

**CHINA: SICHUAN AND CHONGQING COOPERATION-
GUANG'AN DEMONSTRATION AREA INFRASTRUCTURE DEVELOPMENT PROJECT**

ENVIRONMENTAL ASSESSMENT

Executive Summary

AUGUST 2014

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1. INTRODUCTION

The proposed Sichuan and Chongqing Cooperation: Guang'an Demonstration Area Infrastructure Development Project is located in Guang'an Prefecture of Sichuan Province (**Figure 1**). Sichuan is a relatively underdeveloped region of the country, which has only recently begun to share in the prosperity of the country's recent economic growth. Its neighbour Chongqing Municipality (Chongqing) is an autonomous municipality with province-level status, which has now emerged as an industrial hub driving economic growth in the metropolitan area. Despite their administrative separation, the two areas remain close due to their cultural and economic ties. The Sichuan-Chongqing area is highlighted in China's Twelfth Five-Year Plan for National Economic and Social Development (2011-2015) as a strategic area for urbanization due to an identified potential for urban agglomeration.

Sichuan's Guang'an Prefecture is identified as having a future role in facilitating cooperation between Sichuan and Chongqing due to its close proximity to Chongqing. However, the Prefecture is still classified provincial-level poverty area, with population dominated by rural people. While the prefecture city and key towns are fast developing, they still require significant improvements in their infrastructure services and human capital to play a role in the regional economy. The proposed project will support infrastructure investment (including roads, storm water/sewage drainage pipelines, wastewater treatment plant, urban green space etc.) and human capital capacity building in towns of Linhsui County and Qianfeng District of the Guang'an Prefecture.

Considering its environmental and social context, although the physical activities of the project are fairly straightforward and the associated environmental impacts are anticipated to be limited, the environmental and socially related issues related to changes in land use and urban/industrial expansion are potentially significant, therefore, the project is prudently assigned as Category A as per OP4.01. The following World Bank safeguards policies are triggered: (1) OP4.01 Environmental Assessment; (2) OP4.11 Physical Cultural Resources; (3) OP4.12 Involuntary Resettlement.

Environmental impact assessment (EIA) reports have been prepared for Linshui subproject and Qianfeng subproject respectively, based on which two stand-alone Environmental Management Plans (EMP) have been developed. The preparation of EIAs and EMPs followed the relevant laws and regulations of China, World Bank safeguards policies, as well as EHS guidelines, with comments and guidance from the World Bank task team. Besides these environmental safeguards documents, social safeguards documents have also been prepared following the requirement of OP4.12 respectively. These documents were submitted to the Bank in August 2014, and found in conformity with World Bank safeguards policies. They have been locally disclosed in local newspapers, Project Management Offices, local communities, and are also disclosed in the Infoshop.

This document summarizes the potential environmental and social impacts of the proposed Project based on above-mentioned safeguards documents. It highlights the key

environmental and social safeguards issues related to the project construction and operation, describes the main findings and conclusion of impact assessment, and summarizes main mitigation measures and implementation management plans.

In summary, the proposed project will have significant positive impacts by improving infrastructure services, enhancing environmental management and increasing employment opportunities and incomes of local residents. The direct environmental and social impacts are mostly site-specific, not significant and are well identified. Thorough environmental and social management plans have been developed that can adequately avoid, minimize, mitigate and compensate the adverse impacts to an acceptable level. It is also envisaged that the project will facilitate large-scale future urban and industrial development in the project areas. An initial cumulative impact assessment has been conducted and concluded that there will be significant land use change due to future urban and industrial development in both town areas, while these future developments are within the carrying capacity of the local environments and resources. A more detailed cumulative impact assessment is built into the Technical Assistance component of the proposed project, and will be conducted during the project implementation stage.



Figure 1 Location of Proposed Project

2. PROJECT DESCRIPTION

The development objective of the proposed project is *to support Linshui County and Qianfeng District of Guang'an Prefecture to improve transport, wastewater, skills and investment promotion services for current needs and projected growth*. This would be achieved by planning, financing and managing these urban assets and services based on credible analysis of the regional economy, industry and population trends and an assessment of the cumulative environmental impact of the towns' growth plans. The project will include the following components:

Component 1: Preparing for current needs and projected urban growth (US\$ 600,000).

This component will provide technical assistance consulting services to Linshui and Qianfeng to better plan and manage built assets, while taking into account the wider impacts of urban growth on the environment by conducting a cumulative environmental impact assessment. It will also support Linshui to conduct value chain analyses for industries with potential for growth in the Chongqing EMR and design targeted investment promotion, communication and marketing services.

Component 2: Linshui County Town (US\$ 63.78 million). This component will: (a) create a public transport corridor between low-income areas in the urban core and industrial areas and linking to the Guang'an-Chongqing highway; (b) construct storm water drainage, sewage interceptors, sewage pipelines and treated effluent pipelines for existing and new residents and industries; (c) increase wastewater treatment capacity; and (d) develop industry-linked skills training for low-income groups based on target industries.

Component 3: Qianfeng District Town (US\$ 40.12 million). This component will: (a) develop a passenger and cargo route between the railway station and industrial area, bypassing the urban core; and (b) revitalize urban public space and create a slow, green transport corridor along the Lvxi River, connecting low-income areas of the urban core with industrial areas.

Component 4: Project Management and Capacity Building (US\$1.07 million). This component will support design, review and advisory needs for participating institutions to implement the project. The component includes: (a) consulting services for project management and implementation support; and (b) management capacity building and training.

Among the project components, the physical investment in Linshui and Qianfeng (Component 2 and Component 3) will have potential environmental and social impact, thus are subject to impact assessment. The environmental and social considerations will be incorporated into the scope of work and TORs of technical assistance activities under component 1 of the project. In particular, the project will support cumulative impact assessments for Linshui and Qianfeng during project implementation.

Besides the project activities under the proposed Bank project, there are also infrastructure investment projects (including roads, wastewater treatment plants etc.) that complement the overall development plan of the new industrial zones in both Linshui and

Qianfeng. These additional infrastructure investments are locally funded projects and are not included in the proposed Bank project. However, since these locally funded projects, together with Bank funded project activities, are integral part of new industrial parks development in the project areas, and they will be implemented in the same region within a timeframe that coincides/or overlaps with the Bank funded projects, therefore, the environmental impact assessment covers both the Bank funded projects and the locally funded project activities.

The detailed project activities in Linshui and Qianfeng are listed in **Table 1**, the locations of these project activities are shown in **Figure 2** and **Figure 3**.

Table 1 Detailed Project Activities in Linshui and Qianfeng

Component	Sub-projects	Activities	Environmental setting
Linshui County Town	Road construction	<p>The Bank-funded activities include construction of 5 urban roads, including sewage pipelines, storm water pipelines, green belt and ancillary road facilities:</p> <ul style="list-style-type: none"> • No.1 Road: urban trunk road, 4.76km long, 40m wide, design speed 50km/h, asphalt concrete surface • No.2 Road: secondary trunk road, 3.12km long, 20m wide, 40km/h, asphalt concrete surface • No.3 Road: urban branch road, 1.85km long, 16m wide, asphalt concrete surface • No.4 Road: urban branch road, 1.07km long, 16m wide, asphalt concrete surface • No.5 Road: urban branch road, 0.84km long, 16m wide, asphalt concrete surface <p>The locally funded road projects in the same area include construction of 13 roads, with total length of 17km.</p>	New Economic Development Zone (ETDZ) to be developed. Current land use is mainly farmland
	Sewage interceptor	<ul style="list-style-type: none"> • Two sewage interceptor pipelines (13.066km , DN400-DN1200) along both sides of Shiba River, and collected sewage will be sent to a proposed non-bank financed No.2 WWTP • A sewage main pipeline (1.80km , DN800) connecting No.2 Road to No. 3 WWTP and pumping station; and a treated effluent pipeline (2.65km, DN600) from No.3 WWTP to Bajiao River. 	Mainly urban built-up area and northern part of industrial park
	Wastewater Treatment Plant	<p>Bank-funded project will support:</p> <ul style="list-style-type: none"> • Construction of No.3 WWTP in the south of Linshui, with capacity of 4,000m³/d. 	Farmland

		The No.2 WWTP is to be funded locally to receive wastewater collected by Bank- funded sewage interceptor. This No.2 WWTP has a planned capacity of 30,000m ³ /d, and will be implemented during 2014-2016. Yet, its design has not started yet.	
Qianfeng District Town	Road construction	<p>The Bank-funded activities include construction of 3 urban roads, including sewage pipelines, storm water pipelines, green belt and ancillary road facilities:</p> <ul style="list-style-type: none"> • Gongye Avenue: urban trunk road, 3.30km long, 30m wide, design speed 50km/h, asphalt concrete surface • North Binhe Road: urban branch road, 4.43km long, 18m wide, design speed 20km/h, asphalt concrete surface • South Binhe Road: urban branch road, 7.66km long, 18-20m wide, design speed 20km/h, asphalt concrete surface <p>The locally funded road project in the same area include construction of Gangqian Avenue, 1.6km long, 24m wide, linking Gongye Avenue with an existing road.</p>	Rural farmland
	Sewage interceptor	<ul style="list-style-type: none"> • Two sewage interceptor pipelines (13.44km, DN400-DN1200) along both sides of Luxi River, under the proposed North and South Binhe roads. These interceptors will be combined downstream and connected to a non-Bank financed WWTP. <p>Collected sewage is sent to the proposed West Cowboy WWTP at the south of Qianfeng town. The WWTP will be locally funded, and will be constructed during 2014-2015. The design capacity (near-term) of WWTP is 20,000m³/d.</p>	Rural land and urban area
	Riverfront Renovation	<ul style="list-style-type: none"> • River front renovation of ca. 1.23km, with an area of 50,000 m², including: green space, pedestrian paths, sports courts, etc. 	Urban area

