management fund for the project

No.	Item	Location		Unit price (RMB ten thousand yuan)	Funds (RMB ten thousand yuan
1	Environmental training	9 counties		2	18
2	Environmental	Yanliang District	Construction period	2 years ×40,000	8

	Monitoring		Operation period	3 years ×60,000	18
		Chencang District	Construction period	2 years ×30,000	6
			Operation period	3 years ×40,000	12
		Wugong County	Construction period	2 years ×60,000	12
			Operation period	3 years ×80,000	24
		Xunyi County	Construction period	2 years ×20,000	4
			Operation period	3 years ×30,000	9
		Chunhua County	Construction period	2 years ×25,000	5
			Operation period	3 years ×40,000	12
		Chengcheng County	Construction period	2 years ×2.5,000	5
			Operation period	3 years ×40,000	12
		Yintai District	Construction period	2 years ×30,000	6
			Operation period	3 years ×40,000	12
		Hantai District	Construction period	2 years ×35,000	7
			Operation period	3 years ×45,000	13.5
		Hanyin County	Construction period	2 years ×30,000	6
			Operation period	3 years ×40,000	12
	Environmental monitoring for sensitive targets	3 schools in Yanliang District3	Construction period	2 years ×30,000	6
			Operation period	3 years ×30,000	9
		1 school in Wugong County	Construction period	2 years ×10,000	2
			Operation period	3 years ×10,000	3
		1 school in Chunhua County	Construction period	2 years ×10,000	2
			Operation period	3 years ×10,000	3
		3 schools in Chengcheng County	Construction period	2 years ×30,000	6
			Operation period	3 years ×30,000	9
		Chenghuang Temple of Wugong Town	Construction period	2 years ×10,000	2
			Operation period	3 years ×10,000	3
		Teta of Chengguan Town in Xunyi County	Construction period	2 years ×10,000	2
			Operation period	3 years ×10,000	3
		Mosque in Lianfeng Village of Puzhen town in Hantai District	Construction period	2 years ×10,000	2
			Operation period	3 years ×10,000	3
		Qishuihe River in Wugong County	Construction period	2 years ×15,000	3
			Operation period	3 years ×15,000	4.5

		Qishuihe River in Yintai District	Construction period	2 years ×20,000	4
			Operation period	3 years ×20,000	6
		Moon River in Hanyin County	Construction period	2 years ×15,000	3
			Operation period	3 years ×15,000	4.5
		Water supply plant in Wugong County	Construction period	2 years ×50,000	10
			Operation period	3 years ×100,000	30
		Oxidation pond IN Wugong County	Construction period	2 years ×30,000	6
			Operation period	3 years ×40,000	12
4	**Other**				**5**
5	**Total**				**344.5**

The fees listed in the table do not include the fees for Shaanxi Provincial project office's environmental consulting and the cost required for taking environmental protection measures by the construction Contractor. The cost required for taking environmental protection measures by the Contractor is included in the total price of engineering contract.

11. Conclusion of the Assessment

11.1 Comprehensive Assessment Conclusion

11.1.1 Description of the Project Profiles

The township infrastructure construction projects of Shaanxi Province supported by loans of the World Bank are implemented in the cities and towns of 9 districts and counties of 7 cities, belonging to municipal infrastructure construction project, the main works include road works, water supply and drainage works.

11.1.2 Assessment of the Present Environment Conditions

In the present environment indicators for the proposed project place, except that the PM10 of Yanliang District and Yintai District exceeds the grade II standard specified in Environment Air Quality Standard (GB3095-1996), the other indicators all meet the grade II standard of Environment Air Quality Standard (GB3095-1996). In the indicators of the Survey of the Present Surface Water Environment Quality Conditions of the assessed area, the PH value of each river section is as required; those of out-of-limit COD including Shichuan River, Chencang Section of Weihe River, Qishui River (Wugong), and Qishui River (Tongchuan); those of out-of-limit ammonia nitrogen include Shichuan River, Qishui River (Wugong), and Qishui River (Tongchuan) etc; the rest river sections all meet the corresponding standard. The sound environment quality of the assessed area all meet the requirements of Sound Environment Quality Standard for Class 2 areas, and the overall regional environment quality is in good conditions.

11.1.3 Assessment of Environment Impact

11.1.3.1 Assessment of Water Environment Impact

The wastewater of the project during the construction period mainly include the wastewater produced for construction of road and pipe networks and domestic sewage produced by construction personnel; the construction wastewater includes the mud flushing effluent by cleaning the concrete mixing plants, water by flushing the construction materials in construction of the foundation works; and the vehicle flushing oil waste water with the main contaminants include SS and petroleum products of concentration at 3000mg/L and 30mg/L respectively. The main pollutants for the domestic sewage mainly include BOD_5, COD,BOD_5, and COD, with concentration at 200mg/L and 400mg/L respectively. In addition, construction of the roads and pipe network may involve with crossing of some small rivers, improper construction or management may raise impact to the surface water.

The operation effluent of this project will be treated by the local Sewage Treatment Plants, and the effluent will be discharged after being treated as meeting the standard; the surrounding water bodies are class III water bodies; able to accept the sewage treatment plant drainage, thus the environment impact can be controlled effectively, which will be minor. There is a point needing to be attended is that presently, Wugong Town has no completed Sewage Treatment Plant; while as introduced by the employer, the preliminary work for Wugong Town Sewage Treatment Plant has been started. Taking into account the presence of non-synchronous construction risk, the construction unit has developed a transitional treatment program, which uses the stable processing of agricultural irrigation pond. In the assessment, it’s recommended that the employer shall strengthen coordination with the corresponding units to ensure synchronous completion.