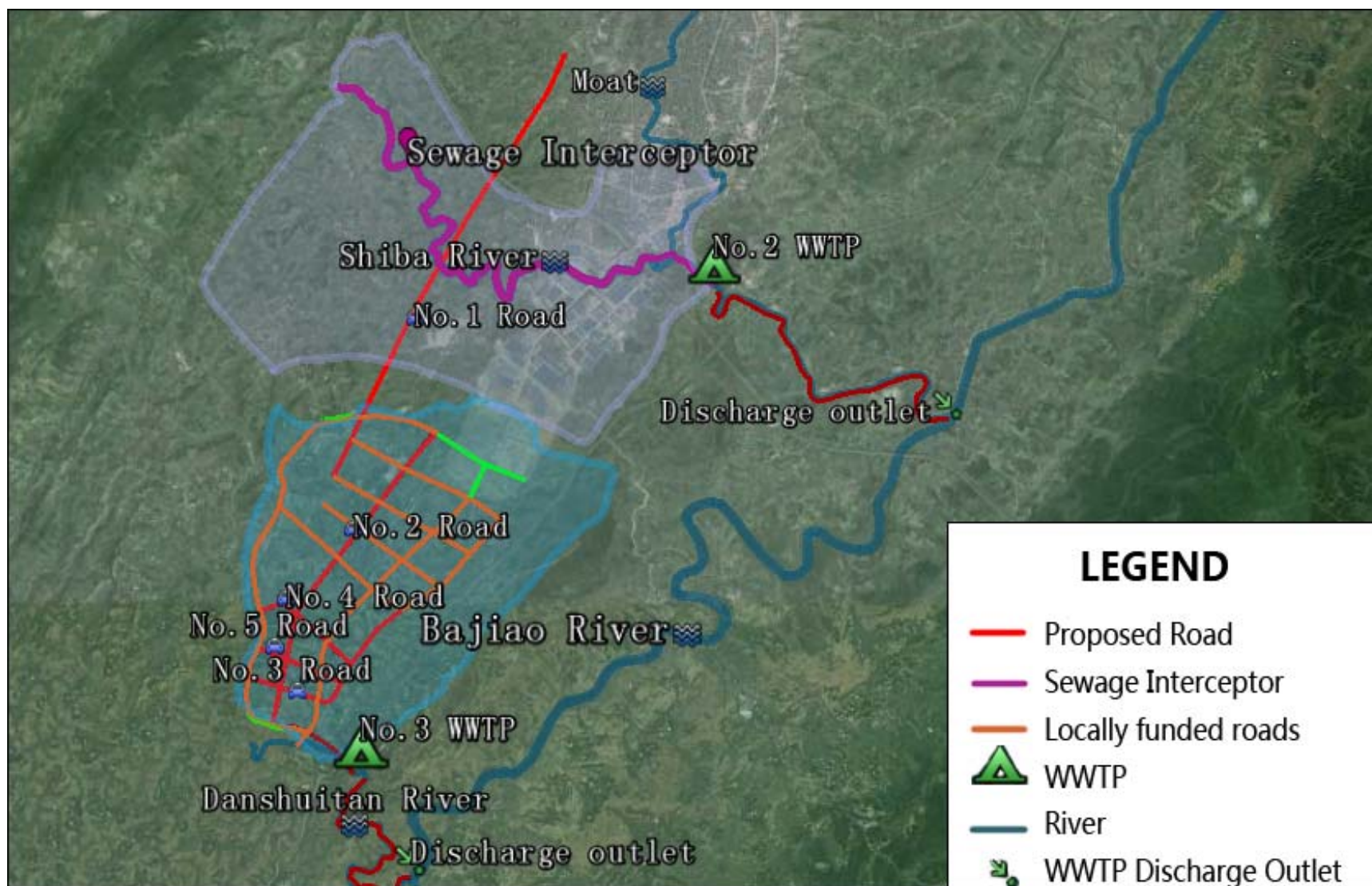


Figure 2 Detailed Project Activities in Linshui County

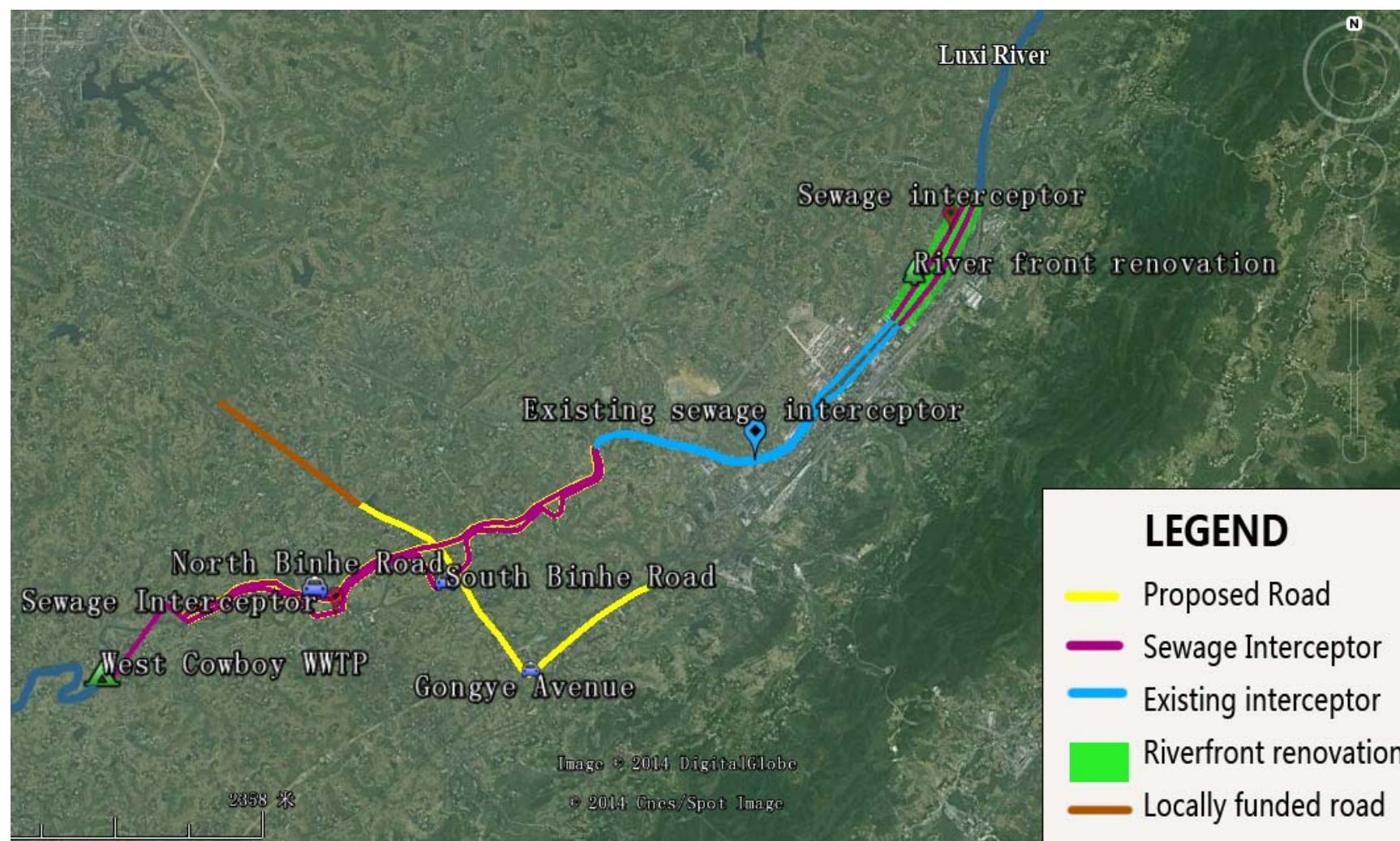


Figure 3 Detailed Project Activities in Qianfeng District

3. REGULATORY AND LEGAL FRAMEWORK

The Environmental Impact Assessment (EIA) for both Linshui and Qianfeng projects was conducted in accordance with Chinese EIA laws/regulations/guidelines, and the World Bank safeguards policies, as well as Environmental, Health and Safety guidelines of World Bank Group.

World Bank Safeguard Policy Requirements

Of the World Bank Groups ten safeguards policies, the following are triggered: 1) OP4.01 Environmental Assessment; 2) OP4.11 Physical Cultural Resources; 3) OP4.12 Involuntary Resettlement. Compliance with these policies, and the World Bank's disclosure of information policy, is summarized in **Table 2**.

Table 2 Compliance with World Bank Safeguards Policies

Safeguard Policies	Compliance
OP/BP 4.01 Environmental Assessment	<ul style="list-style-type: none"> - Category A project. - Full EIAs, EMPs and EA Executive Summary have been prepared. - Two rounds of public consultation conducted as part of EIA process
OP/BP4.11 Physical Cultural Resources	<ul style="list-style-type: none"> - Family graves are to be relocated in both towns which have been addressed in RAPs; - Alignment of sewage interceptor pipeline is adjusted to avoid a protected cultural relic site; - Chance-find procedure has been developed in EMP
OP/BP 4.12 Involuntary Resettlement	<ul style="list-style-type: none"> - Resettlement Action Plans have been prepared for both towns.

The World Bank Group Environmental, Health and Safety Guidelines (WGB EHS Guidelines) also apply to the project, including the General Guidelines and specific Guidelines for Water and Sanitation, Toll Roads, Waste Management Facilities. The general principles and measures in these Guidelines are consistent with the requirements of Chinese laws, regulations, guidelines and construction management norms.

Table 3 Compliance with WBG EHS Guidelines

EHS Guidelines	EIA /EMP Compliance
General Guidelines	EIA/EMPs addressed the environmental issues of air, noise, wastewater, waste management, occupational and community health and safety, and construction related impacts.
Water and Sanitation Guidelines	
Treatment or pre-treatment of industrial wastewater prior to discharge to the sewer or water body	All industrial wastewater in development zones must comply with Class III standard prior to discharge into sewage network for further treatment in WWTP
Separation of storm water with industrial and municipal wastewater	Project adopts separate drainage pipelines for storm water and sewage
Compliance of effluent with national or international accepted standards	Effluent from WWTP complies with the Class 1A standard of Discharge Standard of Pollutants for Municipal

	Wastewater Treatment Plant (GB 18918-2002)
Odor control	Sealed or covered design for odor generation processes adopted; green space is planned as a buffer zone; offset distance is set to prevent new residential buildings
Sludge dewatering and landfill/incineration	Mechanical dewatering and filtration adopted, and dewatered sludge is sent to landfill
Toll Road Guidelines:	
Environmental issues of air emission, solid waste, wastewater, noise, sanitation, occupational and community health and safety	Consistent with requirements of General Guidelines, these environmental and social concerns have been addressed in EIAs and EMPs.
Waste Management Facilities:	
Waste collection and transportation	Sanitation departments of Linshui and Qianfeng are responsible for collection of waste and send to existing urban sanitary landfills for disposal

Chinese Laws and Regulations

The EIA is prepared fully in compliance with relevant China national laws, regulations, technical guidelines and procedures. Compliance with a selective list of key Chinese regulations and EIA technical guidelines are summarized in **Table 4**.

Table 4 Compliance with Key China Domestic Laws and Regulations

China Laws and Regulations	Project Compliance
<i>Environmental Impact Assessment Law</i>	<ul style="list-style-type: none"> EIA prepared by licensed EIA consultant, reviewed and approved by local environmental protection agency.
<i>Classified Directory for Environmental Management of Construction Project</i>	<ul style="list-style-type: none"> Individual EIAs have been prepared according to proper classification
<i>Interim Measures for the Public Participation in Environmental Impact Assessment</i>	<ul style="list-style-type: none"> Two rounds of public participation conducted in surrounding villages/towns, and info disclosure through website of Guilin Municipal Government.
<i>Notice on Strengthening EIA Management for Construction Projects Funded by Loans from International Financial Institutions</i>	<ul style="list-style-type: none"> EIAs and EMPs are prepared in compliance with World Bank safeguards policies.
<i>Water and Soil Conservation Law</i>	<ul style="list-style-type: none"> Water conservation and soil erosion control plan has been prepared and approved by relevant authority.
<i>Culture Property Protection Law</i>	<ul style="list-style-type: none"> Project adjusted to avoid known cultural property Chance find procedures have been developed in EMP
<i>EIA Technical Guidelines on Atmospheric Environment (HJ/T2.2-2008), Surface Water Environment (HJ/T2.3 -93), Noise Impact Assessment (HJ/T2.4-2009), Ecological Environment (HJ/T19-2011), Groundwater (HJ610-2011), Environmental Risk Assessment (HJ/T 169-2004), etc.</i>	<ul style="list-style-type: none"> Impact assessment follows the technical requirements of these guidelines

4. ENVIRONMENTAL AND SOCIAL BASELINES

4.1 Natural Environment

Location

Guang'an Prefecture (city) is located in the eastern part of Sichuan Province, bordering with Chongqing in the east and south. The project town of Linshui County is in the southeast of Guang'an, between E106°41'~107°18' and N30°01'~30°33'. Qianfeng District is in the east of Guang'an, between E105°56'~107°18' and N30°01'~30°50'.

Topography

Linshui is located in between two mountain ridges that run along the direction of SW-NE, with Huayingshan ridge in the west and Tongluoshan ridge in the east. The topography of Linshui County features mild slopes, low hills and a valley basin.

Qianfeng is located in the west of Huayingshan ridge. The topography of Qianfeng mainly features flat land and low hills. The topography of the project areas is illustrated in **Figure 4**.



Figure 4 Topography of Linshui County and Qianfeng District

Meteorology

The project areas of Linshui and Qianfeng belong to the subtropical monsoon zone where the climate is warm and humid climate, with plenty of rain. It has a multi-year average temperature of 16-18°C, with highest temperatures of 40.5 ~41.2°C and lowest of -3.8 ~-

4.5°C. The average relative humidity is 80~85%. The multi-year average rainfall is about 1,100mm, with over 70% precipitation during May – September.

Hydrology

Linshui County

There are dense river systems within the area of Linshui which belongs to the Yangtze River catchment. Main rivers within the project area of impact include Bajiao River, Xiaoxi River (moat), Shiba River and Danshuitan River.

Bajiao River is on the east side of the Linshui Economic and Technological Development Zone (ETDZ), and is the wastewater discharge receiving river of the ETDZ. The average width the Bajia River is c. 50m, with multi-year average flow of 31.3m³/s (4.38m³/s at 90% guarantee rate).

Xiaoxi River (moat) is a tributary of Bajiao River. It flows through the Linshui County, and receives wastewater discharge from the existing urban built-up area of Linshui. The average flow of Xiaoxi River is 2.07m³/s.

Shiba River is a tributary of Xiaoxi River and flows through a few towns of Linshui County. It has an average flow of 0.44m³/s, and joins in Xiaoxi River at Lingbaoshan Mountain of Linshui.

Danshuitan River is a tributary of Bajiao River. The proposed No.3 WWTP is located near the river. It joins in the Bajiao River at about 1.5km downstream of the WWTP site.

Qianfeng District

The main river in the project area of Qianfeng is Luxi River. It is a tributary of Qujiang River, a secondary tributary of Yangtze River. The Luxi River is 47km long, with total catchment area of 183km². Luxi River flows through Qianfeng town, and is the wastewater discharge water body for Qianfeng.

These main rivers in the project areas are shown in **Figure 2** and **Figure 3**.

Ecological Environment

Linshui County

The project activities in Linshui are located in its ETDZ in the south of Linshui. The total planned area of the ETDZ is 2,818ha, including 831 ha of industrial land. Currently, the developed area of the ETDZ is 393 ha, with presence of 40 industrial enterprises. The rest of the undeveloped land in the ETDZ is mainly rural landscape dominated by farmland.

Surface vegetation in the project area is mainly farmland crops and planted trees. There is protected wild plant species in the project area.

Due to intensive human activities and development, there is no large wild animal presence in the project area. Animals in the area are all common species in rural environment, e.g. rodents, frogs etc.

According to historical records and survey, there is no large scale aquatic vascular plant communities, protected aquatic plant species and fish species in the Bajiao River and its tributaries. Based on field survey and consultation with local communities, fish species are decreasing due to water pollution in Shiba River and Xiaoxi River (the moat).

Qianfeng

The project activities in Qianfeng are located in the existing urban built-up area and the planned new town and industrial park area. The current status of the undeveloped area of the new town and industrial park is mainly farmland, whose surface vegetation is dominated by farmland crops, planted trees and bushes. There is no protected wild plant and animal species identified in the project area.

Similar to the project area in Linshui, there is no large wild animal presence in the project area, besides common species in rural environment, e.g. rodent, frog etc. due to intensive human activities. Available information on Luxi River indicates that there is no protected aquatic wildlife species in the river.

4.2 Socio-economic Context

Guang'an Prefecture (City) was established in 1998, and has a total area of 6,344km², with a total population of 4.7million. Urban per capita disposable income in Guang'an Prefecture was RMB 19,973 in 2012, just below the provincial average. Guang'an Prefecture is designated as a provincial-level poverty area.

Linshui County has a total population of about 1 million and total area of 1,912km². In 2012, its urban per capita disposable income was RMB19,274 and rural per capita disposable income was 7,404. Linshui is a provincial-level poverty county in Sichuan. Qianfeng District is a newly established district in Guang'an in 2013. Before, it was part of Guang'an District which is designated as a national poverty area.

In 2013, the rural poverty line was RMB 2734 (\$448) and approximately 24,313 people in Qianfeng (about 11% of the total population) and 86,036 people in Linshui (about 12% of the total population) were registered as rural poor.

4.3 Environmentally and Socially Sensitive Sites

During EA preparation, detailed survey of environmentally and socially sensitive sites within in the area of influence has been conducted through field investigation and consultation with local agencies and communities. It is concluded that there is no special protected area, ecological sensitive area, natural habitat within the area of influence of the proposed project.

The sensitive sites in the vicinity of the project are residential communities along the project roads, rivers in the vicinity of the project activities and family graves to be affected by the project. Based on field survey, the environmental and socially sensitive sites of the proposed project include:

Qianfeng District

- (1) Luxi River (along which two river bank roads and sewage interceptors will be constructed);
- (2) 21 residential communities nearby the project roads;
- (3) 68 family graves to be affected and relocated.

Linshui County

- (1) Bajiao River (receiving effluent from No.2 and No.3 WWTPs), Shiba River (along which the two sewage interceptor pipeline will be laid) and Danshuitan River (by which the No. 3 WWTP is located);
- (2) 1626 family graves to be affected and relocated;
- (3) Lingbaoshan Stone Carving and Bridge protection area near the sewage interceptor pipeline site.

Lingbaoshan Stone Carving and Bridge Relics Site

Lingbaoshan mountain stone carving and three ancient bridges are listed as protected cultural relics by Guang'an City in 2000. These are relics from the Song Dynasty, including 11 pieces of stone carving, sculpture and 3 stone bridges, with cultural value of ancient architecture, calligraphy and stone carving (**Figure 5**). The alignment of the sewage interceptor pipeline is designed to avoid the protection zone of the relics site. However, it is still close to the site, 15m outside the boundary of construction-restriction zone of the site. The detailed relationship of the project pipeline and the Lingbaoshan protection site is shown in **Figure 6**.



Figure 5 Lingbaoshan Stone Carving and Ancient Bridges

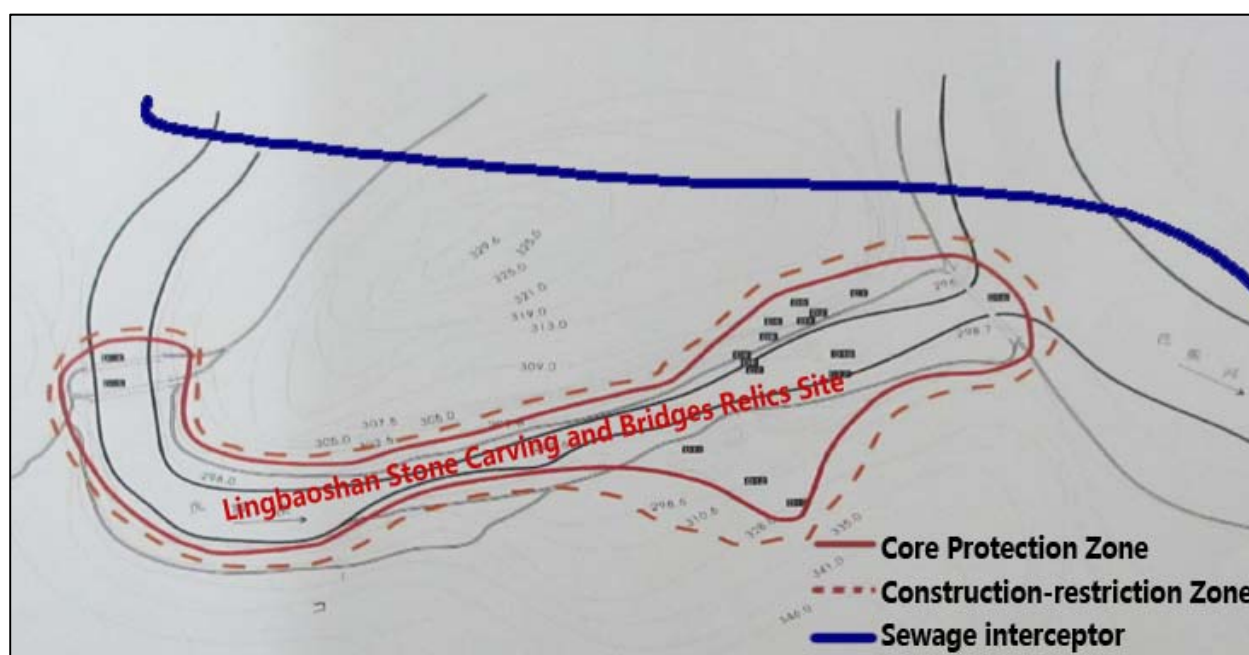


Figure 6 Relationship between Lingbaoshan Relics Site and Sewage Interceptor

Baseline noise was monitored for selective sensitive sites along the proposed project roads in both Linshui and Qianfeng during the environmental assessment process. Monitoring results indicate a generally good acoustic environment in the project areas which conforms to the applicable ambient noise standards, except one community in Qianfeng which cannot meet the night-time standard due to its closeness to an existing railway.

Ambient Air Quality

Ambient air quality at selective sensitive sites and sampling points in the project areas of Linshui and Qianfeng was conducted, with monitoring parameters of SO₂, NO₂ and PM₁₀. The results show the overall compliance with the applicable ambient air quality standards.

Surface Water Quality

In Linshui, surface water monitoring data for Bajiao River, Danshuitan River, Shiba River and Xiaoxi River (the moat) in 2012 (from Plan EIA for ETDZ) were used as references. The parameters assessed include COD, BOD₅, NH₃-N, petroleum, pH and TP. The data shows that upstream of Bajiao River and Shiba River is generally good, with overall compliance with Class III standard of Surface Water Environmental Quality Standards. While, the Xiaoxi River (the moat) flows through the urban area of Linshui where domestic sewage is discharged into the river, leading to non-compliance of NH₃-N and TP.

In Qianfeng, water quality monitoring was conducted for Luxi River during the preparation of EIA. The monitoring results indicate overall compliance with the applicable standards, i.e. Class III standard of Surface Water Environmental Quality Standards.

Groundwater Quality

Groundwater monitoring was conducted in the project areas in both Linshui and Qianfeng, which confirms overall compliance with relevant groundwater quality standards.

4.5 Existing Environmental Infrastructure

Linshui

There is an existing No. 1 WWTP in Linshui, with a capacity of 20,000m³/d, providing service to an area of 9.3km². For those areas outside the service scope, domestic sewage is discharged into irrigation canals or drainage ditches after simple treatment by septic tank. Industrial enterprises are required to pre-treat their wastewater up to Class 1 standards of the Comprehensive Wastewater Discharge Standard (GB8978-1996) before discharged to the environment.