11.1.3.2 Assessment of Air Environment Impact

This is a municipal infrastructure construction project without productive activities or waste gases; however, airborne dust, construction plant exhausts, and asphalt smoke may be generated during the construction period of the project; the atmospheric pollution produced during the operation period is mainly resulted from the road works, mainly by vehicle exhaust gas and road airborne dust.

11.1.3.3 3 Assessment of Sound Environment Impact

The noise of this project is mainly from the transport vehicles and plants for the construction period and the traffic of the operation period. Construction noise is short-term and temporary; road traffic noise belongs to permanent impact.

The traffic volume will almost not change after the road reconstruction of this project, thus there is almost no change to the impact on the sound environment; besides, as the pavement conditions improves, the sound environment around will also be mitigated and improved. After the new road is put into operation, the impact to the sound environment is mainly from the traffic noise from the road. Some of the sensitive points along the project line are close to the road, which will be impacted to some extent by the noise radiation of the vehicles during the operation period. The totally 17 new road of this project is involved with six districts and counties including Yanliang, Chencang, and Chengcheng; since each road section has different design traffic flow, the traffic noise impact scope of each section in the areas along the line is also different.

11.1.3.4 Assessment of Solid Waste Environment Impact

The solid waste arising in the construction period of this project mainly includes the construction waste arising out of demolition and the building rubbish and household refuse at the workyard. As a construction project of municipal infrastructure, this project has nothing to do with the productive activities. It itself does not produce any solid waste, but in its operation period there is the household garbage along the road, the road refuse and the periodically cleaned garbage at storm water discharge outlets.

11.1.3.5 Assessment of Ecological Environment Impact

The newly constructed roads for this project will change the original landform and natural landscape, and change the land use nature from the root. This project will occupy some farmland to change the original farmland into road, leading to reduction of the green land rate in the local area. The project will damage the original agriculture ecology and vegetation, reducing farmland area and biomass. After this project is completed, the local infrastructure will be improved dramatically; the land use nature will be changed to push the urban development. In addition, this project will also lead to soil erosion to some extent.

The area where the project is located is characteristic of original urban and agricultural ecology. After the project is completed, this area shall gradually be characteristic of urban ecology. Relative to agro-ecological system, the ecological value of its urban ecological system is lower, so the construction of this project will generate a certain impact on the local environment. However, after the corresponding actions for ecological protection and restoration are taken, the impact of this project on the environment may be mitigated effectively. Generally this project will not produce a great impact on the ecological environment.

11.1.3.6 Assessment of Social Environment Impact

Total land area to be acquired and occupied for construction of this project is 124.94hm^2, all

belonging to permanent land occupation and mainly for the subgrade. There are 9 townships and 29 villages will be affected by the land acquisition; totally 3530 people of 390 households will be affected by land acquisition resettlement, in which 2223 people of 55 households will be affected by land acquisition and 1307 people of 335 households will be affected by resettlement; the building removal area is 71527.45m^2.

This project is for municipal infrastructure construction without productive activities; however, it will occupy land during the construction period, leading to building relocation, relocation of some dedicated facilities, and resettlement; at the same time, small amount of economic forest will be damaged. The lands occupied by this project are farmland. Therefore, the permanent land occupation of the project will result in agricultural economic loss, although such loss is small in proportion that will not produce serious impact on the local economy, it will produce relatively serious impact to the farmers who are impacted by the land acquisition. Besides, the house for the relocated residents will direct affect their life; in this case, reasonable compensation and resettlement measures shall be taken for the project land occupation and relocation, so as to ensure that the directly affected people will have life quality no reduced for the construction of the project road.

11.1.4 Conclusion of Public Participation

Since the project is aimed at improving the infrastructure of small towns, the construction content of each subproject refers to the infrastructure locally needed to be constructed. The completion of the project can help improve the sanitary conditions and road traffic conditions in the project area and facilitate the residents' living and travel. The public in the proposed project area not only support the construction of this project, but also give their opinions and suggestions.

11.1.5 Comprehensive Assessment Conclusion

Township infrastructure construction projects supported by World Bank Loans are positive to speed up the construction of the key towns of Shaanxi Province, push the urbanization process, perfect the urban infrastructures, ensure urban economic development, and promote the urban management level. The present environment quality of the areas where the projects are is in good conditions. The negative impact of the project is mainly in such aspects of water environment, ecological environment, and soil erosion etc and mainly occurring during the project construction process, having lower impact degree. After the corresponding environment protection measures are taken, the various negative impact can be relieved to some extent. Speaking from the overall situation, the environment benefits, economic benefits, and social benefits of the project construction are significant and the positive impact is primary; therefore, as analyzed from the aspect of environment protection, the project construction is feasible.

11.2 Requirements and Suggestions

(1) Township infrastructure construction projects supported by World Bank Loans are invested for construction by the World Bank; the project environment assessment report not only follows the domestic laws, regulations and the applicable guidelines for environment impact assessment; it also strictly executes the various security policies of the World Bank; therefore, the project employer and construction contractors are required to strictly execute the applicable environment and monitoring plan, and jointly carry out the various environment protection measures.

(2) In the projects, the road projects need asphalt mixing plant and spoil site etc, which shall be located according to the procedure promulgated by the local environment protection department.

(3) During the project construction period, environment monitoring activities shall be carried out.