Linshui has constructed Wucha solid waste landfill in 2008, with a total area of ca. 6 ha and a daily disposal capacity of 125t. The design life of this sanitary landfill is 14 years. Due to rapid urban development and increased population, solid waste collection has reached 160t/d, and the total capacity of the landfill is nearly reached. Currently, an expansion of the landfill is planned with additional 1.3ha land area, and will be put into operation in 2016. Solid waste collection and transportation to landfill is conducted by Linshui Sanitation Department.

Qianfeng

Currently, there is no WWTP in Qianfeng. Domestic sewage in the old urban area is discharged into the Luxi River without or with little treatment. Industrial enterprises that already entered the industrial park are required to have pre-treatment facilities to treat

their wastewater up to Class 1 standards of the Comprehensive Wastewater Discharge Standard (GB8978-1996) before discharged to environment.

Currently, all solid waste collected from Qianfeng is sent to Puan Landfill of Guang'an City, about 50km from Qianfeng. Puan Landfill is a sanitary landfill, with capacity of 300t/d. Solid waste collection and transportation to landfill is conducted by Qianfeng Sanitation Department.

5. ANALYSIS OF ALTERNATIVES

Alternative analysis has been conducted for the project with comprehensive considerations of environmental, social, technical and economic factors, based on which the overall optimum option is selected. The main analysis of alternatives is summarized as follows:

5.1 With/Without Project

In March 2011, the State Council approved the establishment of the Chengdu-Chongqing (Cheng-Yu) Economic Zone to boost economic growth in this area and make Chengdu and Chongqing the hub of western region development. According to the *Cheng-Yu Economic Zone's Regional Plan*, Sichuan's Guang'an will be designated as a demonstration area of cooperation between Sichuan and Chongqing.

The *Master Plan for Cheng-Yu Cooperation Demonstration Area* explicitly planned an electrical industrial park in Linshui. With implementation of the *Master Plan*, more and more industrial enterprises are established in Linshui ETDZ. The existing developed part of the ETDZ will not be able to accommodate the expected increase of industrial enterprises, and thus it is essential to prepare for infrastructure development in the southern part of the ETDZ. The built-up area of ETDZ still uses combined storm water/sewage systems, and all wastewater is discharged directly into the Shiba River. The proposed road infrastructure in the southern part of the ETDZ, sewage interceptors in the existing industrial areas of the ETDZ, and the No.3 WWTP for the new development part of the ETDZ (plus locally funded No. 2 WWTP for existing part of ETDZ) will facilitate the development of Linshui ETDZ with proper environmental infrastructure to address environmental issues envisaged from future development.

The *Master Plan* also clearly planned a central business district/logistics park in Qianfeng. With an increase of incoming enterprises, the existing built-up area in Qianfeng can no longer accommodate such development, thus development of the industrial park and new urban area is unavoidable. Currently, there is a lack of complete sewage interception and collection system and no WWTP in Qianfeng. The proposed road infrastructure, wastewater collection system (plus locally funded WWTP) are essential infrastructure to prepare for the expected future urban and industrial development in Qianfeng.

Thus, it is envisaged that without the project, significant environmental consequences will be expected from such large-scale urban and industrial development in the project areas.

5.2 Alternative Analysis of No. 3 WWTP in Linshui

Locations

Two location options were considered during EA and design stage:

- (1) Option 1 is at Xinhe Village, south of the ETDZ, and by Danshuitan River.

- (2) Option 2 is at Shitai Village, south of the ETDZ, and by Linmazi River. About 2km upstream of Option 1.

Both options have convenient accessibility, effluent discharge into Bajiao River and similar geological conditions. While, Option 1 has little resettlement, and Option 2 has large-scale resettlement. Therefore, Option 1 is selected.

Effluent Discharge Location

Besides consideration of location, the alternative options for effluent discharge locations were also considered. As the No. 3 WWTP is by the side of Danshuitan River, two options of discharge locations were compared: i.e.

- (1) Danshuitan River by the WWTP site;
- (2) Baojiao River at ca. 1.5km downstream of Danshuitan River.

Danshuitan River is a tributary of Bajiao River, and has a significant varied flow over a year, with more than 80% runoff during May-October. While, Bajiao River has a much larger catchment area, steady and large flow rate. The average flow at the proposed outlet location is 28.3m³/s. Therefore, Bajiao River is selected as the receiving water for the effluent of No.3 WWTP. A 2.65km effluent discharge pipeline will be constructed along the Danshuitan River and end at the Bajiao River.

WWTP Treatment Processes

More technical analysis on alternative treatment processes also were considered as part of the feasibility study and project design, including wastewater treatment process (oxidation ditch, A²/O and food chain reactors approaches), effluent disinfection process (UV, chemicals of liquid chlorine/ClO₂/Sodium hypochlorite), sludge thickening/dewatering (gravity thickening/mechanical dewatering vs mechanical thickening and dewatering). These alternatives are mainly technical considerations with the same environmental performance or result.

5.3 Alternatives of Road Projects

The proposed road alignments in both Linshui and Qianfeng are determined by the existing local master plans. Therefore, alternatives were only considered at specific locations, including an expressway crossing No. 1 Road in Linshui, and a bridge crossing the Luxi River by Gongye Avenue in Qianfeng.

Expressway Crossing No. 1 Road in Linshui

The No.1 Road in Linshui will cross the Hu-Rong Expressway. Two options were considered: (1) underpass, and (2) viaduct overpass. The underpass option will require larger amounts of earth/stone works due to consideration of elevation, and is not in conformity with design norms when connected with planned elevations. It will also occupy

half of the expressway during the construction stage, while, the overpass option will not affect the normal operation of the expressway. Therefore, the overpass option is selected.

Bridge Crossing Luxi River by Gongye Avenue in Qianfeng

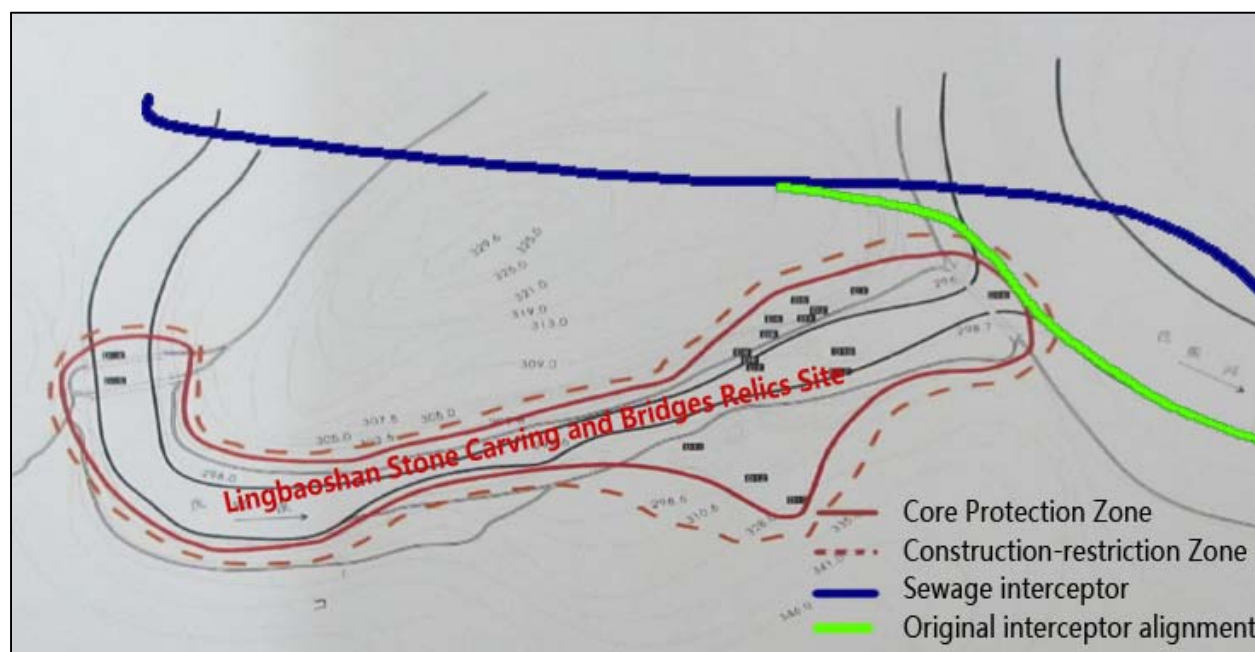
Two bridge schemes were compared for Gongye Avenue crossing Luxi River:

- (1) One-span 25m pre-stressed box beam;
- (2) Two-span (2X12m) concrete frame bridge.

The one-span beam bridge is easy to build, will not affect the river channel and avoid in-water piers. The two-span concrete frame bridge will require the occupation of river channel during construction, and require longer construction duration and higher cost. Therefore, the one-span beam scheme is selected due to its avoidance of impact on river body.

5.4 Alternatives of Sewage Interceptor Pipeline in Linshui

The original design of sewage interceptor pipeline in Linshui will pass through the construction-restriction zone of the Lingbaoshan Stone Carving and Bridge protection site, about 2m outside the boundary of the core protection zone. During the EA process, an alternative alignment is proposed to move the alignment away from the protection zone, as illustrated in **Figure 7**.



6. ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

The proposed project will have significant positive environmental and social benefits through providing environmental and urban infrastructure, improving the urban living environment, creating employment opportunities and facilitating socio-economic development in the project areas. However, the project will have also adverse environmental and social impacts during the construction and operation stage. These impacts include:

Table 5 Potential Impacts during Construction and Operation (to be updated latterly)

Potential Environmental and Social Impacts during Construction	Potential Environmental and Social Impacts during Operation
<ul style="list-style-type: none"> • Land acquisition and resettlement • Impact on physical cultural resources • Traffic and community disturbance • Ecological environmental impact • Construction nuisance of dust and noise • Construction wastewater and sewage • Construction spoil and solid waste management 	<ul style="list-style-type: none"> • Noise impact of road operation • Air quality impact of the project areas • Impact on surface water and groundwater • Waste management of WWTPs • Long-term induced and cumulative impacts

Based on the environmental impact assessment, these impacts are found to be straightforward, limited in scope and can be readily mitigated with good construction and operation management. Adequate measures have been developed in EMP/RAP. In summary, the project will not have significant adverse environmental and social impacts, will not result in significant degradation or conversion of natural habitat and will not have significant impact on any physical cultural resources. Mitigation measures have been developed in the EMP, which can effectively avoid, minimize, mitigate or otherwise compensate potential environmental and social impacts.

Though the direct impacts of the project are straightforward and manageable, the long-term induced and cumulative impacts from rapid urbanization and industrialization which the project is supporting are significant and more challenging. In this regard, an initial cumulative impact assessment has been conducted in the EIAs, and a more detailed Cumulative Impact Assessment is built into the Technical Assistance component of the project to be carried out during the project implementation stage.

6.1 Impacts during Construction Stage

6.1.1 Impacts of Land Acquisition and Resettlement

The project construction will need land acquisition and resettlement, including permanent land acquisition of 58.7ha in Linshui (1,264 households with affected people of 4,442) and 21.3ha in Qianfeng (453 households with affected people of 1,630), resettlement of rural houses of 704 households (2,468 affected people) in Linshui and 421 households (1,515 affected people) in Qianfeng.

To address impacts of land acquisition and resettlement, a Resettlement Action Plan (RAP) has been prepared for Linshui and Qianfeng respectively following the relevant Chinese laws/regulations and World Bank *OP 4.12 Involuntary Resettlement*, and have been reviewed and approved by the World Bank.

6.1.2 Impacts on Physical Cultural Resources

In Linshui, the proposed sewage interception pipeline has been adjusted to avoid the Lingbaoshao Stone Carving and Bridge Relics Site. However, the pipeline is still close to the site, with closest distance of ca. 15m outside the construction-restriction zone (as shown in **Figure 7**). Construction activity of earth excavation and pipeline laying, if not well-managed, will have potential adverse impacts on the relics site, i.e. stability of mountain cliffs and river bed disturbance etc. Not well-trained construction workers may also pose potential threat to the relics sites due to intentional/unintentional damage activities or graffiti.

To minimize the potential impacts, pipe-jacking construction technology is used for sections crossing the river-bed and mountain nearby the protection area (See **Figure 8**). This approach will avoid open excavation and blasting of river-bed and mountain, and this will minimize the potential impact on the relics protection area.

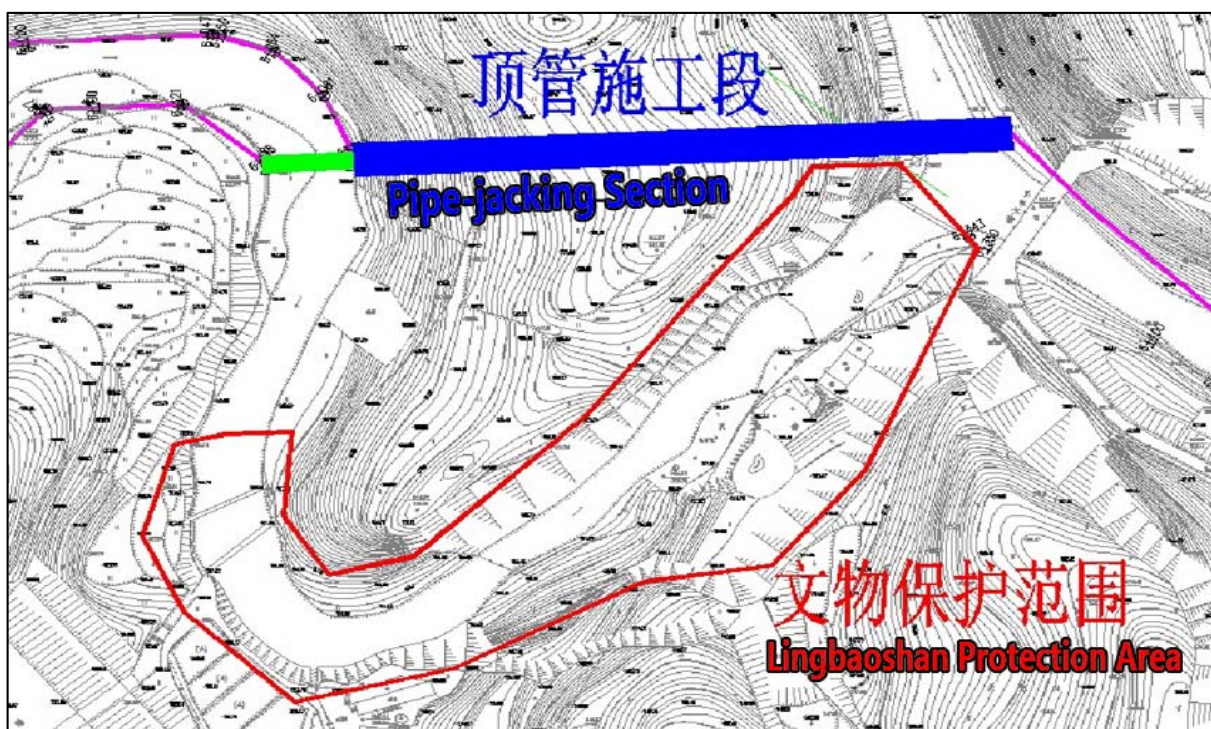


Figure 8 Pipe-jacking Approach Used for Lingbaoshan Protection Area

In addition to use of proper construction technology, training will be provided to construction workers in terms of protection of cultural resources, and precautions will be

adopted during construction. Chance-find procedures have been developed in the EMP and will be enforced.

The project will also involve relocation of 1,694 family graves (1,626 in Linshui and 68 in Qianfeng) that are scatter in farmlands in the project area. Based on field survey and consultation, it is concluded that these local family graves have insignificant archaeological and historical value. As a common issue for infrastructure projects, there are well established national/local resettlement regulations governing the consultation, relocation and compensation process for family graves. Consultations on the grave relocation have been conducted, and relocation and compensation measures have been fully incorporated in the RAPs.

6.1.3 Traffic and Community Disturbance

Construction activities of the project will have adverse impacts on urban traffic and community accessibility due to construction of pipelines and transportation of materials. Though pipelines can be laid section by section, there will be temporary excavation at certain sections, and soil/materials be temporarily stored on-site which will affect road traffic and disturb community accessibility. Excavation works may also affect utility lines for water supply, gas/electricity and communications etc. In summary, such impacts are temporary in nature, and will disappear once construction activities are finished.

To mitigate the impact of traffic and community disturbance, mitigation measures have been developed in EMP including:

- Coordination with utility companies to secure minimized disturbance, and prior notice to public;
- Properly arrange traffic diversion and restriction in coordination with traffic police departments, temporary access paths for community;
- Enforce safety rules as per relevant national laws/regulations/norms;
- Bulletin boards will be installed on site to disclose information on the project contents, construction time and contact for complaints;
- Timely backfill to restore traffic;
- Material transportation shall avoid peak hours of traffic;
- Proper fencing and clear warning signage will be installed around the construction site;
- Conduct public consultations and information disclosure during construction stage to receive public feedback.

6.1.4 Impact on Ecological Environment

The project construction will lead to land use change, thus has adverse impacts on the local ecological environment in terms of loss of surface vegetation and biodiversity. The project areas in both Linshui and Qianfeng are typical rural environments which are dominated by farmlands and planted vegetation. Based on field surveys, there is no protected or endangered wild plant or animal species in the area of influence. The conversion of rural farmland to urban and industrial land will not lead to significant loss of natural habitats or

biodiversity in the area. Intensive green belts and green space are planned along the project roads/pipelines and at restored project sites, which will partially offset the loss of surface vegetation in the project area.

Construction along/crossing rivers may affect the natural river channel and have adverse impacts on river ecology. Earth excavation activities in the project will disturb the original land surface, and if not well managed, will cause soil erosion problems during the rainy season. Earth borrow pits and spoil disposal, if needed, may also have potential ecological impacts.

To minimize ecological environmental impacts, mitigation measures have been developed in the EMPs, including:

- Relocate existing trees as much as possible for later green space restoration after completion of project construction;
- Limit construction activities with right-of-way to minimize disturbance of surface vegetation;
- Proper balance of earth excavation and backfilling, so that no additional borrow site or spoil disposal site is needed for both Linshui and Qianfeng;
- Proper arrange construction schedules to avoid excavations on rainy days;
- Timely restoration of disturbed areas with green belt/space;
- Rationally arrange construction schedules of different roads in the same area to minimize cumulative impacts;
- Properly arrange the storage of soil and bulk materials on site to minimize erosion, with fencing, drainage ditches/settling tanks and temporary cover where necessary;
- Educate workers on ecological protection knowledge and requirements;
- A comprehensive Soil Erosion Control Plan has been developed as per national requirements and incorporated into EMPs.

6.1.5 Impacts of Noise

Construction noise mainly comes from construction machines and transportation vehicles. Noise impact may have an influence scope of 35m during the daytime and 200m during the night time. In particular, night time construction activities will have much larger impact on nearby communities.

To mitigate noise impacts on nearby communities, a series of mitigation measures have been developed in the EMPs, including:

- Rationally arrange the construction site to keep noisy machines/vehicles away from sensitive receptors;
- Restrict night-time construction with high-noise equipment, and forbid night-time (22:00 – 08:00) construction near communities; if cases of continuous construction is inevitable, prior approval of the local environmental authority and prior notice to the public must be secured;
- Properly arrange material transportation routes, and enforce speed limit requirements;
- Low noise construction equipment will be used, with adequate maintenance;

- Temporary noise reduction measures will be adopted near communities, such as fences, mobile noise barrier, sound-insulation cover etc.

6.1.6 Impact of Dust

A major temporary environmental impact of the construction of roads and pipelines is construction dust, mainly from earth excavation, on-site storage, backfilling and secondary dust from material/waste transportation, and cement mixing and asphalt pavement. Based on survey statistics from similar construction projects, construction dust may have an impact scope up to 200m. The sensitive receptors of nearby communities will be subject to dust impact if not enough measures are adopted.

To mitigate such impacts, a series of mitigation measures have been developed in the EMPs, including:

- Properly maintain the cleanness of construction site through water spraying, timely cleaning, wheel-washing, timely removal of waste etc.;
- Temporary enclosure fence will be installed where possible to minimize dust generation;
- Strictly manage the loading/unloading of earth and bulk material, and use properly covered trucks for transportation;
- Suspend construction activities on windy days (over Class 4 wind);
- Proper fencing or covering for temporary piling of bulk material, waste spoil on site;
- Proper maintenance of construction/transportation vehicles to minimize emissions;
- Provide mask for workers, etc.

6.1.7 Impact of Wastewater

During construction, there will be a limited amount of wastewater generated from construction sites, machine/vehicle cleaning, and sewage from workers. The main pollutants of construction wastewater are suspended solid (SS) and small amounts of oil. Without proper collection and treatment, randomly discharged wastewater at construction sites will have adverse impacts on the environment, especially construction activities near rivers. Pipe sealing tests will also generate wastewater, which is mainly clean water with some suspended solid and can be reused for dust suppressing and green space watering.

To mitigate such impacts, a series of mitigation measures have been developed in the EMP, including:

- Settling tanks will be constructed at construction sites to treat construction wastewater for reuse; direct discharge of wastewater without treatment is forbidden;
- Properly manage solid waste from camps and construction sites to avoid potential pollution of surface waters;
- Waste oil from vehicles and construction machines will be specially collected and sent to licensed facilities for safe disposal.
- Strengthen routine maintenance of equipment and vehicles to avoid oil leakage;

- Reusing clean water from pipe testing and dewatering process of foundation excavation.

6.1.8 Impacts of Groundwater

The project construction of roads, sewage interceptors and WWTPs may generate wastewater which may pollute groundwater. Excavation of deep ditches for sewage interceptors and foundations of WWTP lead to groundwater leakage, or need dewatering at the specific site locations. However, such impacts are temporary and site-specific, it will not lead to changes of the groundwater table in the project areas, nor will it block the drainage of groundwater in the region.

To mitigate such impacts, mitigation measures have been developed in the EMPs, including:

- Properly arrange construction schedule to minimize groundwater pumping time period or concentrated dewatering wells in the same location at the same time;
- Arrange excavation of deep ditches at non-flood season, etc.

6.1.9 Impacts of Solid Waste

Solid waste during construction mainly comes from excavated spoil, debris from building demolition, construction debris of sand/aggregate/cement, as well as garbage generated by construction workers.

To mitigate such impacts, mitigation measures have been developed in the EMPs, including:

- Balance excavation and backfilling to avoid demand for disposal of spoil materials;
- Construction waste will be collected and recycled to the extent possible, non-recyclable waste will be sent to construction waste landfills designated by city government;
- Mixing construction with domestic solid waste is forbidden;
- Dumping of solid waste into surface waters is strictly forbidden;
- Construction waste transportation trucks will be covered to avoid littering and spills;
- Garbage from construction camps will be collected on site and disposed of through established municipal solid waste collection and disposal system.

6.2 Impacts during Operation Stage

6.2.1 Noise Impact

During the operation stage, project roads will attract increased traffic which will lead to increase of noise level along the road corridors. Based on simulation of noise impact modeling for the road network, noise compliance offset distance has been calculated which will be used for planning of future buildings along the roads.

The current rural communities in the project areas can generally maintain noise level compliance, except a few villages that are close to existing national highway and railway. However, all these residents will be relocated at the same time/or soon after the

construction of the project roads due to development of industrial parks according to local master plans.

Operation of the No. 3 WWTP in Linshui will also have a noise impact on the ambient environment. Based on noise impact prediction, the noise at the borders of the WWTP can meet applicable ambient noise standards at all directions.

6.2.2 Impact on Air Quality

Vehicle traffic on the project roads will increase air pollution in the project areas. Air dispersion modeling was conducted for the project roads network. The modeling results indicate that the air quality in the project area will remain in compliance with applicable ambient air quality standards.

The operation of No.3 WWTP in Linshui will have potential odor impacts on the ambient environment. Based on analogic comparison and air dispersion modeling for H_2S and NH_3 , it is concluded that operation of No.3 WWTP will have little impact on the ambient environment, i.e. the concentration of H_2S and NH_3 at the boundary of the WWTP is less than 0.2% of the applicable ambient environmental standards.

The mitigation measures adopted in WWTP design include:

- Arrange odor sources in the middle of the plant site;
- Sealed building design for coarse screen, pumping room and fine screen, sludge tank and underground return-sludge pumping room;
- Collected odor gas is treated with UV de-odor equipment
- Daily removal of dewatered sludge;
- Enhanced tree plantation and green space (over 30% area) within WWTP.

6.2.3 Impacts on Surface Water

The operation of sewage interceptors and WWTPs in Linshui and Qianfeng will significantly reduce the wastewater pollution discharged into local rivers, and hence have positive environmental benefits. While, the effluent discharge from the WWTP may have potential environmental impacts on the receiving water body, especially in case of an emergency at the WWTP when untreated sewage is directly discharged into the river through the bypass pipeline.

Mathematic modeling calculation was conducted to assess the impact of effluent discharge from the WWTP. The results show that during normal operation, the effluent discharge will have an impact area of less than a 1m scope around the outlet, and during the emergency scenario, the impact area is less than a 10m scope around the outlet. Therefore, the potential water quality impact of effluent discharge from WWTP is limited.

For the effective operation of the WWTP, the main mitigation measures will include:

- Establish operation management procedures, provide training to workers;

- Install on-line monitoring equipment for pH, SS, COD, NH₃-N and TP with connection to local environmental authorities;
- Provide backup design for power supply and main treatment units for emergency scenario, and develop emergency response plans;
- Enforce industrial wastewater discharge standards for sources that feed into the WWTPs.

6.2.4 Impacts on Groundwater

During the operation stage, possible leakage of sewage pipelines and WWTP facilities may result in pollution to groundwater. To minimize such impacts, mitigation measures will include:

- Ensure anti-seepage design of WWTP facilities with impermeable foundations for buildings;
- Strengthen routine monitoring and maintenance inspection;
- Develop emergency response plan

6.2.5 Impacts of Solid Waste

The main solid waste of the project during operation is from WWTPs, including debris from screens and sludge, and small amounts of garbage from working staff. These solid wastes will be sent to existing local sanitary landfills for final disposal, and thus little impact is expected.

6.2.6 Impact on Ecological Environment

The project will lead to a change of land use pattern in the project areas, i.e. converting rural ecological environment into urban and industrial environment. The surface vegetation of rural crops and trees will be replaced by urban built-up area, which will lead to a net decrease of green field and vegetation. This is a planned process according to local development plans, and such impacts have been taken into consideration in the master plans. These induced and cumulative impacts will be further studies during project implementation under the TA component.

6.3 Induced and Cumulative Impacts

It can be concluded that the direct environmental and social impacts of the proposed projects are straightforward, limited in scope and can be readily mitigated with well know mitigation measures for construction and operation management. The most challenging aspect of the proposed project is the induced and cumulative impacts from future development in the project areas, i.e. rapid urbanization and industrialization to which the proposed project will support. Such impacts will be beyond the direct area of influence of the project, and if not well addressed, significant adverse environmental and social consequences can be expected from a long-term point of view.

6.3.1 Initial Assessment of Induced and Cumulative Impacts

Review of Current Development

Linshui

Currently, Linshui County has a total area of 1,919km² and population of 1.03 million. The urban built-up area of Linshui town is 11.12km², with a population of 170,000. The Linshui ETDZ was established in 2006, and so far the ETDZ has a developed area of 7km². About 60 industrial enterprises entered the ETDZ, including agricultural products processing, machinery manufacturing, electric and information, spare parts for trains and cars, non-ferrous metal metallurgy and processing industries.

Based on statistics, the total pollution emission status in Linshui is: industrial source COD 465.27t/a, NH₃-N 26.8t/a, and municipal source COD 420.48t/a, NH₃-N 42.05t/a; industrial source SO₂ 1,173.05t/a, NO₂ 327.18t/a, dust 993.4t/a, and municipal source SO₂ 21.3t/a and dust 20.8t/a.

Comparing the current ambient environmental quality of air, surface water, groundwater and noise with that of March 2012, all monitored parameters can meet the relevant applicable environmental standards. There is a slight improvement of surface water, air and groundwater, while there is a general increase in noise levels due to new road development in the ETDZ. It can be concluded that development of the ETDZ did not cause significant environmental impacts, which can be attributed to the emphasis placed on environmental management concepts by the ETDZ authority, i.e. restricting enterprises to light polluting, labour intensive and technology-oriented industries; promoting clean energy; and providing environmental infrastructure including the WWTP and landfill.

Qianfeng

Qianfeng District is a newly established administrative district of Guang'an City, approved by the State Council in 2013. As of April 2014, the built-up area of Qianfeng is 5km², with a population of 170,000. The industrial park of Qianfeng is in the south of the town, and currently has 29 enterprises covering spare parts for automobiles and motorcycles, textiles and garments. According to available emissions data, all enterprises are in compliance with applicable emissions standards. The emissions of the industrial park in 2011 were: industrial source COD 259.15t/a, NH₃-N 31.76t/a, SO₂ 328.45t/a, NO_x 105.75t/a; rural non-point source COD 111.2t/a, NH₃-N 17.2t/a.

Comparing the current ambient environmental quality of air, surface water, groundwater and noise with that of 2011, all monitored parameters meet relevant applicable environmental standards.

Future Development Scenarios

Linshui

According to the *Master Plan of Linshui County (2009-2030)*, Linshui has a near-term development phase for 2014-2019 and a long-term phase for 2020-2030. For the near-term phase, the built-up area of Linshui will reach 22km², with machinery manufacturing and electric and information as the dominant industries. By 2030, the built-up area is expected to increase to 28.3km², with the main industries being storage and logistics, spare parts for trains and new energy cars, machinery manufacturing and non-ferrous metal metallurgy and processing industries. The future development plan is illustrated in **Figure 9**.

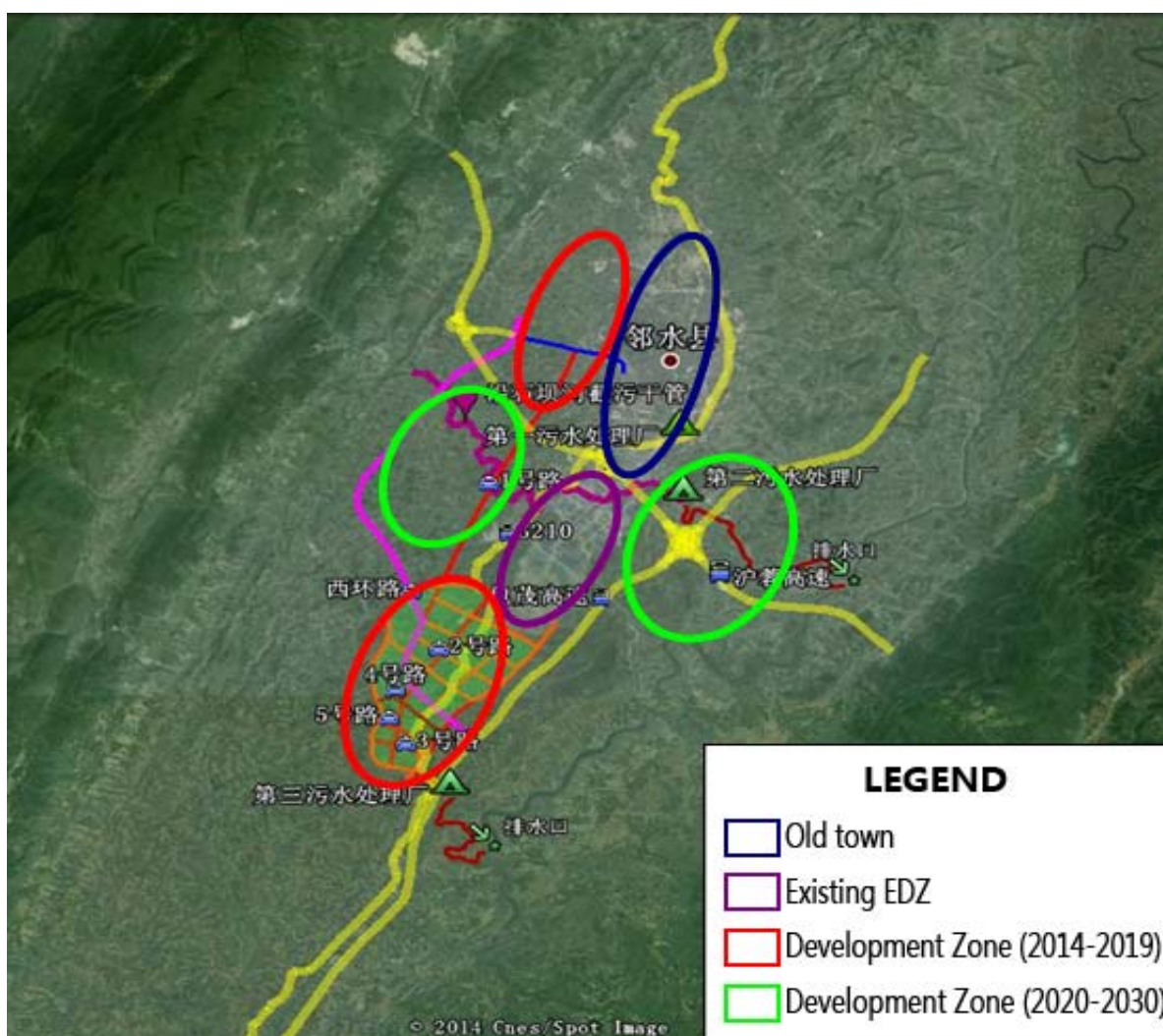


Figure 9 Future Development Plan of Linshui

Qianfeng

According to the *Master Plan for the Industrial Park in Qianfeng (2011-2020)*, by 2020, the built-up area will reach 35.48km², with two main development areas in both north and south/southeast of the town. Industrial enterprises are planned to focus on automobile spare parts, electronic products, garments, textiles and shoe manufacturing. The future development plan of Qianfeng is illustrated in **Figure 10**

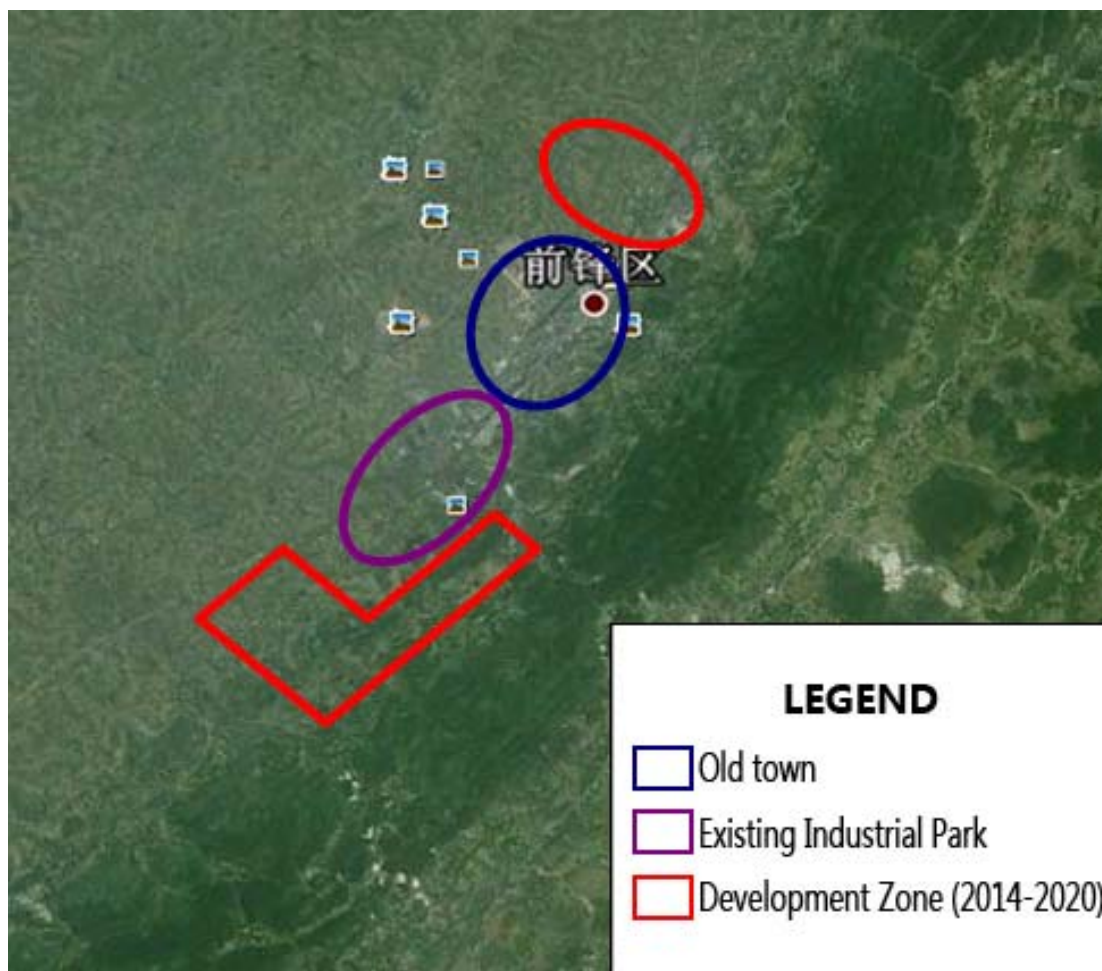


Figure 10 Future Development Plan of Qianfeng

Envisaged Induced and Cumulative Impacts

Initial assessment of the potential induced and cumulative impacts concluded that the following long-term impacts are envisaged:

- Land use change and loss of green area: there will be significant land use change, i.e. the built-up area will increase from 18km² to 28.3km² in Linshui and from 5km² to 35.48km² in Qianfeng. Expansion of the urban and industrial park area will convert farmland, and green spaces into urban residential and industrial buildings. Such a

change will result in loss of surface vegetation, turning a rural ecological environment into an urban built-up environment. Since the land is mostly agricultural land with intensive disturbance of human activities, such a conversion is unlikely to cause significant loss of natural habitats and regional biodiversity.

- Loss of agricultural land: land use conversion will lead to loss of agricultural land, thus reduce rural incomes of local farmers. Such a change is a planned result that urban and industrial development in the project area will convert rural livelihood to urban and industrial employment which will provide higher, non-farm incomes for local people.
- Air pollution: a preliminary simulation of the worst case scenario (i.e. all enterprises use coal as energy sources) indicates that air quality in the project areas can maintain its compliance with relevant standards. An atmospheric carrying capacity calculation also indicates that long-term air pollution will be within the environmental capacity of the area.
- Surface water quality: increased urbanization and industrialization will lead to increased wastewater which, if not well addressed, will cause pollution of surface water bodies. Such an impact is envisaged in the master plan, and WWTPs are planned to be constructed, including No.3 WWTP included in the project. A detailed environmental carrying capacity of Bajiao River in Linshui and Luxi River in Qianfeng is calculated in the EIA and it confirmed that there is enough capacity to accommodate the induced increase of wastewater.
- Groundwater: Groundwater reserves in Linshui are not rich, neither are they developed as water resources. Groundwater is recharged by rivers and precipitation. The development of the ETDZ will convert natural land surface to impermeable surface (buildings or paved roads), thus will have impact on the seepage of storm water as a recharging source for groundwater.
- Solid waste: Both towns will see an increase in solid waste generation from both municipal and industrial sources. It is envisaged that the existing and planned landfill facilities will have the capacity to handle the increased solid waste.
- Regional drainage: The planned development will not occupy natural river channels, thus will not have significant impact on regional drainage patterns. While due to land use change, more storm water surface runoff may end up in rivers since less can seep into the ground. This will increase local flooding probabilities and has to be taken into account in the design and building of drainage system.
- Social development: It is envisaged that the urbanization and industrialization in both Linshui and Qianfeng will significantly promote local social development by providing better urban and environmental infrastructure, creating employment opportunities and improving the living environment. However, loss of farmland and agriculture-

based livelihoods and conversion to urban and industrial based ones present both opportunities and challenges to local communities.

6.3.2 Detailed Induced and Cumulative Impact Assessment

Based on the initial assessment of induced and cumulative impacts assessment, both Linshui and Qianfeng have had some urban expansion and industrial development over the past years. They also have master plans for future development with different timeframes. The induced and cumulative impacts have been screened and could be significant if urban and industrial development is not well planned. The two towns have taken actions to address these issues, including stipulating development boundaries, building wastewater collection and treatment facilities, solid waste facilities, restricting enterprises to light polluting, labor intensive industries, building environmental monitoring and management institutions. However, rapid urban expansion and industrial development are usually associated with deterioration in environmental quality around core urban areas with potential long-term consequences on local communities.

The project will support a technical assistance activity to conduct follow-up cumulative impacts assessment during project implementation following a continuous step-by-step process based on the status of development and capacities of the local authorities. This effort will take into account a hybrid of induced, cumulative and strategic issues related to the urban and industrial developments in the two towns, and enable a more detailed assessment that is adaptive to ongoing actual developments in the two towns. It will include specific measures on how industries, wastes, and pollution will be monitored and how to guide industry development during implementation. A terms of reference has been developed building upon the preliminary assessment already made, and included in the EMP.

7. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

Public consultation and information disclosure have been conducted following national laws and regulations, as well as World Bank safeguards policies. Two rounds of consultation and information disclosure were carried out during April–July 2014 through a combination of public meetings, field interviews and questionnaire surveys in the project affected communities.

Prior to consultations, brief project information, environmental impacts and mitigation measures as well as linkage of full environmental impact assessment reports were disclosed through the website of Guang'an Government (<http://www.gasfgw.gov.cn>). Meanwhile, posters were placed in main communities of the project areas. Following the information disclosure, public consultations were conducted among project affected communities, including field interviews, public meetings and questionnaire surveys among the public.

In total, more than 550 project affected people participated in the consultation. The project received broad support from the public consulted, most of which expressed strong wishes to speed up this infrastructure and environmental improvement project. The key environmental concerns by the public mainly focus on:

- Proper construction arrangement to minimize dust, noise and vibration impacts;
- Traffic disturbance during construction;
- Effective measures to reduce noise during operation stage;
- Enhanced landscaping and living environment;

These public concerns have been given due considerations in the EIA, and necessary mitigation measures have been developed in the Environmental Management Plans (EMPs) to avoid, minimize, mitigate or compensate the adverse impacts.



Figure 11 Public Consultation and Information Disclosure in Project Areas

The revised full draft EIA reports for both Linshui and Qianfeng components were locally disclosed on August 22, 2014 at the website of Guang'an DRC, with newspaper

announcement on Guang'an Daily on August 23, 2014. The draft RAPs were locally disclosed in Guang'an on August 25, 2014.

8. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A stand-alone Environmental Management Plan (EMP) has been developed for Linshui and Qainfeng component respectively, which specifies environmental management and supervision roles and responsibilities, mitigation measures, environmental monitoring, capacity building programs and EMP budget.

8.1 Roles and Responsibilities

The implementation of the EMP requires the involvement of multi stakeholders (**Figure 12**), each fulfilling a different but vital role to ensure effective environmental management for the project.

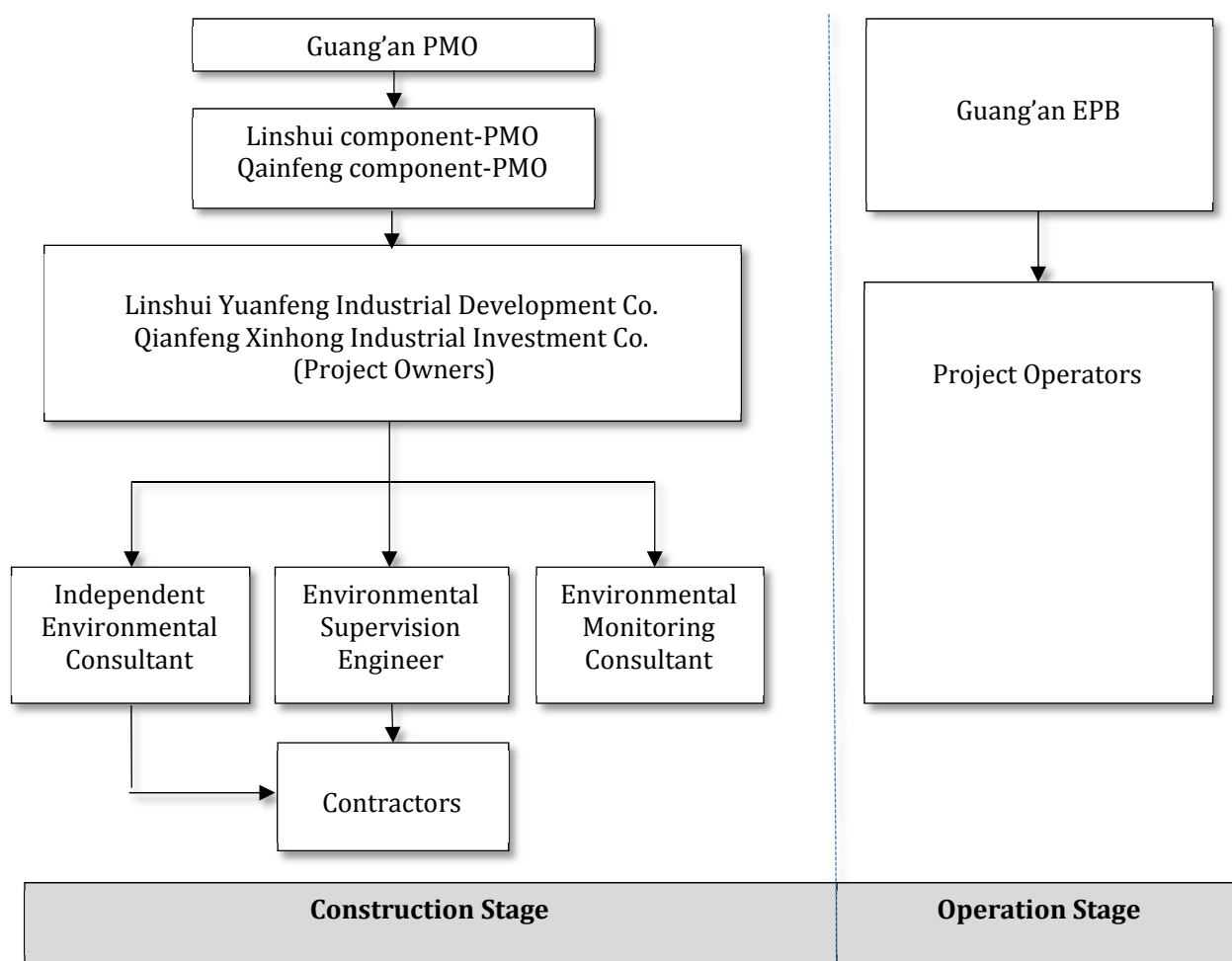


Figure 12 Environmental Management Structure of the Project

Table 6 Key Environmental Management Responsibilities

Stakeholder	Responsibility
Guang'an PMO	<ul style="list-style-type: none"> • Overall coordination of project implementation; • Overall responsible for implementation of environmental management plans • Liaison and report to World Bank on implementation of environmental management plans
Linhsui Component PMO Qianfeng Component PMO	<ul style="list-style-type: none"> • Responsible for environmental management of its component; • Ensure EMP mitigation measures be incorporated into bidding documents and construction contracts; • Ensure environmental supervision requirements be incorporated into supervision contracts; • Supervise the implementation of environmental mitigation measures by contractors; • Organize and coordinate safeguards trainings; • Entrust external environment consultant to monitor the EMP implementation; • Entrust external environment monitoring institute to monitor ambient environment.
Project owners	<ul style="list-style-type: none"> • Supervise environmental performance of contractors; • Track the EMP implementation progress and report to local PMOs; • Receive, investigate and handle and public complaints
Construction contractors	<ul style="list-style-type: none"> • Develop detailed environmental management plans for construction works; • Implement mitigation measures as per bidding documents, contract and EMPs; • Receive supervision and guidance from project owner, environmental supervision engineers and local governments; • Conduct public consultation during construction
Environmental Supervision Engineers	<ul style="list-style-type: none"> • Review design to ensure compliance with EMP requirements; • Supervise the implementation of EMP measures by contractors as per contract requirements and provide guidance; • Verify the effectiveness of contractor's implementation EMP; • Report to project owners about the EMP implementation; • Verify and approve payment based on EMP implementation.
Independent Environmental Consultant	<ul style="list-style-type: none"> • Conduct periodic independent supervision on the environmental performance of contractor and supervision engineers; • Provide recommendations to project owners on improvement of EMP implementation; • Assist PMO to provide semi-annual environmental report to the World Bank.
Environment Monitoring Consultant	<ul style="list-style-type: none"> • Conduct environmental monitoring according to the monitoring plan in EMP; • Conduct ad hoc monitoring upon request of project owners.
Operators	<ul style="list-style-type: none"> • Manage the operation of WWTPs and roads • Ensure environmental compliance of WWTPs

8.2 Mitigation Measures

Mitigation measures have been developed for each component covering the full cycle of project preparation, construction and operation. The development of mitigation measures follows national laws/regulations, technical guidelines and construction norms, with references to previous similar project experiences and World Bank safeguards policies and *Environmental, Health, and Safety General Guidelines*, *Environmental, Health, and Safety Guidelines for Water and Sanitation*, *Environmental, Health, and Safety Guidelines for Toll Road and Sanitation* and *Environmental, Health, and Safety Guidelines for Waste Management Facilities*.

These mitigation measures are developed in separate EMPs for Linshui and Qianfeng components, and will be incorporated into the bidding documents and contracts to ensure effective implementation. For details of the mitigation measures, please refer to the EMPs in the project file.

8.3 Management of Contractors

Contractors will play a key role in environmental management, pollution control and impact mitigation during construction. During the construction period, contractors are mainly responsible for effective implementation of environmental protection and pollution mitigation measures. Therefore, environmental awareness and capacity of contractors are critical for the good environmental performance of the project.

In order to ensure strong environmental capacity and smooth implementation of environmental protection measures, the following contractor management measures will be implemented:

- 1) During pre-qualification, environmental management will be included in the authentication clause when the contractor's qualification is reviewed. Under the same condition, priority shall be given to the bidders who have passed the ISO9000 and ISO14000 authentication;
- 2) In preparation of bidding documents, the project owner will ensure mitigation measures included in the EMP are fully incorporated, and require the potential bidders to prepare the bids that fully cover the budgetary estimates for EMP implementation. Therefore, the implementation of the environmental protection measures will become the obligation and responsibility of the successful bidder;
- 3) Every Contractor will be required to provide dedicated environmental staff on each section of the Project. In order to be qualified for the job, the environmental staff will receive an environmental training program prior to construction;
- 4) Prior to construction, the Contractors are required to submit site-specific Environmental Protection Implementation Plan and Environmental Protection

Construction Organization Plan for key project activities with potential impacts (if any). The Plans shall demonstrate compliance with domestic environmental regulations, the mitigation measures specified in the EMP. The plans shall provide details such as commitment to environmental protection by the Contractor's project management team; methodology of implementing the project EMP; detailed designs and installation of pollution control facilities (e.g. drainage channel, settling tank, etc.); environmental control mechanism; detailed earthworks management plans and site operation plans outlining the measures that are proposed to minimize, mitigate and manage the effects, for the duration of the construction works; and environmental monitoring program during different stages of construction period.

- 5) Prior to the commencement of construction, the Contractor shall receive adequate training on EMP and relevant regulations.

8.4 Environmental Monitoring Plan

An environmental monitoring plan has been developed to monitor ambient environmental quality and pollution discharge during construction and operation. Project owners will hire licensed environmental monitoring consultants to conduct monitoring, and provide monitoring results to local EPBs and the World Bank.

The monitoring plans for Linshui and Qianfeng are summarized in **Table 7**.

Table 7 Environmental Monitoring Plan for Linshui and Qianfeng

Stage	Item	Locations	Parameters	Frequency
Construction	Air	Major construction activities near sensitive sites	TSP	Random based on construction progress
	Noise	Major construction activities near sensitive sites	Leq dB (A)	Once a month
	Water	River sections near construction sites	COD, BOD ₅ , SS, oil	Quarterly
	Soil erosion	Major excavation and backfilling areas	Areas of disturbance; protection measures; soil erosion status	Monthly for areas of disturbance; quarterly for soil erosion factor monitoring.
Operation	Noise	Sensitive receptors of communities	Leq dB (A)	Quarterly
	Water	Effluent discharge outlet and downstream river	pH, COD _{Cr} , BOD ₅ , NH ₃ -N, TP	Continuous monitoring for outlet; monthly for downstream river

	Air	Down wind direction at the boundary of WWTPs	H ₂ S, NH ₃ -N, and odor	Quarterly
	Soil erosion	Drainage ditch slopes, green belt along roads/above pipelines, WWTP sites	Slope protection, erosion control measures, green space and survival of planation, cleanness of WWTP	Quarterly

8.5 Environmental Reporting

During project implementation, with assistance of the Independent Environmental Consultant, the PMOs/project owners are required to provide environmental monitoring reports to the Guang'an Environmental Protection Bureau (EPB) and the World Bank. The purpose of such reporting is to ensure effective implementation of EMP mitigation measures, identify any inadequacy or problems at early stages in order to implement timely remedial action, and learn experiences/lessons to guide future works.

The main contents of the report include:

- 1) Description of project progress;
- 2) Environmental management organization setup and responsibilities;
- 3) Key construction activities, associated environmental impacts and actual implementation of EMP mitigation measures, including any problems and remedial actions or plans;
- 4) Implementation of environmental monitoring plan and key results;
- 5) Any public complaints (records, resolution and public feedback);

During construction, contractors and supervision engineers are required to provide periodic environmental reports to the project owners.

8.6 Environmental Training Plan

Environmental capacity training is an important part of the environmental management of the project, which will be provided to environmental management and supervision staff in the PMO, project owners, contractors, supervision engineers. Prior to commencement of construction, Guang'an PMO/Linshui and Qianfeng PMOs shall organize environmental training for contractors and workers, as well as supervision engineers and project management staff in PMOs and project owners.

8.7 EMP Budget

All mitigation measures have been budgeted and fully incorporated in project costs including monitoring and supervision. The total EMP budget estimate for the project is RMB 87,955,500 for Linshui and RMB 86,275,900 for Qianfeng, i.e. 10.3% and 14.9% of total project investment.

The detailed EMP budget is shown in **Table 8**.

Table 8 EMP Budget Estimate

Stage	Item		Investment (RMB)	
			Linshui	Qianfeng
Construction	Community	Media, notice	100,000	100,000
		Bulletin boards at construction site	100,000	100,000
	Soil erosion	Storage of earth /spoil	69,744,000	61,430,000
		Vegetation restoration		
		Bulk material cover		
		Monitoring	485,000	460,000
	Dust	Water spraying	100,000	100,000
		Dust control measures	100,000	100,000
		Monitoring	50,000	50,000
	Wastewater	Construction wastewater	300,000	50,000
		Monitoring	50,000	50,000
	Noise	Noise reduction /barriers etc.	50,000	300,000
		Monitoring	50,000	50,000
	Solid waste	Spoil backfilling	1,000,000	1,200,000
		Garbage disposal	100,000	50,000
	Environmental supervision		600,000	550,000
	Independent environmental consultant		400,000	360,000
	Sub-total		73,139,000	64,950,000
Operation	Ecology	Greening	12,606,500	19,675,900
	Air	Odor control facility	710,000	350,000
		Monitoring (1 st year)	200,000	100,000
	Noise	Noise control	400,000	200,000
		Monitoring (1 st year)	100,000	50,000
	Water	Anti-seepage measures	200,000	400,000
		Monitoring (1 st year)	100,000	50,000
Sub-total		14,316,500	20,825,900	
Environmental training			500,000	500,000
Total			87,955,500	86,275,900
Total Project Investment			854,457,400	578,764,600
Percentage of EMP budget in total investment			10.3%	14.9%